VOLUME

2

PRODUCT DATA FILES

ElectronicDesign's

GOLD BOOK

1984/1985

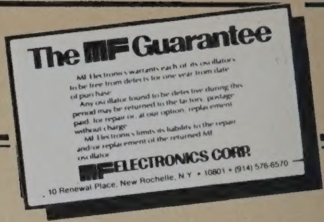
11th Edition

WORLDWIDE ELECTRONICS
DIRECTORY AND PRODUCT DATA SOURCE

Electronic Design's Directory/Master Catalog

Hayden Publishing Company, Inc.

DIP CRYSTAL OSCILLATORS


The MF Guarantee

MF Electronics warrants each of its oscillators to be free from defects for one year from date of purchase.

Any oscillator found to be defective during this period may be returned to the factory, postage paid, for repair or, at our option, replacement without charge.

MF Electronics limits its liability to the repair and/or replacement of the returned MF oscillator.

MF ELECTRONICS CORP.
10 Renewal Place, New Rochelle, N.Y. • 10801 • (914) 576-6570

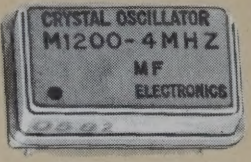
The Broadest line in the industry.

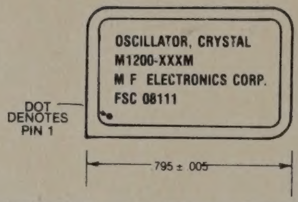
- Units use overtone crystals from 20 MHz to 100 MHz, very stable electrically and more reliable mechanically.
- All units guaranteed for one year to operate within specifications
- Units specified at temperatures exceeding 0 to 70°C are individually recorded 100% for freqency vs temperature insuring compliance.

RESISTANCE-WELD CRYSTAL CLOCK OSCILLATORS • 250 KHz TO 100 MHz IN ALL METAL CASE

Series	Stability
M1200	± .01%
M1214	± .05%
M1215	± .10%
M1216	± 1.0%
M1244	± .0025% (25ppm)
M1245	± .0050% (50ppm)

- **All metal welded package with standoff insulator**
- **Area on PC board is one true TTL space-.795 X .495**
- **Seated height less than 0.215, including insulator**
- **Frequency from 250 KHz to 100 MHz**
- **TTL Compatible**
- **Stability options from 1.0% to .0025%**
- **Units at 4MHz and higher are simple and reliable using the exclusive MF Clock-chip**
- **Metal Package-Unit is hermetically seated by resistance weld, with glass-to-metal seal connector which may be soldered or plugged into socket.**


CRYSTAL OSCILLATOR
M1200-4MHZ
MF
ELECTRONICS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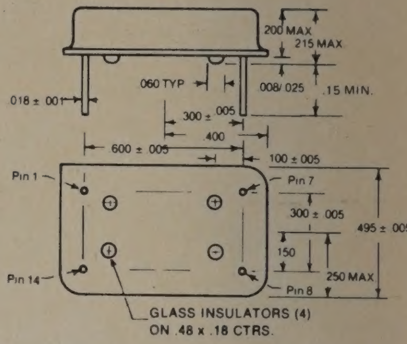
M1200-XXXM
M F ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
795 ± 005


200 MAX
215 MAX
060 TYP
008/ 025
.15 MIN.
018 ± 001
300 ± 005
400
600 ± 005
100 ± 005
Pin 1
Pin 7
300 ± 005
495 ± 005
150
250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4) ON .48 x .18 CTRS.

HYBRID TTL GUARANTEED CRYSTAL CLOCK OSCILLATORS • 250 KHz-50 MHz

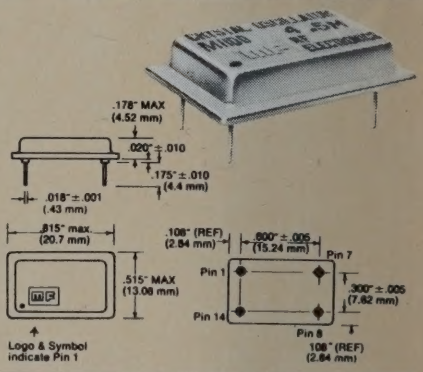
Frequency: any specified frequency from **250 KHz** to **50MHz**
Frequency Stability: Including calibration at 25°C, operating temperature, change of input voltage, change of load, shock and vibration.

Series	Stability
M1100	± .01%
M1114	± .05%
M1115	± .10%
M1116	± 1.0%
M1144	± .0025% (25 ppm)
M1145	± .0050% (50 ppm)

Temperature: Operating 0 to 70°C
Storage -55 to + 125°C

Input voltage: +5 ±.5VDC
Input current: 60 ma., maximum, under all conditions.
TTL output: All units, 0 to 70°C

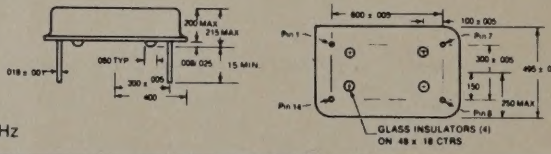
Symmetry	60/40 @ 1.4 VDC
Rise and Fall time	6ns. maximum from 0.5 to 2.4V.
"O" Level	+0.5V, maximum
"I" Level	24V minimum
Loads	10TTL Loads, standard or Shottky

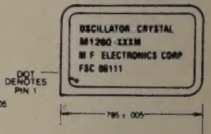

.178" MAX (4.52 mm)
.020" ± .010
.175" ± .010 (4.4 mm)
.018" ± .001 (.43 mm)
.815" max. (20.7 mm)
.515" MAX (13.08 mm)
.108" (REF) (2.84 mm)
.600" ± .005 (15.24 mm)
Pin 7
Pin 1
.300" ± .005 (7.62 mm)
Pin 14
Pin 8
108" (REF) (2.84 mm)
Logo & Symbol indicate Pin 1

CRYSTAL CLOCK FOR MOS MICROPROCESSORS SERIES M1260, M1259, M1257

Same Dimensions as M1200

- Drives Z80a AND Z8000, Mostek MK3990-4, Sharp LH0080A, AMD AMz8000, NEC 780C-1
- 2 Times TTL frequency on M1259
- 4 Times TTL frequency on M1257
- MOS output drives 200pf.
- Other frequencies available from 1MHz thru 16MHz

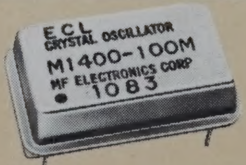

200 MAX
215 MAX
060 TYP
008/ 025
15 MIN.
018 ± 001
300 ± 005
400
600 ± 005
100 ± 005
Pin 1
Pin 7
300 ± 005
495 ± 005
150
250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4) ON .48 x .18 CTRS

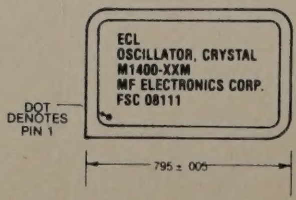

OSCILLATOR CRYSTAL
M1200-XXXM
M F ELECTRONICS CORP
FSC 08111
DOT DENOTES PIN 1
795 ± 005

ECL SINGLE/COMPLEMENTARY OUTPUT: 10 MHz TO 125 MHz IN ALL METAL CASE

- **Reliable units for Commercial or Industrial application generating your frequency to 125 MHz and delivering standard 10.000 ECL output. Stability ranges ±.0025% to ±1.0%.**

Series	Stability
M1400, M2400	±.01%
M1410, M2410	±.02%
M1414, M2414	±.05%
M1415, M2415	±.10%
M1416, M2416	± 1.0%
M1444, M2444	±.0025% (25ppm)
M1445, M2445	±.0050% (50ppm)


ECL
CRYSTAL OSCILLATOR
M1400-100M
MF ELECTRONICS CORP
1083


ECL
OSCILLATOR, CRYSTAL
M1400-XXM
MF ELECTRONICS CORP.
FSC 08111
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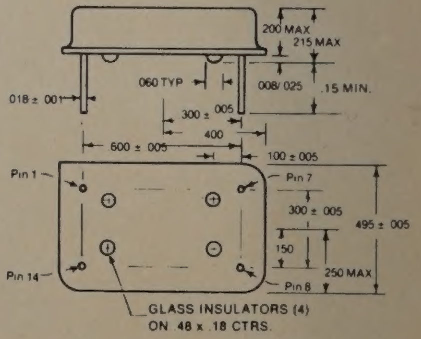
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495 ± 005
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250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4) ON .48 x .18 CTRS.

CIRCLE NO. 562

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10 Renewal Place, New Rochelle, N.Y. • 10801 • (914) 576-6570 • TWX: 710-563-0643

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Use before 8/31/85

Area Code ☐☐☐ Office Telephone ☐☐☐-☐☐☐☐

1st/2nd Initial ☐ ☐ Last Name ☐ Title

Company Name (Do not abbreviate if possible)

Division ☐ Internal Mail Code

Company Street Address

Company City ☐ State ☐ Zip Code

Circle Reader Service number for Literature/Catalogs

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
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6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
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509	519	529	539	549	559	569	607	617	627
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B

No. of engineers here ☐
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- (D) 20-49
- (E) 50-99
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1. Products you specify or authorize purchase of:
   (Check all codes that apply)

- ☐ 802 Amplifiers (Equipment)
- ☐ 803 Amplifiers (Components)
- ☐ 804 Audio Components
- ☐ 806 Book and Publications
- ☐ 808 Capacitors
- ☐ 810 Coils / Inductors
- ☐ 812 Communications Equipment
- ☐ 814 Computers
- ☐ 815 Computer Peripherals
- ☐ 816 Interconnection Products
- ☐ 818 Control Components
- ☐ 820 Fans / Blowers / Heat Sinks
- ☐ 822 Crystals
- ☐ 823 Crystal Oscillators / Filters
- ☐ 824 Delay Lines
- ☐ 826 Displays / Indicators
- ☐ 828 Enclosures
- ☐ 830 Environmental Test Equipment
- ☐ 832 Filters (Except Crystal)
- ☐ 834 Function Modules
- ☐ 838 Instruments / Recorders
- ☐ 840 IC's Hybrid
- ☐ 842 IC's Monolithic
- ☐ 844 Keyboards / Keyswitches
- ☐ 846 Magnetic Products
- ☐ 852 Panel Meters
- ☐ 854 Microwave Components
- ☐ 855 RF Components
- ☐ 856 Motors
- ☐ 858 Optoelectronic Components
- ☐ 859 Fiberoptic Components / Systems
- ☐ 864 Panel Hardware (Knobs etc.)
- ☐ 866 Power Supplies (Lab Type)
- ☐ 867 Power Supplies / Batteries
- ☐ 868 Production Equipment (Tools etc.)
- ☐ 870 Protective Devices (Fuses etc.)
- ☐ 872 Prototype Design Aids
- ☐ 874 Fixed Resistors
- ☐ 876 Pots / Trimmers
- ☐ 878 Relays / Solenoids
- ☐ 880 Semiconductors (Discrete & Monolithic)
- ☐ 882 Sensors / Transducers / Encoders
- ☐ 884 Shields / Shielding
- ☐ 885 Software
- ☐ 886 Switches
- ☐ 888 Thermal Elements
- ☐ 890 Transformers (Power)
- ☐ 891 Transformers (Signal)
- ☐ 892 Tubes
- ☐ 894 Wire / Cable
- ☐ 901 Microprocessors
- ☐ 902 Microcomputers
- ☐ 903 Production Materials / Supplies
- ☐ 904 Computer Supplies (Paper, Tape etc.)

2. Do you specify or purchase through Distributors?
   ☐ Yes (905) ☐ No (906)

3. Do you receive a personal copy of:
   ☐ EEM (907) ☐ IC Master (908) ☐ Neither (909)

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GOLD BOOK

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P.O. Box 1430
Riverton, NJ 08077

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VOLUME

2

PRODUCT DATA FILES

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Because the product categories are broad, refer to the Product Directory in Volume 1 to pinpoint the exact product data page for a specific product, by manufacturer. To quickly identify the file number in which data on a product will most likely appear, consult the Product Data File Index on page 4 of this volume and the Expanded Product Data File Index in Volume 1, on page 14.

Product data for the following companies appears in the volumes indicated:*

ONE-COMPANY VOLUMES **VOL. 3**	**• C&K (C&K Switches)** **• DTI (Data Translation) • SYN (Synertek)**

See Volumes 1 and 1a for these Directory Sections:

VOL. 1	**Product Directory/Trade Name Directory**
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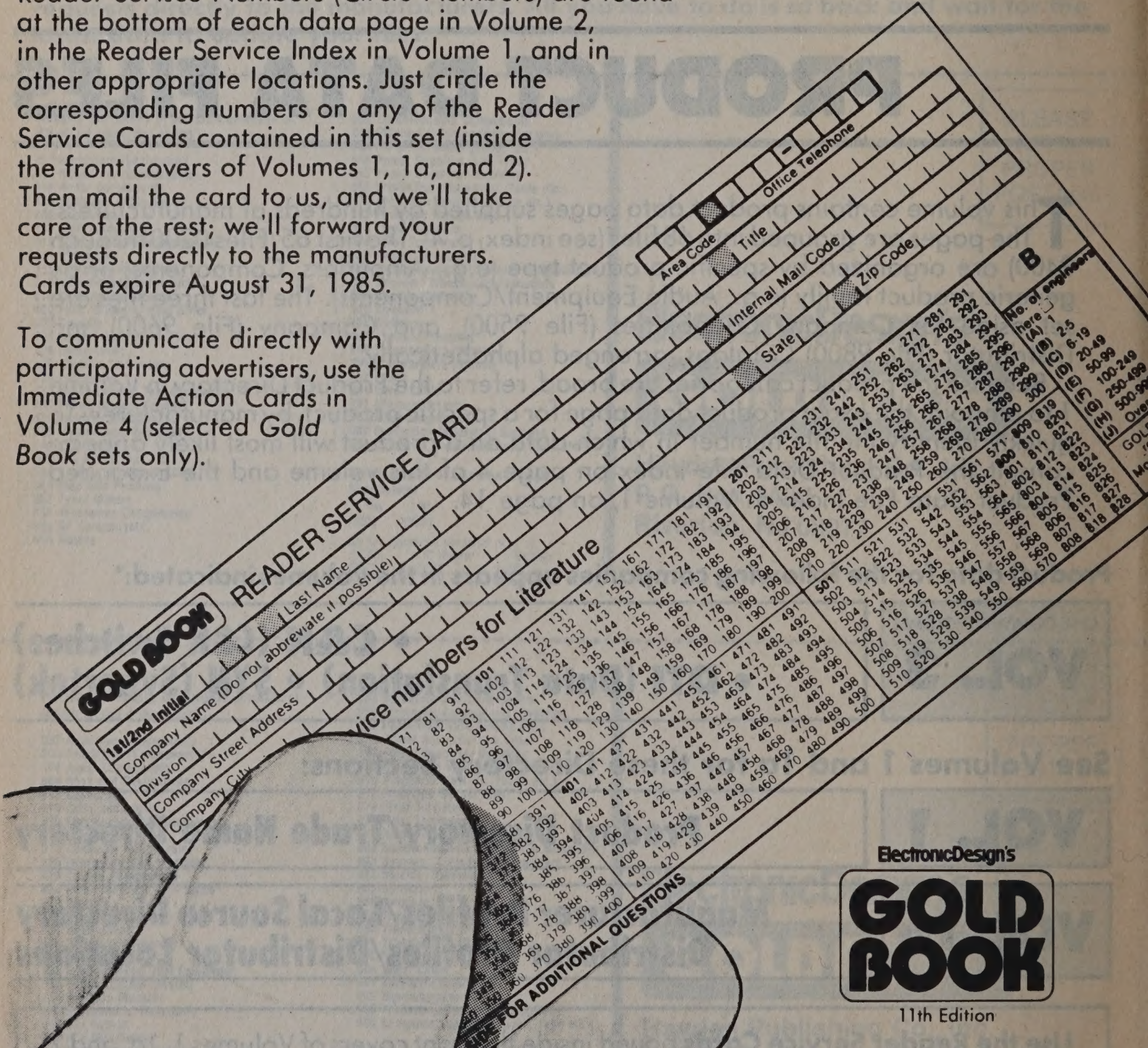
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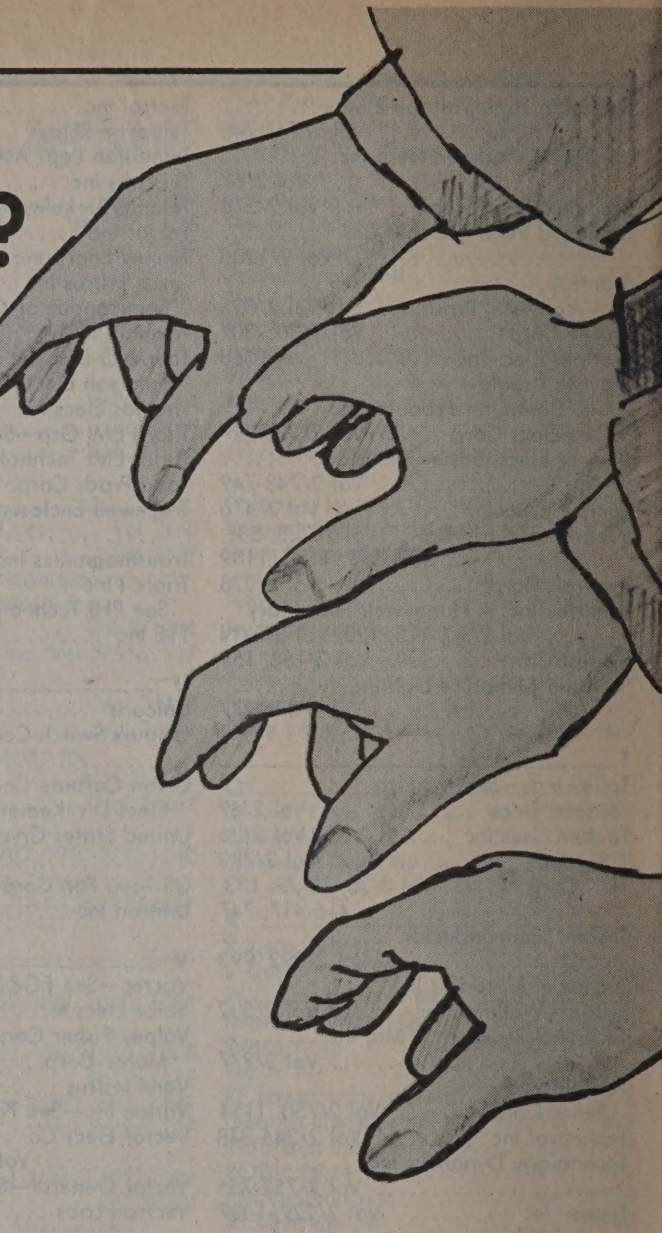

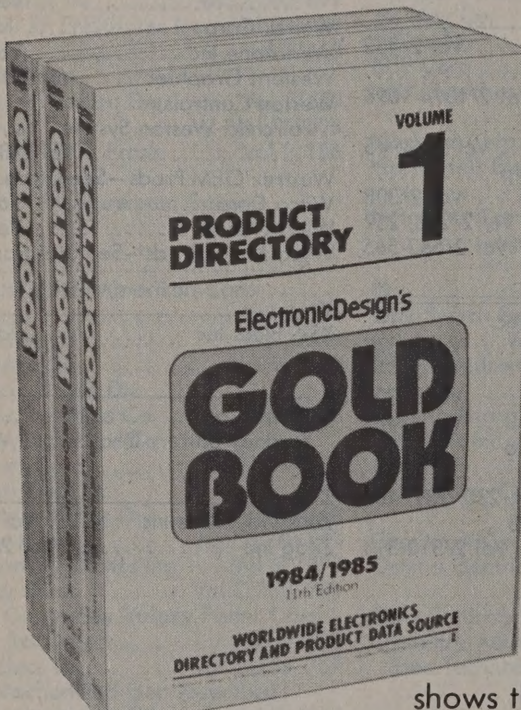
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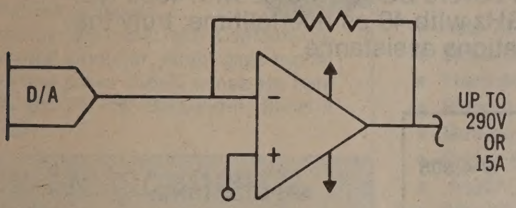

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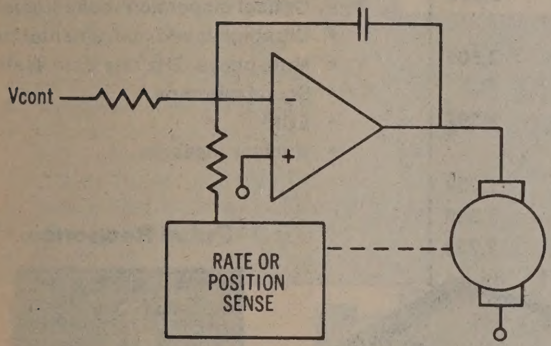

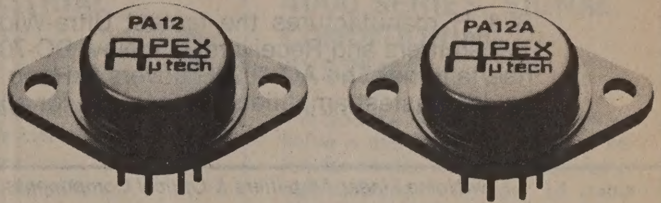

DESCRIPTION

APEX MICROTECHNOLOGY CORP. offers the industry's largest selection of high voltage, high current operational amplifiers designed for resistive, inductive and capacitive loads. The output of high current models is protected against inductive kickback or back EMF. For optimum linearity, most output stages are biased for class A/B operation. These devices are housed in hermetically sealed 8 pin TO-3 packages.

APPLICATION

These hybrid integrated circuits allow the designer to achieve the precision associated with Op Amps and the power associated with discrete multi-component boosters all in one device. This improves factors of reliability, performance and cost. Some of the prime applications for High current Models include: Motor Drives controlling rate or position, magnetic CRT Deflection, Programmable Power Supplies for constant voltage or current, Valve control, Pin drivers for ATE equipment and compact audio amplifiers. High voltage models often share some of the above applications and also take on tasks such as Electrostatic CRT Deflection and driving piezoelectric transducers.

SPECIFICATIONS & CROSS REFERENCE

		HIGH CURRENT MODELS								HIGH VOLTAGE MODELS			
		PA01	PA02/A	PA07/A*	PA09/A	PA10/A*	PA12/A*	PA51/A*	PA73	PA08/A*	PA83/A*	PA84/A*	Units
INPUT													
OFFSET VOLTAGE, initial at T_C=25°C	MAX	±12	±10/±3	±2 ±.5	±3/±.5	±6/±3	±6/±3	±10/±5	±10	±2/±.5	±3/±1	±3/±1	mV
OFFSET VOLTAGE, vs temperature	MAX	±65	±50/±25	±30/±10	±30/±10	±65/±40	±65/±40	±65/±40	±65	±30/±10	±25/±10	±25/±10	μV/°C
BIAS CURRENT, initial at T_C=25°C	MAX	50	.2/.1	.05/.01	.10/.02	30/20	30/20	40/20	40	.05/.01	.05/.01	.05/.01	nA
BIAS CURRENT, vs temperature	MAX	400	FET	FET	FET	±400	±400	400	400	FET	FET	FET	pA/°C
OFFSET CURRENT, initial at T_C=25°C	MAX	15	±.1/±.05	.05/.01	.05/.01	±30/±10	±30/±10	±10/±3	10	.05/.01	.05/.01	.05/.01	nA
INPUT IMPEDANCE, DC	TYP	2 x 10^8	10^{12}	10^{11}	10^{11}	2 x 10^8	2 x 10^8	2 x 10^8	2 x 10^8	10^{11}	10^{11}	10^{11}	Ω
INPUT VOLTAGE, differential, safe	MAX	±V_S −3	±V_S −5	±V_S	±V_S	±V_S −3	±V_S −3	±V_S −3	±V_S −3	±50	±V_S −10	±V_S −10	V
COMMON MODE VOLTAGE, operating	MIN	±V_S −6	±V_S −6	±V_S −12	±V_S −10	±V_S −5	±V_S −5	±V_S −6	−V_S −6	±V_S −12	±V_S −12	±V_S	V
COMMON MODE VOLTAGE, safe	MAX	±V_S	±V_S −2	±V_S	±V_S	±V_S	±V_S	±V_S	±V_S	±V_S	±300	±300	V
COMMON MODE REJECTION, DC	TYP	110	100	120	104	100	100	110	110	130	130	130	dB
GAIN													
OPEN LOOP, full load at 10 Hz	MIN	91	86	92	80	96	96	94	91	96	96	100	dB
GAIN-BANDWIDTH PRODUCT, at 1 MHz	TYP	1	4.5	1.3	150	6	4	1	1	5	5	75	MHz
POWER BANDWIDTH, at nom. supply	TYP	23	500	18	2500	23	20	16	23	90	60	250	KHz
OUTPUT													
VOLTAGE SWING	TYP	±V_S −5	±V_S −2	±V_S −3	±V_S −7	±V_S −5	±V_S −5	±V_S −5	±V_S −5	±V −5	±V_S −5	±V_S −3	V
CURRENT, peak at T_C=25°C	MIN	5	5	5	4	5	10/15	10	5	.15	.075	.040	A
CURRENT, short circuit		adjustable	adjustable	adjustable	4.5 A	adjustable	adjustable	adjustable	adjustable	adjustable	.1 TYP	.050 TYP	A
SLEW RATE, at max. load	TYP	2.6	20	5	400	5	4	2.8	2.6	30	30	200	V/μs
POWER SUPPLY													
VOLTAGE, operating	MIN	±10	±7	±12	±10	±10	±10	±10	±10	±15	±15	±15	V
VOLTAGE, operating	NOM	±28	±15	±35	±30	±40	±40	±28/±34	±28	±100	±150	±150	V
VOLTAGE, operating	MAX	±28	±19	±50	±40	±45/±50	±45/±50	±36/±40	±30	±150	±150	±150	V
CURRENT, quiescent at T_C - 25°C	MAX	50	37	30	85	25	50/35	10	5	6.5	8.5	7.5	mA
POWER TO LOAD, AC peak T_C=70	MAX	105	70	180	120	165	420	270	110	13	10	5.7	Watts
THERMAL													
RESISTANCE, junction to case, DC	MAX	2.6	2.6	2.6	1.8	2.6	1.4	1.8	2.6	6.5	6.5	6.5	°C/W
RESISTANCE, case to air	TYP	30	30	30	30	30	30	30	30	30	30	30	°C/W
TEMPERATURE RANGE, storage		−65 to 150	−65 to 150	−65 to 150	−65 to 150	−65 to 150	−65 to 150	−65 to 150	−65 to 150	−65 to 150	−65 to 150	−65 to 150	°C
TEMPERATURE RANGE, operating, case		−25 to 85	−55 to 125	−55 to 125	−25 to 85	−55 to 100/125	−55 to 100/125	−55 to 125	−55 to 85	−55 to 125	−55 to 125	−55 to 125	°C
TEMPERATURE RANGE, specified case		−25 to 85	−25/55 to 85/125	−25 to 85	−25 to 85	−25/55 to 85/125	−25/55 to 85/125	−25/55 to 85/125	−25 to 85	−25 to 85	−25 to 85	−25 to 85	°C
INTERNAL POWER DISSIPATION, AC peak T_C=70	MAX	60	35	60	60	60	135	105	60	26	26	26	Watts
THERMAL SHUTDOWN		NO	NO	NO	YES	NO	NO	NO	NO	YES	YES	YES	N/A
SECOND SOURCED BY			National LH0101					Burr Brown OPA501	Burr Brown 3573		Burr Brown 3583	Burr Brown 3584	

* These models are available in MIL-STD./883B method 5008 screening. Specify "M version" (ie: PA10M) (ie: PA10M)

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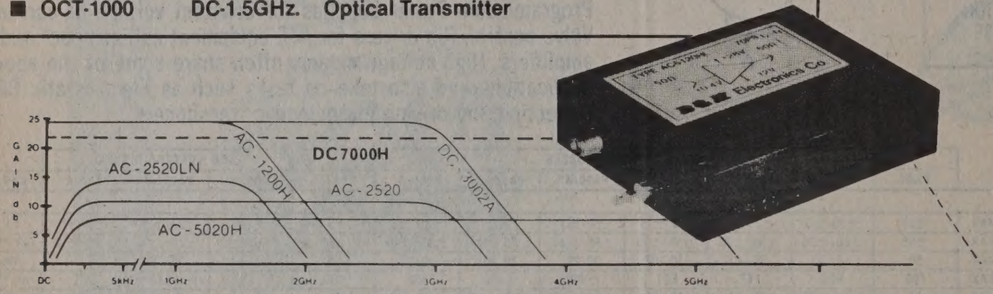
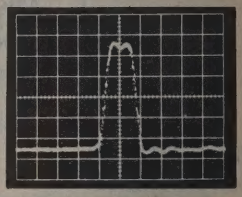
■ **DC-3002A**	DC-3.15GHz.	138ps rise/falltime	Gain = 23.5db	1,609
	Small signal Good SWR + 1dbm compression point.			
■ **AC-7020H**	2kHz-7.5GHz.	49ps rise/falltime	Gain = 20.5db	3,505
	AC version of the DC-7000H.			
■ **AC-5120H**	2kHz-5.4GHz.	69ps rise/falltime	Gain = 20.5db	2,505
	Low SWR + 19dbm 1db compression point			
■ **AC-3120HI**	2kHz-3.5GHz	115ps rise/falltime	Gain = 21db	3,397
	Large signal + 28 dbm (630mW) 1db compression pt.			
■ **AC-3020**	2kHz-3.15GHz	130ps rise/falltime	Gain = 23.5db	1,399
/LN	2kHz-1.4GHz.	2.6db N.F.	Gain = 24db	1,399
■ **OC-3002LN**	Photo detector/preamp	DC-5GHz.	80ps t_r/t_f	2,728
■ **OCT-1000**	DC-1.5GHz.	Optical Transmitter		

APPLICATIONS:

- Giga Bit optical communications
- High resolution radar
- Optical dispersion measurements
- Ultrahighspeed instrumentation
- Multi-phase GHz rate data systems
- Scope preamps
- ECM
- Nuclear research



Pulse Response



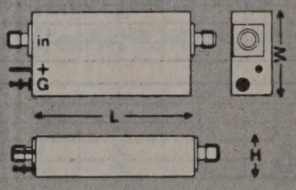
AC 5120H 200ps/Div.

*** HIGH SPEED AMPLIFIERS AND OPTICAL COMPONENTS ***

Model	Bandwidth†	Gain in db	Noise Figure	Risetime	P out @ 1 db comp.	Case #
AC-12XY	XY to 1.40GHz	25.00	4.8 @ 1GHz	275ps	+20dbm	24
AC-24XY	XY to 3.15GHz	11.00	4.0 @ 3GHz	130ps	+ 2dbm	18
AC-25XY-LN	XY to 1.70GHz	14.00	2.5 @ 1GHz	230ps	+ 2dbm	18
AC-30XY	XY to 3.15GHz	23.50	4.0 @ 3GHz	130ps	+ 2dbm	19
AC-30XY-LN	XY to 1.40GHz	24.00	2.6 @ 1GHz	275ps	+ 2dbm	16
AC-31XYH/P	XY to 3.5GHz	21.00	6.0 @ 3GHz	115ps	+24.5/28.0dbm	25
AC-50XYH	XY to 5.50GHz	7.50	6.0 @ 3GHz	69ps	+19dbm	25
AC-51XYH/P	XY to 5.50GHz	20.50	6.0 @ 3GHz	70ps	+19dbm	26
AC-60XYH	XY to 6.3GHz	20.00	6.0 @ 3GHz	58ps	+19dbm	26
AC-70XYH	XY to 7.3GHz	20.50	6.0 @ 3GHz	49ps	+19dbm	26
DC3002A	DC to 3.15GHz	23.50	4.0 @ 3GHz	138ps	+ 2dbm	20
DC5000H	DC to 5.0GHz	21.00	6.0 @ 3GHz	69ps	+19dbm	28
DC6000H	DC to 6.0GHz	21.00	6.0 @ 3GHz	56ps	+19dbm	28
DC7000H	DC to 7.0GHz	21.00	6.0 @ 3GHz	46ps	+19dbm	28
SL-300	DC to 5.50GHz	-0.10	------------	65ps	+ 1dbm	21
OC3002-LN	DC to 5.0GHz	20A/W*	5.0db 0.4 to 1.0nm	80ps	+ 2dbm	27
OC5020-LN	2kHz to 3.0GHz	450A/W*	4db "	100ps	+19dbm	27-28
OC5000-LN	DC to 3.0GHz	450A/W*	4db "	100ps	+19dbm	27-28
OCT-1000	DC to 1.5GHz	-10db	------------	220ps	3mw @ .85 µm	21

†NOTE: Low end cut-off specifiable from 2kHz to 10MHz

Type	Case#	W	L	H
		Dimensions in inches		
AC-1200	24	1.93	2.50	0.75
AC-25XY	18	1.66	1.25	0.62
AC-30XY	19	2.54	1.25	0.62
AC-30XY-LN	16	1.66	1.25	0.62
AC-5120H	26	3.21	2.50	0.75
DC-3002A	20	2.80	2.50	0.75
DC5000H	28	3.21	3.00	1.05
DC6000H	28	3.21	3.00	1.05
DC7000H	28	3.21	3.00	1.05
SL-300/A	21	0.88	1.25	0.62
OC-3002LN	27	2.85	2.50	1.50
OCT-1000	27	2.85	2.50	1.50
OC5000LN	27-28	5.80	2.50	1.50



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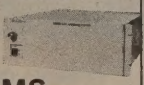

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- 110 dB CMR
- Independent Fixed Gains x1 to x1000
- Independent Fixed Filter 10Hz to 1KHz
- Optional Excitation Power Supply
- Optional Bridge Calibration
- Optional Bridge Completion
- Bulletin 2011

680 INDUSTRIAL SERIES

- Auto Zero
- Strain Gage Conditioning
- Thermocouple Linearization
- Reference Junctions
- Multifunction Amplifiers
- Bridge Excitation and Bipolar Cal.
- .5 µV/°C Zero Stability
- 120 dB CMR and 300V CMV
- 12V dc, 28V dc or 115V ac power
- Bulletin 2005

700 WIDEBAND SERIES

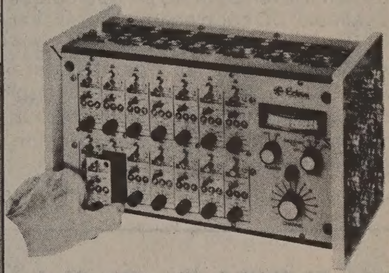
- 100 kHz Bandwidth
- Manual or Programmable Gain
- Digital Storage
- Local Readout
- 1 µV/°C Zero Stability
- .003%/°C Gain T.C.
- .01% Gain Accuracy
- 300V CMV • 126 dB CMR
- 3-pole filters • Dual outputs
- Bulletin 2003

776 SERIES HIGH PERFORMANCE SIGNAL CONDITIONING UNIT

- CMV ± 1200 Volts DC or Equiv. AC
- CMR 125dB DC to 50KHz, 85dB to 1MHz
- 10 Meg Ohm Input Impedance
- Selectable Gain x1 to x1000 with Vernier
- 0.1% Gain Accuracy, 0.01% Stability
- 100KHz Bandwidth
- Selectable Filter
- Constant Voltage or Dual Tracking Constant Current Excitation
- Internal Calibration Source
- AC Powered
- Bulletin 2014

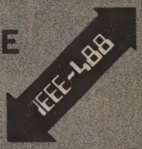
4000 SERIES, SIGNAL CONDITIONING SYSTEMS

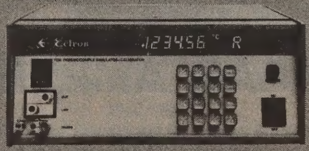
The typical 4000 series system shown below is designed for Airborne or Vehicular service involving moderately high G forces. It includes 14 stable 400 series amplifiers, a monitor meter and monitor selection switch, individual CAL switches, bridge excitation, bridge balance and conditioning.



Other 4000 series systems are designed for operation during shocks up to 100 G's. Features available in these systems include integral VCO's, FET Calibration, Channel ID signals, Rechargeable Battery Pack and others. (See Bulletin 2010)

MODEL 1120 THERMOCOUPLE SIMULATOR CALIBRATOR





CALIBRATES . . .
Digital Thermometers
Temperature Recorders
Thermocouple Transmitters

- 8 TC Types: E,J,K,T,R,S,B,C
- 0.005% of Reading Accuracy
- IEEE - 488 Interface
- Key in temperature directly in C or F
- Microprocessor based
- DC Calibration capability
- Bulletin 2012

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CORPORATION

MVP ELECTRONICS

WIDEBAND LOG VIDEO AMPLIFIERS
PROGRAMMABLE GAIN AMPLIFIERS
WIDEBAND LINEAR AMPLIFIERS

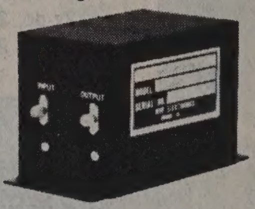
LOGARITHMIC VIDEO AMPLIFIERS

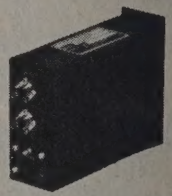
DESCRIPTION

The MVP Electronics line of Wideband Logarithmic Video Amplifiers are intended for broadband applications which require wide dynamic range, low drift and excellent linearity. The output rise time and other transient characteristics do not vary appreciably as a function of input signal level. Both AC and DC coupled units are available. DC coupled units are available with drift correction circuits. A dual mode unit is also available which can be operated as either a straight DC coupled unit or as a DC coupled unit with drift correction. Drift corrected units will also compensate for a DC level variation on the input (user's output).

FEATURES

Bandwidths to 35 Mhz (full power)
Dynamic ranges to 100 DB.
±1.0 DB log linearity
Very low drift and noise
Custom designs at low cost





SELECTABLE GAIN AMPLIFIERS

DESCRIPTION

The MVP Electronics line of Selectable Gain Amplifiers provide selected gains by means of a front panel selector switch. Up to seven gains are available. Both standard and custom designs can be provided. Units are available with or without an internal power supply. Internal filters can also be included.

FEATURES

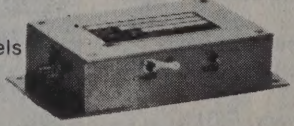
Bandwidth 6 Mhz
Gain ratios of 1,2,5,10,20, 50 and 100
15 volts peak to peak output
Excellent gain stability
DC coupled
50 ohm input impedance

GAIN SELECTOR

LINEAR AMPLIFIERS

WIDEBAND DC AMPLIFIERS

Bandwidths to 40 Mhz
Low drift (1 uv/Deg. C)
Single ended and differential models
Excellent gain stability
Low noise



HIGH GAIN AMPLIFIERS

AC coupled
Gains to 74 DB
Excellent gain stability
Bandwidths to 12 Mhz
Low Noise
Plate or rack mounted

PROGRAMMABLE GAIN AMPLIFIERS

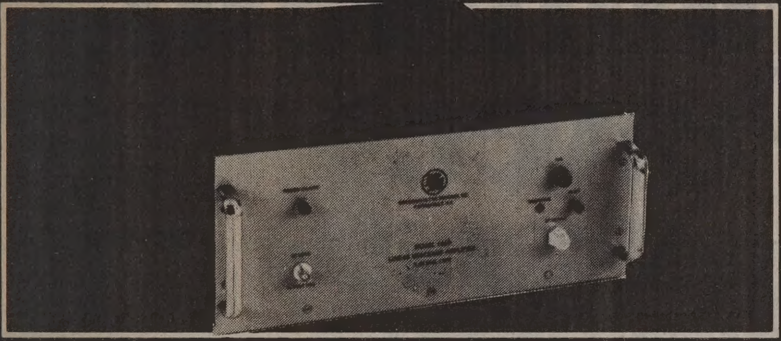
Digitally programmable
Up to 16 gain ratios
Bandwidths to 30 Mhz
Low noise and drift
Excellent gain stability
DC coupled

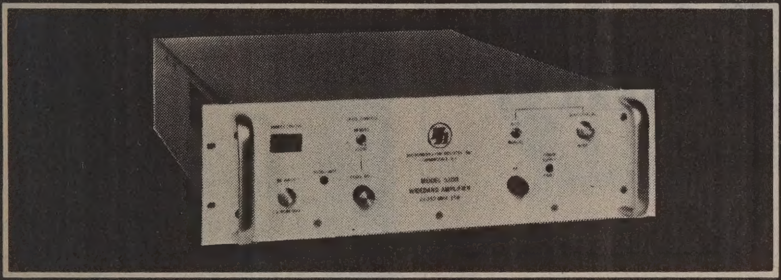
MULTIPLE OUTPUT AMPLIFIERS

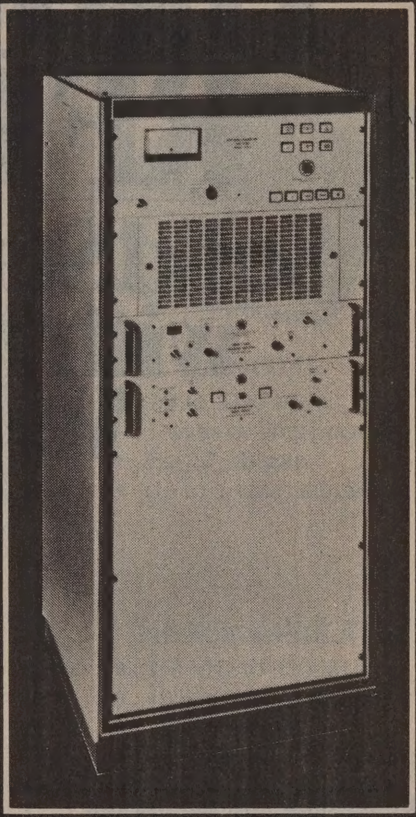
DC coupled
Up to 4 outputs
High level outputs
Gains to 20 DB
Bandwidths to 10 Mhz
Excellent gain stability
Plate or rack mounted

P.O. BOX 5534, ORANGE, CALIFORNIA 92667; PHONE (714) 639-9246

For More Information. Circle No. 4







depend on ifi: High gain, High power, High quality, Wideband power amplifiers

400 SERIES Ultra Wideband RF Power Amplifiers			5300 SERIES Broadband Solid State Power Amplifiers			1600 SERIES Solid State Broadband HF Power Amplifiers		
Model	**Rated Output (Watts)**	**Frequency**	**Model**	**Rated Output(Watts)**	**Frequency**	**Model**	**Rated Output(Watts)**	**Frequency**
402	100	.01 to 220 MHz	5300	15	.01 to 250 MHz	1660	5, Class A	.2 to 35 MHz
412	100	1 to 220 MHz	5301	10	.01 to 500 MHz	1560	5, Class A	.01 to 20 MHz
422	200	1 to 220 MHz	5310	15	1 to 320 MHz	1670	35, Class A	.2 to 35 MHz
404	400	.01 to 220 MHz	5311	10	1 to 500 MHz	1570	35, Class A	.01 to 20 MHz
414	400	1 to 220 MHz	5360	50	.01 to 250 MHz	1680	70, Class A	.2 to 35 MHz
406	1000	.01 to 220 MHz	5361	35	.01 to 500 MHz	1580	70, Class A	.01 to 20 MHz
416	1000	1 to 220 MHz	5362	40	1 to 500 MHz	1600	130, Class A	.2 to 35 MHz
410	2000	.01 to 220 MHz	5370	50	1 to 320 MHz	1500	130, Class A	.01 to 20 MHz
430	2000	1 to 220 MHz	5401	10	500 to 1000 MHz	1690	150, Class AB	.5 to 30 MHz
469	5000	1 to 100 MHz	5411	15	500 to 1000 MHz	1700	280, Class AB	.5 to 30 MHz
489	15000	1 to 100 MHz				1610	500, Class AB	.5 to 30 MHz
						3220	1000, Class AB	.5 to 30 MHz

Also depend on IFI for:

- ***E-Field Generators and Sensors***
- ***TEM Test Cells***
- ***Radiation Hazard Monitors***
- ***Leveling Preamplifiers***
- ***Custom EMC/Susceptibility Systems***

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(516) 694-1414

The Ultimate in RF Power.

Solid State Reliability with Incredible Versatility.

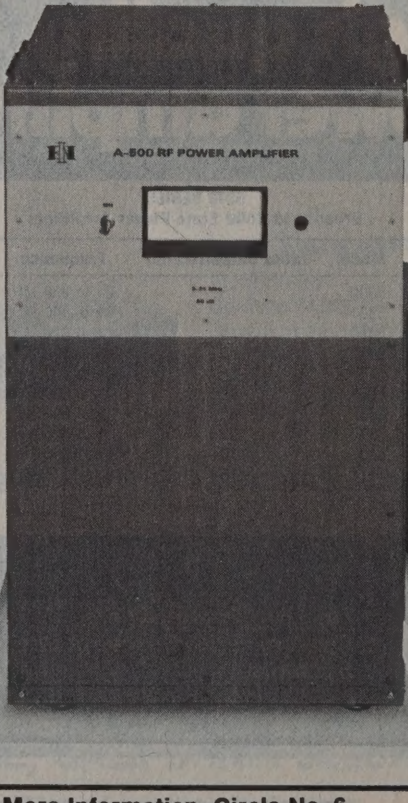
400 Watts/1040L

- 10 kHz to 500 kHz
- Up to 700 watts output
- Useful power up to 1 MHz
- Built-in true average power meter

MODEL 1040L POWER AMPLIFIER

500 Watts/A-500

- 300 kHz to 35 MHz
- Up to 1000 watts pulse and CW
- No bandswitching
- Works into any load impedance


A-500 RF POWER AMPLIFIER

100 Watts/2100L

- 10 kHz to 12 MHz coverage
- 100 watts linear Class A power
- Up to 250 watts saturated

MODEL 2100L RF POWER AMPLIFIER

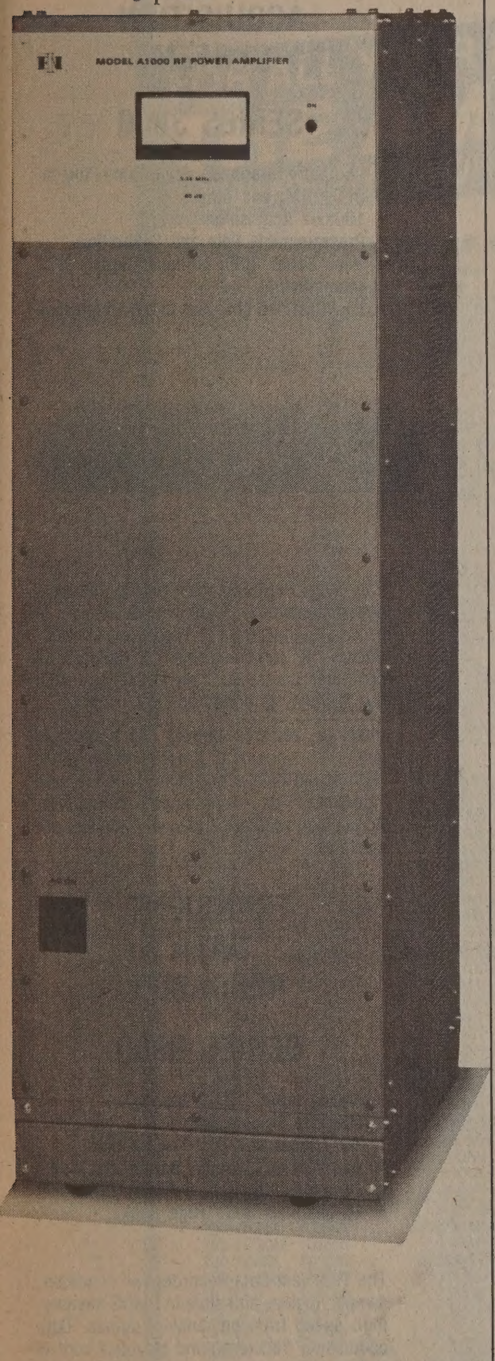
200 Watts/3200L

- 250 kHz to 150 MHz
- 200 watts linear power to 120 MHz
- 175 watts to 150 MHz
- Operates from 115/230V receptacle

3200L RF POWER AMPLIFIER

1000 Watts/A1000

- 300 kHz to 35 MHz
- 1000 watts linear Class A
- Ruggedly built
- Operates from 230 VAC, 3 phase

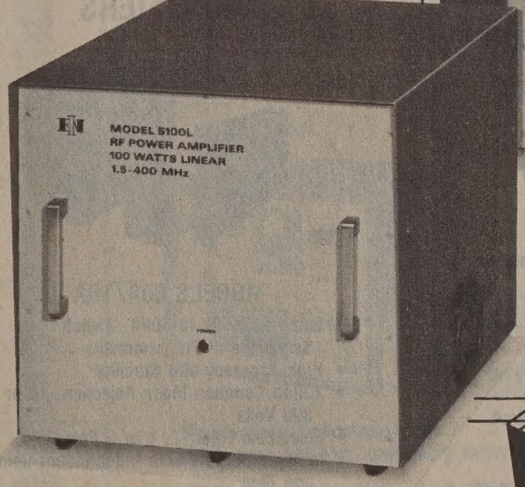

MODEL A1000 RF POWER AMPLIFIER

25 Watts/525LA

- Flat 1 to 500 MHz
- 25 watts linear output
- Up to 40 watts pulse and CW
- No bandswitching

100 Watts/5100L

- Flat 1.5 to 400 MHz
- 100 watts linear power
- 200 watts to 200 MHz
- No bandswitching

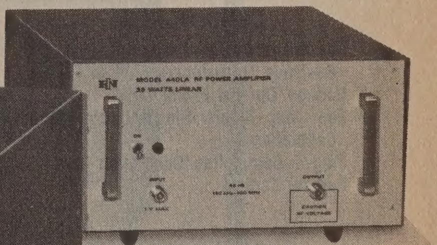

MODEL 5100L
RF POWER AMPLIFIER
100 WATTS LINEAR
1.5-400 MHz

3 Watts/603L

- 0.8 to 1000 MHz
- 3 watts of linear power
- Flat 37 dB gain
- Up to 5 watts saturated

40 Watts/440LA

- 150 kHz to 300 MHz
- 40 watts Class A linear
- State-of-the-Art
- Up to 75 watts CW and pulse


MODEL 440LA RF POWER AMPLIFIER

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The advanced design line of RF power amplifiers

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PACIFIC

TRANSDUCER SIGNAL CONDITIONING

SERIES 8200

- Mainframe/Plug-in Transducer Conditioners
- Transducer Calibration and Balance
- Isolated Excitation and Output
- Differential Instrumentation Amplifier
- Optically Isolated Remote Control
- Self-Contained, Line-Operated
- Compact-10 Channels in 5¼" High Rack

MODEL 8210 TRANSDUCER CONDITIONER

- Conditions 1, 2 and 4-Arm Resistive Transducers
- Voltage/Current Excitation
- Four Step Bipolar Single/Double Shunt Calibration
- Plug-in Completion/Calibration Card
- Remote Control

MODELS 8260/8265 INSTRUMENTATION AMPLIFIER

- Wideband Differential Instrumentation Amplifier
- Gains 1 to 2500
- 10 Volt or 300 Volt Common Mode
- Full Scale Output Offset
- Switch Selectable 2 or 4 Pole Filter
- AC or DC Input Coupling
- Dual Outputs, ±10 Volts at 100mA

MODEL 8270 CARRIER AMPLIFIER/DEMODULATOR

- LVDT, Variable Reluctance, Strain Gage Transducers
- Adjustable 1 to 5 Volts, 3kHz Excitation
- Gains from 2 to 1000
- Remote 5-Step Calibration
- 6-Pole (36db/octave) Filter
- Data, Tape and Recorder Outputs

TRANSDUCER AMPLIFIERS

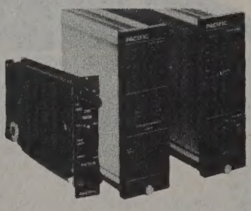
MODELS 8250/8255

- Strain Gage; 1, 2, or 4-Arm Bridges; RTD's and Potentiometers
- Isolated Voltage/Current Excitation
- Automatic Balance, Remote Calibration
- Instrumentation Amplifier, Gains 1 to 2500
- Switch Selectable 2 and 4-Pole Filters
- 10 or 300 Volt Common Mode
- Data, Tape and Recorder Outputs, ±10 Volts at 100mA

MODELS 3210/3215

- Strain Gage or Bridge Transducers
- Computer Addressable Calibration and Multiplexed Outputs
- Differential Amplifier, Gains 1 to 2500
- 10 or 300 Volt Common Mode
- Low Cost - $390 per Channel

INSTRUMENTATION AMPLIFIERS



MODELS 60A/70A

- Gains from .01 to 5000, Switch Selectable or Programmable
- High Accuracy and Stability
- 130db Common Mode Rejection, 10 or 300 Volts
- Selectable Filter; 2, 4 or 6 Poles
- Multiple Outputs with Independent Gain and Zero
- Self-Contained, Line-Powered
- Compact, 10-Channels in 5¼" High Rack

MODELS 3100/3150

- Gains from .01 to 2500, Continuously Adjustable
- 10 or 300 Volt Common Mode
- Computer Addressable Multiplexed Outputs
- Lowest Cost - $250 per Channel

DATA ACQUISITION SYSTEM

SERIES 3000

- Computer Interfaced, Mainframe Plug-in
- DEC, IBM, and Others
- 100kHz Acquisition
- Programmable Gain and Calibration
- Uses Series 3000 Modular Signal Conditioning
- Low Cost/16 channels in 3½" high rack

The 3000 Series Transducer Conditioning System provides a user with the ability to process signals from diverse types of transducers. It combines the convenience of computer controlled data acquisition with the flexibility of hands-on local control.

Interface address buffers store multiple scan lists including programmable gain. High speed data acquisition is routine with "personal" or "mini/micro" computers. Acquisition software and system drivers are available.

TRANSIENT DATA RECORDER

SERIES 9800

- Analog Input, 12-Bit Resolution
- 500 kHz Sample Rate
- Pre-Trigger and Post-Trigger Data
- Non-Volatile Memory, Battery Back-up
- Computer Interface, Software Drivers
- 10-Channels in 7" High Rack

The Transient Data Recorder will condition, sample, digitize and store in CMOS memory, high speed transient analog signals. Data acquisition, recording and playback control functions are structured for direct computer interface.

Two hundred channels may be controlled by a single interface. Battery back-up assures data integrity in severe environmental applications.

PACIFIC INSTRUMENTS 2355 Whitman Road, Concord, California 94518 • (415) 827-9010 • TWX (910) 481-9977

FOR ALL YOUR RFI/EMI NEEDS

THE AMPLIFIER HOUSE

"WHERE THE WORLD SHOPS"

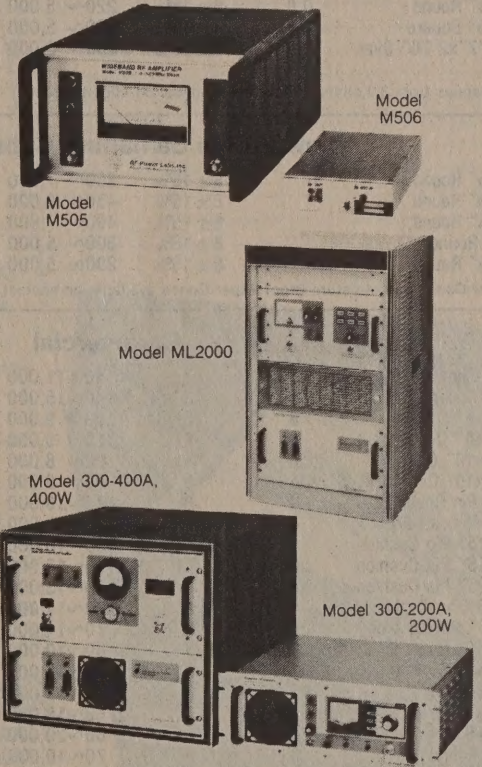
LINEAR WIDEBAND RF AMPLIFIERS

Model	CW Output	Frequency Range	Gain	Construction
*A102	2W	1-100MHz	25dB	S
M102L	2W	30Hz-100MHz	40dB	S
*M502	2W	.5-450MHz	35dB	S
M502-C	2W	.5-450MHz	35dB	S
M305	5W	.3-280MHz	37dB	S
*M305-S	5W	.5-250MHz	37dB	S
M505	5W	1-520MHz	33dB	S
*M506	5W	1-520MHz	33dB	S
M110	10W	.5-150MHz	40dB	S
M310	10W	.3-280MHz	37dB	S
250-10	10W	.01-230MHz	35dB	TS
LM310	10W	.5-300MHz	50dB	S
30-12AC	12W	.1-32MHz	40dB	S
*30-12L	12W	.01-25MHz	40dB	S
30-12LC	12W	.01-25MHz	40dB	S
*30-12AM	12W	.1-32MHz	40dB	S
M120	20W	1-150MHz	45dB	S
M320	20W	1-275MHz	45dB	S
30-25AC	25W	.1-32MHz	42dB	S
30-25C	25W	2-32MHz	42dB	S
*30-25AM	25W	.1-32MHz	42dB	S
M125L	25W	50Hz-100MHz	50dB	TS
300-35	35W	225-400MHz	40dB	S
*U35	35W	225-400MHz	9dB	S
30-50AC	50W	.1-32MHz	42dB	S
30-50C	50W	2-32MHz	45dB	S
M150	50W	.5-100MHz	50dB	S
250-110	100W	.01-250MHz	10dB	T
250-145	100W	.01-230MHz	48dB	T
250-145B	100W	2-200MHz	48dB	T
130-100A	100W	110-160MHz	45dB	S
*130-100B	100W	110-160MHz	17dB	S
*V100	100W	110-160MHz	17dB	S
*V100B	100W	110-160MHz	34dB	S
*V100C	100W	110-160MHz	40dB	S
300-100A	100W	225-400MHz	45dB	S
*300-100B	100W	225-400MHz	17dB	S
*U100	100W	225-400MHz	17dB	S
300-200A	200W	225-400MHz	47dB	S
*300-200B	200W	225-400MHz	16dB	S
ML200	200W	1-30MHz	50dB	S
220-250A	200W	.2-200MHz	13dB	T
220-250B	200W	.01-200MHz	48dB	T
220-250	200W	.2-200MHz	50dB	T
300-400A	400W	225-400MHz	50dB	S
*300-400B	400W	225-400MHz	50dB	S
M4000	400W	.01-400MHz	55dB	TS
ML500	400W	2-30MHz	50dB	S
220-525	500W	.25-200MHz	23dB	T
220-525A	500W	.01-200MHz	23dB	T
220-560A	500W	.01-200MHz	60dB	T
220-560B	500W	.1-200MHz	60dB	T
ML1000	700W	2-30MHz	50dB	S
220-1K30L	1000W	.01-200MHz	20dB	T
220-1K30M	1000W	1-200MHz	20dB	T
220-1K60L	1000W	.01-200MHz	60dB	T
220-1K60M	1000W	1-200MHz	60dB	T
ML2000	1200W	2-30MHz	60dB	S
220-2K20	2000W	2-30MHz	20dB	T
220-2K30	2000W	2-30MHz	60dB	T
M5001	5000W Pulse	1-10MHz	68dB	TS
M5010	5000W Puse	10-50MHz	68dB	TS

*DENOTES: Module Without Power Supply. T = Tube Final; S = All Solid State; TS = Hybrid

RF POWER LABS produces the most complete line of wideband RF power amplifiers. All amplifiers have been designed and developed with reliability and versatility in mind. Every advance in this field's current technology has been applied in these State-of-the-Art instruments, which makes these amplifiers valuable where reliability is a must.

Custom-produced equipment. RF Power Labs can design a piece of equipment that meets your specific needs and requirements.



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SPEAKERS

General Purpose Miniature *

TYPE NUMBER	CONE DIAMETER & SHAPE	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	FREQUENCY RESPONSE (Hz)	MAGNET MATERIAL	MAGNET WEIGHT (Oz.)	DEPTH	REMARKS
S150RA	1½″ Round	0.1	8±15%	770~ 4,000	Alnico V	0.34	.705″	
S175RA	1¾″ Round	0.1	8±15%	550~ 4,000	Alnico V	0.34	.705″	
S200RA	2″ Round	0.2	8±15%	450~ 4,000	Alnico V	0.34	.705″	
S200SA	2″ Square	0.2	8±15%	450~ 5,000	Alnico V	0.34	.740″	
S225RA	2¼″ Round	0.2	8±15%	400~ 4,000	Alnico V	0.34	.740″	
S250RA	2½″ Round	0.3	8±15%	330~ 4,000	Alnico V	0.34	.830″	
S275RA	2¾″ Round	0.3	8±15%	280~ 4,000	Alnico V	0.34	.840″	
S300RA	3″ Round	0.5	8±15%	250~ 5,000	Alnico V	0.34	.915″	
S300SA	3″ Square	0.5	8±15%	250~ 5,000	Alnico V	0.34	.975″	
S350RA	3½″ Round	0.8	8±15%	220~ 5,000	Alnico V	0.34	1.100″	
S350SA	3½″ Square	0.8	8±15%	220~ 5,000	Alnico V	0.34	1.100″	
S2X3VA	1.77″x2.76″ Oval	0.5	8±15%	280~ 5,000	Alnico V	0.35	1.03″	

*Voice Coil Impedances from 3.0 ohms - 100 ohms available on special order.

Low Profile Samarium Cobalt Magnet**

TYPE NUMBER	CONE DIAMETER & SHAPE	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	FREQUENCY RESPONSE (Hz)	MAGNET MATERIAL	MAGNET WEIGHT (Oz.)	DEPTH	REMARKS
S150RL	1½″ Round		8±15%	350~ 7,000		.056	.250″	
S150RLS	1½″ Round		8±15%	450~ 8,000		.056	.327″	
S175RL	1¾″ Round		8±15%	400~ 7,000		.056	.334″	
S200RL	2″ Round		8±15%	300~ 5,000		.056	.350″	
S225RL	2¼″ Round		8±15%	200~ 5,000		.056	.445″	

**Waterproof Mylar Cones and Moisture Proof Paper Cones available on special order.

Commercial

TYPE NUMBER	CONE DIAMETER & SHAPE	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	FREQUENCY RESPONSE (Hz)	MAGNET MATERIAL	MAGNET WEIGHT (Oz.)	DEPTH	REMARKS
S400S3	4″ Square	3	8	150~11,000	Ceramic	3		
S400S6	4″ Square	4	8	140~15,000	Ceramic	6		
S4X6V3	4″x6″ Oval	3	8	110~ 9,000	Ceramic	3		
S4X6V6	4″x6″ Oval	4	8	110~ 9,000	Ceramic	6		
S4X10V3	4″x10″ Oval	3	8	90~ 8,000	Ceramic	3		
S4X10V6	4″x10″ Oval	6	8	90~ 8,000	Ceramic	6		
S500P3	5″ Pin Cushion	3	8	135~10,000	Ceramic	3		
S500P6	5″ Pin Cushion	6	8	135~12,000	Ceramic	6		
S525P3	5.25″ Pin Cushion	4	8	105~10,000	Ceramic	3		
S525P6	5.25″ Pin Cushion	6	8	120~13,000	Ceramic	6		
S525P10	5.25″ Pin Cushion	10	8	120~13,000	Ceramic	10		
S650P3	6.5″ Pin Cushion	4	8	70~14,000	Ceramic	3		
S650P6	6.5″ Pin Cushion	6	8	70~14,000	Ceramic	6		
S6X9V3	6″x9″ Oval	3	8	80~10,000	Ceramic	3		
S6X9V6	6″x9″ Oval	6	8	70~15,000	Ceramic	6		
S6X9D10	6″x9″ Oval	15	8	70~15,000	Ceramic	10		Dual Cone
S6X9C20	6″x9″ Oval	25	8	60~18,000	Ceramic	20		Co-Axial
S6X9T20	6″x9″ Oval	25	8	60~20,000	Ceramic	20		3-Way
S800R3	8″ Round	3	8	70~10,000	Ceramic	3		
S800R6	8″ Round	6	8	70~10,000	Ceramic	6		
S800C10	8″ Round	15	8	70~13,000	Ceramic	10		Co-Axial
S800D10	8″ Round	15	8	70~12,000	Ceramic	10		Dual

Horns

TYPE NUMBER	CONE DIAMETER & SHAPE	RATED POWER (Watts)	VOICE COIL IMPEDANCE (Ohms)	FREQUENCY RESPONSE (Hz)	MAGNET MATERIAL	MAGNET WEIGHT (Oz.)	DEPTH	REMARKS
5″		10W	8	180~13,000				
5″ x 8″		25W	8	170~13,000				
8″		25W	8	160~13,000				
12″		35W	8	130~15,000				

BUZZERS

Shape	Round, Rectangular, P.C. Mount and Wire Lead Construction
DC Voltage Range	1.1V-30V
Current Range	16mA-30mA

SPEAKERS

HORNS

BUZZERS

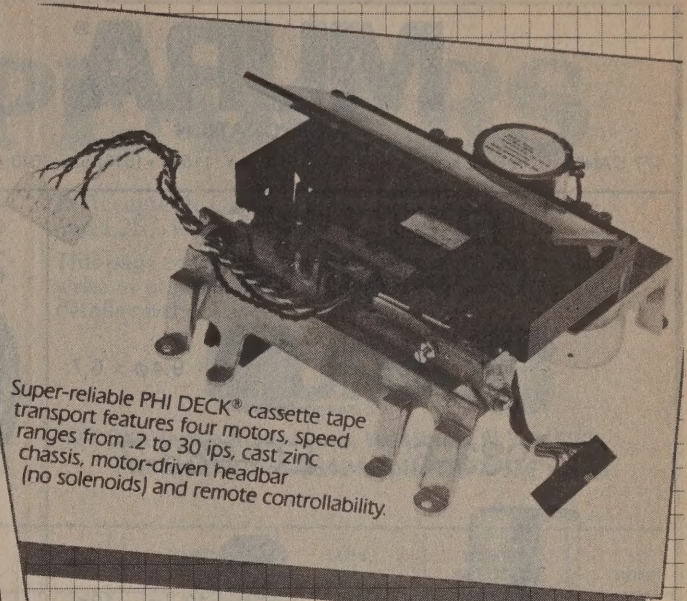
The Phi Deck® Cassette Tape Transport — so reliable that nuclear subs use our deck on board theirs.

Whether you're sweating over a prototype or you're ready for mass production, the PHI DECK® from Phi Technologies gives you the finest American-made quality at a budget-conscious price. That's because you can buy the rugged, reliable PHI-DECK a la carte or with associated electronics. And a wide range of heads and options makes each deck a custom unit. Choose from four basic models, featuring:

- AC or DC capstan motors
- Speed ranges from .2 to 30 ips
- Cast zinc chassis
- Variable speed servo drive systems
- Motor-driven headbar (no solenoids)
- Computer and remote controllability
- Analog and digital applications
- More than 100,000 in use worldwide

Phi Technologies can also supply you with PHI DECK-related electronics for a wide range of uses, including:

- **Motion Control Board** Accepts 5-volt CMOS signals for Run, Stop, Fast Forward and Fast Rewind. Tape tension, braking and motion sensing are automatically controlled.
- **Combined Motion Control and Record/Play Amplifier** Stereo R/P operates from a single 12-volt supply. Line and mike inputs, line and speaker outputs.
- **Combined Motion Control and Read/Write Amplifier** For saturated digital recording and reading. TTL Level data interface logic. Recording density up to 1600 FRPI.
- **Addressable Search System Board** Zeros in on precise address with average access speed of 120 ips., accurate to within one audio word. Either keypad or computer entry of desired tape position.
- **Search 400** A complete subsystem that provides rapid, random access to any of a large number of audio recordings. Microcomputer controllable.
- **Custom Design Engineering and Production** Services include recording mechanisms, interface electronics, hardware and software design, digital audio, speech synthesis and more.



Super-reliable PHI DECK® cassette tape transport features four motors, speed ranges from .2 to 30 ips, cast zinc chassis, motor-driven headbar (no solenoids) and remote controllability.

PHI-DECK
SEARCH 400

Search 400
Random Access Audio system

PHI Technologies, Inc.

Leaders in cassette deck technology and service.

4605 N. Stiles
Oklahoma City, OK 73105
(405) 521-9000
TWX: 910-831-3286

For more information, call or write Steve Browning at Phi Technologies (405) 521-9000 about your design requirements.

MURA®
CORPORATION
177 CANTIAGUE ROCK ROAD, WESTBURY, N.Y. 11590 • (516) 935-3640 • TELEX 967 879

MICROPHONE CARTRIDGES

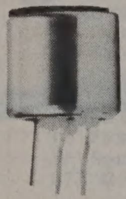
ELECTRET CONDENSER

9.4ϕ × 6h

EC-983-6

9.4ϕ × 6.7

EC-983-7


10ϕ × 10h

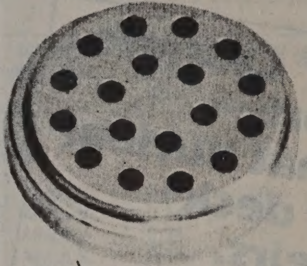
EC-983-10

10.7ϕ × 13h

EC-983-11

Sensitivity: —65dB ±3dB (0 dB:1v/μbar, 1 KHz)
Impedance: 600Ω
Frequency Range: 10-15,000 Hz
Operating Voltage: 2-10V

CERAMIC

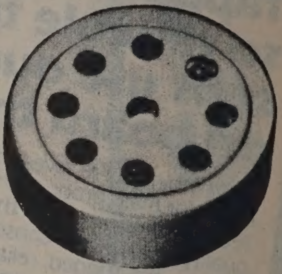


CC-30

Sensitivity : —55 dB
Response : 30 - 15 KHz
Dimensions : 30ϕ X 10.5mm
Weight : 4.5 grs.

CC-20K

Sensitivity : —70 dB
Response : 100 - 7 KHz
Dimensions : 21.6 X 15 X 8.6 mm
Weight : 2 grs.



CC-253

Sensitivity : —60 dB
Response : 30 - 15 KHz
Dimensions : 25ϕ X 10mm
Weight : 3 grs.

***CC-30** and **CC-253** are also available with crystal element.

CRYSTAL

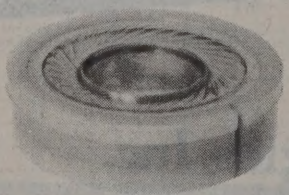
CRM-901

Sensitivity(OdB=1V/μbar) : —70dB±4dB(at 1KHz)
Frequency Response : 150-12,000Hz
Capacity : 650PF ± 30%
Impedance : Over 500K ohm.
Dimensions : 23.5 X 11mm ± 0.5mm
Weight : 3g ± 0.2g

*available with insulated wire leads.

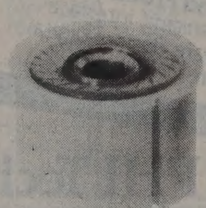
DYNAMIC

DMC-5F



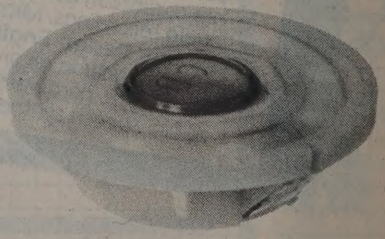
Dimensions : 30ϕ X 9mm
Sensitivity (OdB=2V/μbar) : —71dB(at 1KHz)
Impedance : 500Ω
Directionality : Omnidirectional
Weight : 29g

DMC-15F



Dimensions : 19ϕ X 13mm
Sensitivity (OdB=1V/μbar) : —79dB(at 1KHz)
Impedance : 400Ω
Directionality : Omnidirectional
Weight : 12g

DMC-8A



Dimensions : 40ϕ X 13mm
Sensitivity (OdB=1V/μbar) : —68dB(at 1KHz)
Impedance : 500Ω, 40Ω, or 55Ω
Directionality : Bidirectional
Weight : 30g

For More Information. Circle No. 11

MURA® SPEAKERS

MURA offers a full range of general purpose miniature speakers in sizes less than an inch in diameter up to a 6 x 9 inch oval version. All speakers are available in standard impedances of 3.2, 4, 8, 16, 45, 75 and 100 ohms. Special coil impedances are available upon request. Many of our smaller speakers are available with samarium cobalt magnets in addition to the more common alnico and ceramic materials. Modern manufacturing, automation and technique assures a high quality and uniformly made product. Each production lot undergoes a MIL-STD-105D single sample inspection at General Inspection Level II, Acceptable Quality Level 0.65% for performance and 1.25% for appearance.

This page contains excerpts from our catalog. Please write or call us for our complete 8 page catalog or details on those speakers shown below.

MURA®
CORPORATION
177 Cantiague Rock Road, Westbury, N.Y. 11590
Phone: 516-935-3640 ■ Telex: 967-879

DEL D.	NOMINAL SIZE	FRAME STYLE	RESONANT FREQ.	FREQ. RANGE	MAX POWER	MAGNET WEIGHT	FLUX DENSITY	DIAMETER (A)	DEPTH (B)	MOUNTING DIAMETER (D)	NET WEIGHT
	(inch)		Hz	Hz	W	g(oz)	gauss	mm(inch)	mm(inch)	mm(inch)	g(oz)
RP01									20.5 (0.80)	—	42 (1.48)
RP02									18 (0.71)	—	25.2 (0.88)
RP04									18.8 (0.74)	—	39 (1.38)
RP06								(1.97)	18.5 (0.73)	—	31 (1.09)
RP01	2¼	R	400	F₀~5,000	0.3	11.7 (0.4)	6,500	57 (2.24)	22 (0.86)	—	45 (1.58)
RP02	2¼	R	450	F₀~4,000	0.2	10 (0.35)		57 (2.24)	19.5 (0.76)	—	45 (1.58)
RP03	2¼	R	430								
RP05	2¼	R	400								
RP09	2¼	R									
SP07	2¼	S									
RP01	2½	R	300		0.4	11.7 (0.4)	6,500	66 (2.6)	23.2 (0.91)		
RP02	2½	R	350	F₀~5,000	0.5	14.5 (0.53)	6,800	66 (2.6)	27.2 (1.07)	—	50 (1.76)
							6,300	66 (2.6)	21.4 (0.84)	—	47 (1.65)
							6,300	66 (2.6)	21.5 (0.85)	72 (2.83)	51 (1.79)
							6,500	66 (2.6)	28.5 (1.12)	72 (2.83)	55 (1.93)
							6,500	70 (2.76)	23 (0.9)	—	48.5 (1.71)
							6,800	70 (2.76)	26.5 (1.04)	—	60 (2.1)
			350			10 (0.35)	6,300	70 (2.76)	21.5 (0.85)	—	46 (1.62)
RP01	3	R	300	F₀~5,000	1	11.7 (0.4)	6,500	77 (3.03)	25.5 (1)	—	51 (1.8)
RP02	3	R	300	F₀~5,000	1		6,500	77 (3.03)	25.7 (1)		
RP03	3	R	300								
RP09	3	R	300								
SP05	3	S	250								
SP06	3	S	300								(2.1)
SP11	3	S	250			14.5 (0.53)					65.8 (2.31)
SP02	3½	S	200	F₀~8,000	1	11.7 (0.4)	6,500	87 (3.43)	31.4 (1.24)	100 (3.94)	73 (2.58)
SP03	3½	S	200	F₀~8,000	1.5	14.5 (0.53)	6,800	87 (3.43)	34 (1.34)	100 (3.94)	84 (2.9)
RP02							6,800	92 (3.62)	35.5 (1.32)	—	79 (2.76)
							6,500	92 (3.62)	29.5 (1.16)	—	70 (2.47)
							6,300	92 (3.62)	27.5 (1.08)	—	65 (2.28)
SP05							6,500	92 (3.62)	31 (1.22)	103 (4.06)	75 (2.65)
SP07							6,300	92 (3.62)	28 (1.10)	103 (4.06)	71 (2.47)
RP02		R					6,500	103 (4.06)	35 (1.38)	—	87 (2.97)
RP09	4	R	160	F₀~10,000	2	16.9 (0.6)	6,800	103 (4.06)	38 (1.5)	—	107 (3.78)
RP11	4	R	180	F₀~10,000	1.5		6,800		38 (1.5)	—	96 (3.38)
SP01	4	S	180	F₀~10,000	1						
SP05	4	S	180	F₀~10,000	2						
SP07	4	S	180	F₀~10,000	3						
SP12	4	S	180	F₀~10,000	1						
SP17	4	S	180	F₀~10,000	1			103 (4.06)	34 (1.34)		92 (3.25)

OVAL SPEAKERS

FERRITE MAGNET SPEA

MYLAR CONE

ALNICO MAGNETIC

FLUX TYPE

MICRO SPEAKER

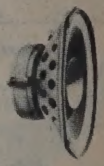
For More Information. Circle No. 11

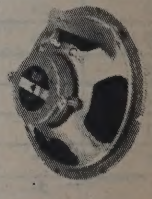
Quam Loudspeakers: The Sound Decision

For Industrial Applications

8 ohm impedances

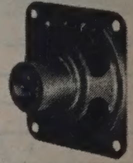
MODEL NUMBER	SIZE (Inches) AND SHAPE	FREQUENCY RESPONSE (Hertz)	POWER HANDLING CAPACITY (Watts)	VOICE COIL IMPEDANCE (Ohms)	VOICE COIL DIAMETER (Inches)	MAGNET MATERIAL AND WEIGHT (Ounces) AV—Alnico V BF-Ceramic	DEPTH (Inches)	SHIPPING WEIGHT (Lbs.)
2A05Z8	2 RD	300 Hz to 6K Hz	1	8-10	9/16	.52AV	7/8	1/4
22A05Z8	2-1/4 RD	300 Hz to 10K Hz	1	8-10	9/16	.52AV	1	1/4
23A05Z8	2x3 Oval	250 Hz to 15K Hz	1	8-10	9/16	.52AV	1-1/8	1/4
25A05Z8R	2-1/2 RD	150 Hz to 12K Hz	1-1/2	8-10	9/16	.52AV	1-1/8	1/4
25A07Z8	2-1/2 SQ	150 Hz to 12K Hz	1-1/2	8-10	9/16	.65AV	1-1/4	1/4
26A07Z8	2x6 Oval	130 Hz to 16K Hz	2	8-10	9/16	.65AV	1-19/32	1/2
27A05Z8	2-3/4 RD	150 Hz to 8K Hz	1	8-10	9/16	.52AV	1-3/16	1/4
30A05Z8	3 SQ	150 Hz to 12K Hz	2	8-10	9/16	.52AV	1-9/32	1/4
30A05Z8R	3 RD	250 Hz to 12K Hz	2	8-10	9/16	.52AV	13/16	1/4
30C1Z8	3 SQ	150 Hz to 12K Hz	4	8-10	9/16	1.1BF	1-3/16	1/2
30C25Z8	3 SQ	150 Hz to 14K Hz	5	8-10	9/16	2.35BF	1-3/16	3/4
3A05Z8	3-1/2 SQ	130 Hz to 12K Hz	2	8-10	9/16	.52AV	1-5/16	1/4
3A05Z8R	3-1/2 RD	150 Hz to 11K Hz	2	8-10	9/16	.52AV	1-3/8	1/4
3C1Z8	3-1/2 SQ	130 Hz to 12K Hz	4	8-10	9/16	1.1BF	1-5/16	1/2
35A05Z8	3x5 Oval	130 Hz to 14K Hz	2	8-10	9/16	.52AV	1-1/2	1/4
35A2Z8	3x5 Oval	130 Hz to 12K Hz	4	8-10	3/4	1.2AV	1-11/16	1/2
35C1Z8	3x5 Oval	130 Hz to 12K Hz	4	8-10	9/16	1.1BF	1-1/2	1/2
35C3Z8	3x5 Oval	130 Hz to 12K Hz	5	8-10	3/4	3BF	1-11/16	3/4
4A05Z8R	4 RD	200 Hz to 12K Hz	2-1/2	8-10	9/16	.52AV	1-1/2	1/2
4A1Z8	4 SQ	200 Hz to 12K Hz	3	8-10	9/16	.65AV	1-5/8	3/4
4C1Z8	4 SQ	200 Hz to 12K Hz	4	8-10	9/16	1.1BF	1-1/2	1/2
4C25Z8	4 SQ	200 Hz to 12K Hz	5	8-10	9/16	2.35BF	1-5/8	3/4
4C5Z8	4 SQ	120 Hz to 15K Hz	7	8-10	3/4	4.8BF	1-5/8	1
46A1Z10	4x6 Oval	150 Hz to 9K Hz	3-1/2	8-10	9/16	.65AV	1-11/16	3/4
46C3Z8	4x6 Oval	130 Hz to 10K Hz	6	8-10	3/4	3.0BF	1-3/4	1
48C3Z8	4x8 Oval	120 Hz to 12K Hz	6	8-10	3/4	3BF	2-1/16	1-1/2
410A2Z10	4x10 Oval	120 Hz to 12K Hz	6	8-10	3/4	1.2AV	2-11/16	1
5A1Z8	5 PC	125 Hz to 12K Hz	3-1/2	8-10	9/16	.65AV	1-13/16	3/4
5C1Z8	5 PC	130 Hz to 12K Hz	4	8-10	9/16	1.1BF	1-11/16	1/2
5C3Z8	5 PC	130 Hz to 14K Hz	5	8-10	3/4	3.0BF	1-7/8	1
52A1Z8	5-1/4 PC	100 Hz to 12K Hz	3-1/2	8-10	9/16	.65AV	1-7/8	3/4
52C10Z8	5-1/4 PC	125 Hz to 9K Hz	10	8-10	1	10BF	2-1/4	2-1/4
57C3Z8	5x7 Oval	75 Hz to 10K Hz	7	8-10	3/4	3BF	2-5/16	1
6A2Z8	6-1/2 PC	70 Hz to 14K Hz	6	8-10	3/4	1.2AV	2-5/8	1
6C5Z8	6-1/2 PC	70 Hz to 14K Hz	7	8-10	3/4	4.8BF	3	1-3/4
69A2Z10	6x9 Oval	70 Hz to 15K Hz	8	8-10	3/4	1.2AV	2-3/4	1-1/4





Miniature speakers

2A05	2 RD	300 Hz to 6K Hz	1	3-4	9/16	.52AV	7/8	1/4
2A05Z8	2 RD	300 Hz to 6K Hz	1	8-10	9/16	.52AV	7/8	1/4
2A05Z45	2 RD	300 Hz to 6K Hz	1	45	9/16	.52AV	7/8	1/4
2A05Z100	2 RD	300 Hz to 6K Hz	1	100	9/16	.52AV	7/8	1/4
22A05Z8	2-1/4 RD	300 Hz to 10K Hz	1	8-10	9/16	.52AV	1	1/4
2205Z100	2-1/4 RD	300 Hz to 10K Hz	1	100	9/16	.52AV	1	1/4
23A05	2x3 Oval	250 Hz to 15K Hz	1	3-4	9/16	.52AV	1-1/8	1/4
23A05Z8	2x3 Oval	250 Hz to 15K Hz	1	8-10	9/16	.52AV	1-1/8	1/4
25A05Z8R	2-1/2 RD	150 Hz to 12K Hz	1-1/2	8-10	9/16	.52AV	1-1/8	1/4
25A07	2-1/2 SQ	130 Hz to 14K Hz	1-1/2	3-4	9/16	.65AV	1-1/4	1/4
25A07Z8	2-1/2 SQ	150 Hz to 12K Hz	1-1/2	8	9/16	.65AV	1-1/4	1/4
25A07Z45	2-1/2 SQ	150 Hz to 12K Hz	1-1/2	45	9/16	.65AV	1-1/4	1/4
25C1Z80T	2-1/2 SQ	200 Hz to 8K Hz	4	8-10	9/16	1.1AV	1-1/16	1/2
27A05Z8	2-3/4 RD	150 Hz to 8K Hz	1	8-10	9/16	.52AV	1-1/16	1/4
27A05Z45	2-3/4 RD	130 Hz to 6K Hz	1	45	9/16	.52AV	1-1/16	1/4



For more than 50 years,

Quam-Nichols Company has been making speakers that make good sound, and supplying them in ways that make good sense. Our product line currently includes more than 3,000 standard models with thousands of others that can be manufactured to meet specific requirements.

Quam speakers are available off-the-shelf through our nationwide distributor network, with a backup inventory of 70,000 standard units at our factory warehouse.

Engineering assistance is available for special applications. Such special designs can be produced in quantities as small as 100.

Quam-Nichols Company

234 East Marquette Road • Chicago, Illinois 60637
(312) 488-5800

Quam Loudspeakers: The Sound Decision

For Communications Applications

Intercom

MODEL NUMBER	SIZE (Inches) AND SHAPE	FREQUENCY RESPONSE (Hertz)	POWER HANDLING CAPACITY (Watts)	VOICE COIL IMPEDANCE (Ohms)	VOICE COIL DIAMETER (Inches)	MAGNET MATERIAL AND WEIGHT (Ounces) AV—Alnico V BF-Ceramic	DEPTH (Inches)	SHIPPING WEIGHT (Lbs.)
2A05Z45	2 RD	300 Hz to 6K Hz	1	45	9/16	.52AV	7/8	1/4
25A07Z16	2-1/2 SQ	150 Hz to 12K Hz	1-1/2	16	9/16	.65AV	1-1/4	1/4
25A07Z45	2-1/2 SQ	150 Hz to 12K Hz	1-1/2	45	9/16	.65AV	1-1/4	1/4
27A05Z45	2-3/4 RD	130 Hz to 6K Hz	1	45	9/16	.52AV	1-1/16	1/4
30A05Z45	3 SQ	130 Hz to 14K Hz	2	45	9/16	.52AV	1-3/16	1/4
30C1Z450T	3 SQ	170 Hz to 12K Hz	4	45	9/16	1.1BF	1-3/16	1/2
3A07Z450T	3-1/2 SQ	150 Hz to 10K Hz	2-1/2	45	9/16	.65AV	1-7/16	1/2
35A05Z16	3x5 Oval	100 Hz to 12K Hz	2	16	9/16	.52AV	1-1/2	1/4
4A1Z16	4 SQ	180 Hz to 15K Hz	3	16	9/16	.65AV	1-5/8	3/4
4A1Z45	4 SQ	180 Hz to 12K Hz	3.0	45	9/16	.65AV	1-13/16	3/4
5A1Z45	5 PC	130 Hz to 9K Hz	3-1/2	45	9/16	.65AV	1-13/16	3/4
5C1Z450T	5 PC	130 Hz to 9K Hz	4	45	9/16	1.1BF	1-11/16	1/2
8C6Z45	8 PC	70 Hz to 12K Hz	12	45	1	6.0BF	3	2-1/2

For Sound System Applications

Outdoor

25C1Z80T	2-1/2 SQ	200 Hz to 8K Hz	4	8-10	9/16	1.1BF	1-1/16	1/2
30C1Z450T	3 SQ	170 Hz to 12K Hz	4	45	9/16	1.1BF	1-3/16	1/2
3A070T	3-1/2 SQ	150 Hz to 10K Hz	2-1/2	3-4	9/16	.65AV	1-7/16	1/2
3A07Z450T	3-1/2 SQ	150 Hz to 10K Hz	2-1/2	45	9/16	.65AV	1-7/16	1/2
3C1Z80T	3-1/2 SQ	180 Hz to 15K Hz	4	8-10	9/16	1.1BF	1-1/4	1/2
4A20T	4 SQ	130 Hz to 9K Hz	4	3-4	3/4	1.2AV	1-5/8	3/4
4A2Z80T	4 SQ	130 Hz to 9K Hz	4	8-10	3/4	1.2AV	1-5/8	3/4
5C1Z450T	5 PC	130 Hz to 9K Hz	4	45	9/16	1.1BF	1-11/16	1/2
8C6PA0T	8 PC	80 Hz to 8K Hz	12	8-10	1	6.0BF	2-7/8	2-1/2

Background music and public address

4C10PA	4 PC	65 Hz to 15K Hz	18	8-10	1	10BF	3-1/2	2-1/4
8C5PAX	8 PC	70 Hz to 18K Hz	8	8-10	3/4	4.8BF	2-3/4	2
8C6PAX	8 PC	75 Hz to 19K Hz	12	8-10	1	6BF	3	2-1/2
8C10DVFR	8 PC	70 Hz to 12K Hz	15	8-10	1	10BF	3-1/8	3
8C10FEPAX	8 RD	40 Hz to 20K Hz	18	8-10	1	10BF	3-1/8	3
8C10PA	8 RD	70 Hz to 12K Hz	15	8-10	1	10BF	3	3
8C10PAX	8 PC	75 Hz to 20K Hz	15	8-10	1	10BF	3	2-3/4
8C12PA	8 RD	65 Hz to 9K Hz	20	8-10	1-1/4	12BF	3-1/8	3-1/4
10C10PA	10RD	70 Hz to 12K Hz	15	8-10	1	10BF	3-7/8	4-1/4
12C6PAS	12RD	75 Hz to 20K Hz	15	8-10	1	6BF	3-5/8	4
12C10PAX	12RD	60 Hz to 14K Hz	18	8-10	1	10BF	4-3/8	4-1/4
12C12PAX	12RD	50 Hz to 12K Hz	25	8-10	1-1/4	12BF	4-1/2	5-1/2

Transformers

MODEL NUMBER	POWER RATING	PRIMARY VOLTS	PRIMARY TAPS	INSERTION LOSS (Db)	MOUNTING CENTERS	CORE SIZE	SECONDARY LOAD (OHMS)	SHIPPING WEIGHT
TBL25	4W	25	1/4-1/2-1-2-4W	1.2	2"	1/2x5/8	8	1/2 lb.
TCL25	8W	25	1/2-1-2-4-8W	1.6	2-3/8"	5/8x5/8	8	3/4 lb.
TBL70	4W	70.7	1/4-1/2-1-2-4W	1.2	2"	1/2x5/8	8	1/2 lb.
TCL70	8W	70.7	1/2-1-2-4-8W	1.0	2-3/8"	5/8x5/8	8	3/4 lb.
TBLU	5W	25/70	5/16-5/8-1-1/4-2-1/2-5W	1.3 & 1.2	2"	1/2x5/8	8	1/2 lb.

Ceiling baffles

MODEL NUMBER	TYPE	SPEAKER SIZE (Inches)	BAFFLE DIAMETER (Inches)	MATERIAL	FINISH	CEILING PROJECTION (INCHES)	SHIPPING WEIGHT
BR8W	One-step contour	8	12-7/8	22-ga. steel (Zincrometal)	White semi-gloss powdered epoxy	3/8	1-1/2 lb.
BR8A	One-step contour	8	12-7/8	22-ga. aluminum	Brushed aluminum	3/8	1 lb.
BR8WC	Two-step contour	8	12-3/4	22-ga. steel (Zincrometal)	White semi-gloss powdered epoxy	5/16	1-1/2 lb.
BR8WP	Louvered two-step contour	8	12-3/4	White plastic	—	5/16	1 lb.

Complete speaker assemblies, including speaker, baffle and line matching transformer, are available completely assembled at the factory at no extra charge. Pre-assembled units with volume controls also are available.

Quam-Nichols Company

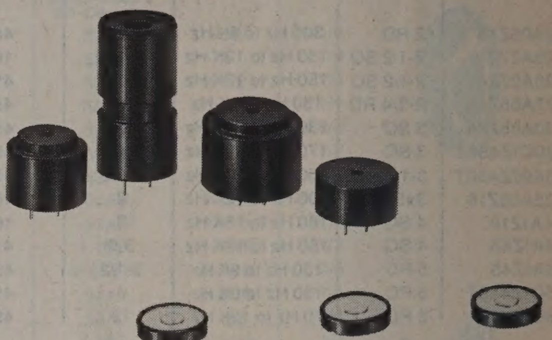
234 East Marquette Road • Chicago, Illinois 60637
(312) 488-5800

SOUNDUCERS

TDK®

TDK CORPORATION OF AMERICA 4711 West Golf Road Suite 300 Skokie Illinois 60076 U.S.A. Phone (312) 679-8200 **LOS ANGELES BRANCH** (213) 539-6631 **NEW YORK BRANCH** (516) 625-0100 **INDIANAPOLIS BRANCH** (317) 872-0370 **DETROIT OFFICE** (313) 353-9393 **TDK CORPORATION** 13-1 Nihonbashi 1-chome Chuo-ku Tokyo 103 Japan

TDK Sounducers are magnetic type sound producing devices having excellent sound quality due to the use of high performance magnets and precision manufacturing technology. These Sounducers can be used in a wide range of produces including not only general household electrical appliances but also industrial equipment.

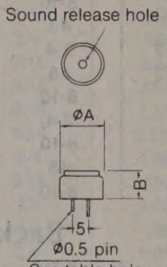


Features

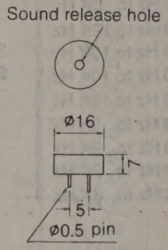
1) Input impedance is low to allow producing sound using a very low voltage.
2) No moving parts to guarantee outstanding reliability for many years.
3) Excellent sound quality because sound is produced using the resonant vibrations of the circular vibration plate and the cavity.
4) Consistently high product quality and reliable delivery dates thanks to a streamlined and highly automated manufacturing process.

Applications

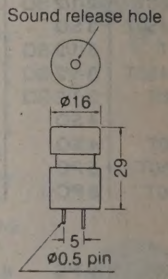
TDK Sounducers are compact, inexpensive acoustic transducers that are, in principle, similar to magnetic loudspeakers. They are suitable for producing single tones, melodies and for speech synthesis.



See table below



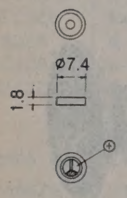
SD160701
SD160708
SD160709
SD160710



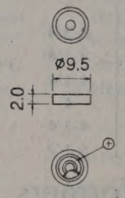
SD162901
SD162904
SD162905
SD162910

Dimensions in mm

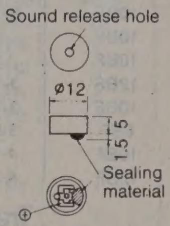
Part No.	A	B
SD141001	14	10
SD161201 SD161210 SD161215 SD161216	16	12
SD201401 SD201406 SD201409 SD201410	14	20



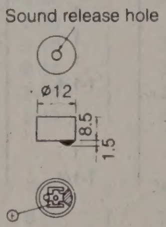
MSD741801



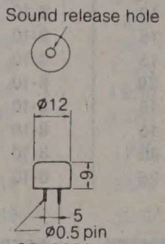
MSD952001



SD120502



SD120802



SD120901
SD120904

Part No.	Size (mm)	Operating signal voltage (Vo-p)	Frequency (Hz)	Sound* pressure (dB(A)/10cm)	Test voltage (Vo-p)	Current (mAp-p) typ	DC resistance (Ω)	Terminal construction
MSD741801	7.4 × 1.8	1 to 3	4096	68	1.5	12	110	Printed circuit board
MSD952001	9.5 × 2	1 to 3	4096	72	1.5	15	90	
SD120502	12 × 5	1 to 3	4096	75	1.5	30	46	
SD120802	12 × 8.5	1 to 3	4096	85	1.5	30	46	
SD120901	12 × 9	1 to 4	2048	80	3	60	50	Pin terminal
SD120904		1 to 4	4096	80	3	80	25	
SD141001	14 × 10	1 to 5	2048	80	3	60	50	
SD160710	16 × 7	1 to 3	4096	80	1.5	80	15	
SD160701		1 to 5	4096	80	3	60	50	
SD160709		3 to 9	4096	80	5	70	70	
SD160708		6 to 15	4096	80	12	80	120	
SD161210	16 × 12	1 to 3	2048	80	1.5	80	15	
SD161201		1 to 5	2048	80	3	60	50	
SD161216		3 to 9	2048	85	5	70	70	
SD161215		6 to 15	2048	85	12	80	120	
SD162910	16 × 29	1 to 3	2048	90	1.5	85	15	
SD162901		1 to 5	2048	90	3	60	50	
SD162904		3 to 9	2048	95	5	70	70	
SD162905		6 to 15	2048	95	12	85	120	
SD201410	20 × 14	1 to 3	2048	80	1.5	80	15	
SD201401		1 to 5	2048	80	3	60	50	
SD201409		3 to 9	2048	85	5	70	70	
SD201408		6 to 15	2048	85	12	80	120	

*Square wave, duty 5%.

For More Information. Circle No. 13

Lithiode™...Lithium-Iodine Batteries

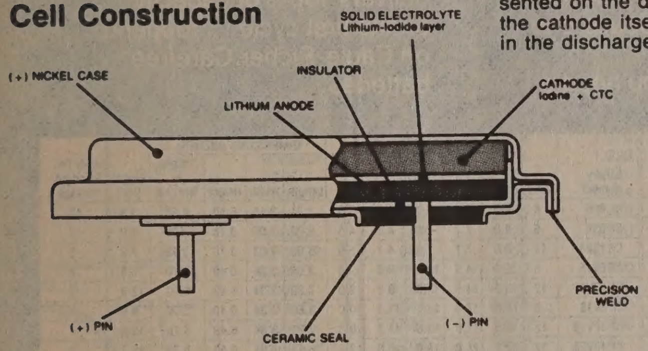
The solid-state chemistry makes the difference

The only solid-state lithium battery for CMOS RAM backup.

A Lithiode™ cell is formed when a lithium anode is brought into contact with a cathode composed of iodine and an organic which forms a conductive charge transfer complex (CTC). An initial chemical reaction between these components forms the electrolyte: solid lithium-iodide.

As current is drawn from the cell, lithium is oxidized and iodine reduced, forming additional lithium-iodide. This lithium-iodide, which serves as both electrolyte and separator, accumulates as the cell is discharged, increasing the internal resistance. The result is an initial linear decline in voltage, represented on the discharge curves. Later, when the CTC loses most of its iodine, the cathode itself begins to rise in resistance. This results in the "knee" seen in the discharge curves.

Cell Construction



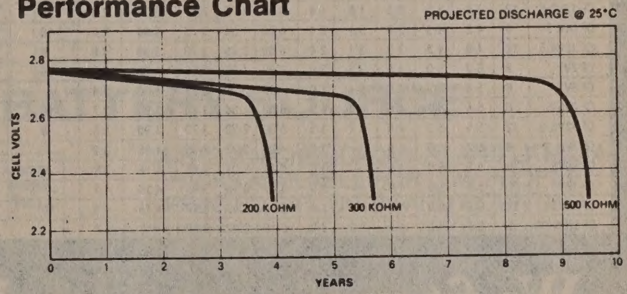
Performance Advantages

LONG LIFE	Over 10-year life capability based on 8 years of pacemaker battery test data
HERMETICALLY SEALED	Prevents battery leakage and improves battery life and reliability
BATTERY MOUNTING	Designed for standard circuit boards and wave soldering
TEMPERATURE RANGE	Will operate from −55°C to +125°C
OPERATING SAFETY	Completely safe under short circuit and voltage reversal conditions
HIGH ENERGY OUTPUT	Energy density is 0.6 watt-hr/cc and 0.12 watt-hr/gm

Battery Chart

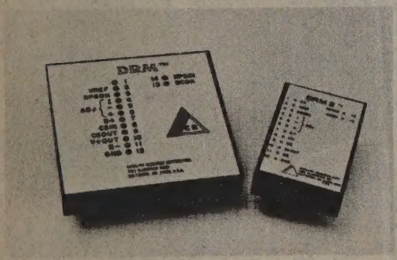
Battery Model	Voltage	Capacity	Current Capability at 25°C	Physical Size		Weight
				Diameter	Height	
1935	2.8	200 mAhr	15 μamp	19mm	3.5mm	4.8gm
2736	2.8	350 mAhr	15 μamp	27mm	3.6mm	7.1gm
3440	2.8	700 mAhr	30 μamp	34mm	4.0mm	17.8gm

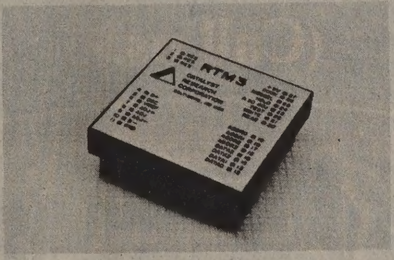
Performance Chart

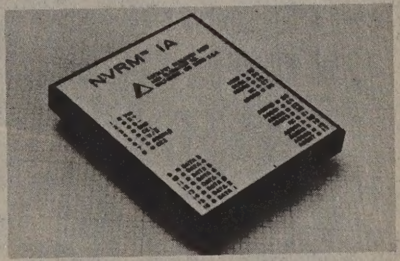


Lithiode™ Modules—Contain battery and switching circuitry for non-volatility

Save: memory, board space, design time, money. Over 10 years shelf and operational life, non-volatility.







DRM™/DRM2™—Data Retention Module
- Operational mode/data retention mode switch
- Logic level monitor
- Voltage monitor
- DCOK signal
- 13 used, 14 allocated, standard 24 pin dip pattern
- 2" x 2" x .4"/1" x 1.5" x .4"
- Available with or without battery

RTM3™—Real Time Clock/Calendar
- Microprocessor bus-oriented
- Clocks seconds, minutes, hours, day-of-week, date, month and year.
- 12 or 24 hour format
- Leap year identification
- ±30 second set
- 5V power supply
- 2" x 2" x .4"

NVRM1A™—Non-Volatile RAM Module
- 2K x 8 bits organization
- TTL compatible inputs and outputs
- 5V single power supply
- −30 C to +70 C operation
- DCOK signal
- 3.1" x 2.6" x .4"

Note: All specifications subject to change. Contact CR for verification.

Lithiode™ batteries and modules are ready for immediate shipment.
For application assistance, prices and additional information, call or write:

CATALYST RESEARCH
A DIVISION OF MINE SAFETY APPLIANCES COMPANY

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Baltimore, Maryland 21209-9987, USA
Telephone 301/296-7000 TLX 87-768 CATLYSTRES BAL

For More Information. Circle No. 14

Eagle-Picher Carefree® Batteries.

Make Eagle-Picher your first choice for rechargeable, maintenance-free batteries. We offer the broadest variety in the world.

And, if one of our over 40 standard Carefree® rechargeables doesn't fit your needs, we'll custom design and produce one that will.

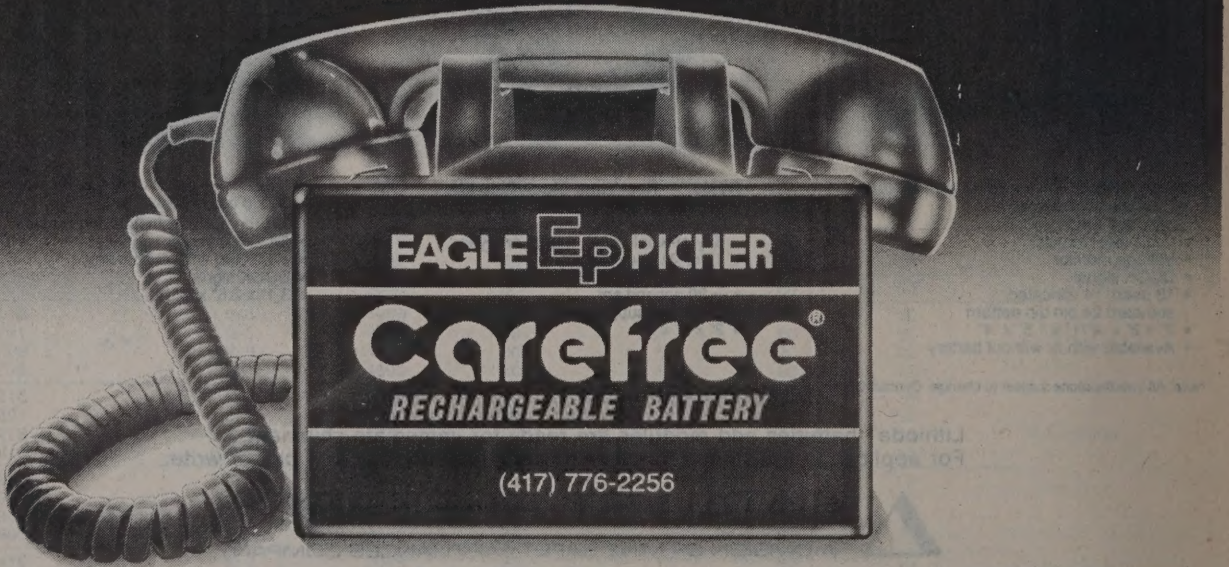
So, when you need a dependable, maintenance-free battery . . . one that delivers 100% of capacity on the first cycle . . . depend on Eagle-Picher Carefree® batteries.

Battery Number	Volts	RATED CAPACITY @					DIMENSIONS (INCHES)				Weight (lbs)	Units Per Standard Package
		20 Hr	10 Hr	5 Hr	1½ Hr	1 Hr	Length	Width	Height	Height To Terminal		
CF 6V½	6	0.45	0.38	0.35	0.21	0.23	1.92	1.00	2.00	2.25	0.3	130
CF 12V½-L	12	0.45	0.38	0.35	—	0.23	3.90	1.00	2.00	2.25	0.6	—
CF 6V1	6	0.90	0.87	0.81	0.60	0.57	2.00	1.65	1.97	2.20	0.5	72
CF 12V1	12	0.90	0.87	0.81	0.60	0.57	3.30	2.00	1.97	2.20	1.1	30
CF 12V1-L	12	0.90	0.87	0.81	0.60	0.57	4.02	1.65	1.97	2.20	1.1	24
CF 18V1	18	0.90	0.87	0.81	0.60	0.57	4.90	2.00	1.97	2.20	1.7	27
CF 12V1.5	12	1.5	1.4	1.3	1.0	0.9	7.02	1.33	2.40	2.60	1.9	24
CF 2V2.5	2	2.6	2.4	2.2	1.7	1.6	2.30	1.04	2.60	2.94	0.46	—
CF 6V2.6	6	2.6	2.5	2.3	1.8	1.6	5.30	1.35	2.37	2.56	1.4	30
CF 12V2.6	12	2.6	2.5	2.3	1.8	1.6	5.30	2.72	2.37	2.56	2.8	8
CF 6V4.5	6	4.6	4.3	3.9	3.1	2.4	6.00	1.34	3.70	3.90	2.4	16
CF 12V4.5	12	4.6	4.3	3.9	3.1	2.4	6.00	2.70	3.70	3.90	4.9	8
CF 2V5	2	5.2	5.0	4.5	3.3	3.0	2.33	1.06	3.95	4.33	0.78	36
CF 6V5	6	5.2	5.0	4.5	—	3.0	3.18	2.31	3.95	4.16	2.4	—
CF 6V5.5	6	5.5	5.3	4.8	4.2	3.5	6.00	1.34	3.70	3.90	2.7	16
CF 12V5.5	12	5.5	5.3	4.8	4.2	3.5	6.00	2.70	3.70	3.90	5.5	8
CF 8V5	8	5.2	5.0	4.5	—	3.0	4.25	2.31	3.95	4.16	3.2	—
CF 10V5	10	5.2	5.0	4.5	—	3.0	5.30	2.31	3.95	4.16	3.9	—
CF 12V5	12	5.2	5.0	4.5	—	3.0	4.62	3.18	3.95	4.16	4.7	—
CF 12V5-L	12	5.2	5.0	4.5	3.3	3.0	6.12	2.42	3.94	4.16	4.8	10
CF 12V5-PP	12	5.2	5.0	4.5	3.3	3.0	6.12	2.42	6.60	—	5.0	1
CF 8V6	8	6.0	5.7	5.3	3.6	3.5	3.34	2.15	6.50	6.66	3.9	10
CF 6V8	6	8.0	7.7	7.0	4.7	4.5	6.00	2.00	3.75	3.93	3.9	12
CF 12V8	12	8.0	7.7	7.0	4.7	5.0	6.00	4.03	3.75	3.93	7.9	6
CF 6V15	6	15.0	14.5	13.0	9.8	9.0	3.60	3.34	6.49	6.70	6.4	8
CF 12V15	12	15.0	14.5	13.0	9.8	9.0	7.22	3.34	6.49	6.70	12.8	4
CF 6V18	6	18.0	17.0	15.0	11.3	10.0	3.60	3.34	6.49	6.70	6.8	8
CF 12V18	12	18.0	17.0	15.0	11.3	10.0	7.21	3.34	6.49	6.70	13.6	4
CF 12V20	12	22.0	21.0	19.0	15.0	13.5	6.51	4.91	6.53	6.75	16.2	2
CF 24V20	24	22.0	21.0	19.0	15.0	13.5	9.83	6.51	6.53	6.75	33.0	1
CF 2V30	2	28.0	26.0	23.0	18.8	16.0	3.34	2.15	6.50	6.85	4.1	12
CF 6V30	6	28.0	26.0	23.0	18.8	16.0	6.25	3.35	6.50	6.75	12.1	4
CF 6V30-L	6	28.0	26.0	23.0	18.8	16.0	10.04	2.15	6.50	6.75	12.3	4
CF 12V30	12	28.0	26.0	23.0	18.8	16.0	6.72	6.25	6.50	6.75	24.2	2
CF 12V30-L	12	26.0	26.0	23.0	18.8	16.0	10.04	4.31	6.50	6.75	24.6	2
CF 24V30	24	28.0	26.0	23.0	18.8	16.0	12.50	6.72	6.50	6.75	48.4	1
CFM 6V33	6	33.0	31.0	27.0	21.6	19.0	6.25	3.35	6.50	6.75	12.2	4
CFM 12V33	12	33.0	31.0	27.0	21.6	19.0	6.72	6.25	6.50	6.75	24.5	2
CFM 24V33	24	33.0	31.0	27.0	—	19.0	12.50	6.70	6.50	6.75	49.0	1
CF 6V40	6	44.0	42.0	38.0	30.0	27.0	6.51	4.91	6.53	6.75	16.5	2
CF 6V50	6	50.0	45.0	40.0	27.0	26.0	7.42	4.51	7.42	8.32	21.5	2

NOTE: Data on the above listing is to be presumed correct.

We fit more space and power requirements than anyone else in the world.

(Call us.)



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We have over 100,000 cell and battery sizes in stock.

Nickel—Cadmium RECHARGEABLE SEALED CELLS AND BATTERIES

CAPACITIES UP TO 2000 AMPERE HOURS ON REQUEST

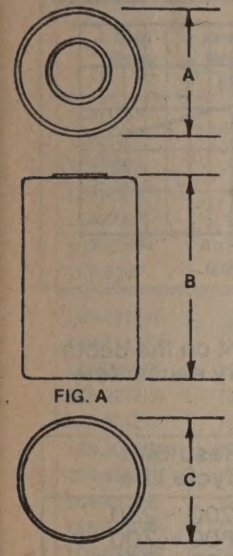

FIG. A

TYPICAL CYLINDRICAL CELLS
(FIG. A) 1.2 VOLTS PER CELL

Type	Capacity mAH	Dimensions (in.)		WT. (oz.)
		A	B	
070SC	75	.375	.805	.14
80SC	70	0.497	0.593	0.2
100SC	100	0.571	0.669	.28
110SC	110	0.55	0.65	0.24
150SC	150	0.475	1.135	0.4
170SC	170	0.625	0.625	0.4
180SC	180	0.405	1.730	0.4
225SC	225	0.675	0.646	0.4
270SCS	270	0.560	1.168	0.5
450SC	450	0.675	1.120	0.7
500SC	500	0.554	1.920	1.0
600SCP	600	0.554	1.920	1.0
600SC	600	0.625	1.920	1.0
700SCP	700	.906	1.044	1.0
700SC	750	0.655	1.920	1.0
750SC	750	1.020	0.910	1.1
100SCP	800	.550	2.5	1.0
1000SC	1000	1.000	1.280	1.1
1200SC	1200	0.875	1.600	1.5
1550SCP	1550	0.875	1.600	1.5
1800SC	1800	1.000	1.840	2.5
2200SCP	2200	1.000	0.84	2.8
2000SC	2000	1.272	1.400	2.8
4000SC	4000	1.289	2.300	4.6
4000SCP	4400	1.289	2.300	4.6
7000SC	7000	1.290	3.490	7.6
10.000SCS	10.000	1.683	4.218	12.5

All cylindrical and oval battery types feature a pressure safety device for security and reliability making them especially suited for cordless consumer and electronic products.

CUSTOM BATTERY PACKS

Cylindrical cells are incased in a rigid, high impact case. Case materials are highly dielectric to provide maximum cell insulation at minimum cost. The case is vented to each cell to provide cooling and long life. Packs are available to your specifications in any voltage.

FAST CHARGE CELLS

Special fast charge cells are available on special order either individually or in custom battery packs with thermistors for extra fast recharge capability.

Button cell batteries are constructed of sealed nickel cadmium button cells (see fig. B) to meet almost any application requirement. The compact size of button cells permits easy stacking to form multiple cell batteries of optimum power/volume ratio and space utlization. Completely sealed button cells are ideally suited for portable radios, flashlights, photoflash, alarms, and any low-drain, high capacity application.

NEW PANASONIC BATTERY SOURCE

PANASONIC LITHIUM BATTERIES

Type	Model No.	Nominal Voltage (V)	Nominal Capacity (MAh)	Standard Drain (mA)	Maximum Drain (mA)	Dimensions (MAX) (inches)		Average Weight (oz.)
						Height	Diameter	
Cylinder	BR-C	3	5,000	150	300	1.969	1.024	1.66
	BR2/3AA	3	600	2	40	1.300	.554	1.50
	BR-2/3A	3	1,200	35	150	1.319	0.669	0.48
	BR-1/2A	3	750	5	70	0.906	0.669	0.34
Coin	BR2325	3	160	0.2	5	0.998	0.906	0.11
	BR2320	3	110	0.2	5	0.079	0.906	0.09
	BR2020	3	85	0.2	10	0.075	0.783	0.09
	BR2016	3	60	0.1	2	0.063	0.787	0.05
	BR1225	3	35	0.1	2	0.098	0.492	0.03
	CR2025	3	110	0.2	5	0.008	0.787	8.00
	CR2016	3	50	0.2	5	0.063	0.787	0.06
Pin	BR435	3	40	1	3	1.413	0.165	0.03
	BR425	3	20	0.5	1.5	1.020	0.165	0.02

UNION CARBIDE "EVEREADY" LITHIUM BATTERIES

Type	Model No.	Nominal Voltage (V)	Nominal Capacity (MAh)	Standard Drain (mA)	Maximum Drain (mA)	Dimensions (MAX) (inches)		Average Weight (oz.)
						Height	Diameter	
Buttons	801*	1.5	100			0.165	0.465	
	803*	3	1.5	160		0.220	0.455	
Coin	CR2032**	3	190			0.126	0.787	
Cylindrical	2L76**	3	160			0.425	0.456	
	L544**	6	160			0.990	0.505	
	L31***	3.6	1.0Ah			1.809	0.523	

*Lithium Iron **Lithium/Manganese Dioxide ***Lithium/Thionyl Chloride

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Shown are just a few of the infinite variety of pin and lug mounts we supply. We will weld 0.032″ diameter PC board, pins to batteries of any configuration or voltage, for all types of cells or battery packs. Double pin polarized models are available.

(Not shown in photo)

CUSTOM NICKEL-CADMIUM AND LITHIUM PACKS AVAILABLE FOR LOW PROFILE PRINTED CIRCUIT BOARD MOUNTING

INVESTIGATE direct current emergency power sources available in any regulated voltage or current, featuring automatic SCR solid state switchover to a sell-contained battery. We have the answer to reliable economical D.C. power with automatic emergency back-up.

ALSO MARKETS: • Emergency lighting units. • Flashlight and lantern rechargeable batteries. • Custom and prototype design battery packs built to your specifications. • Battery chargers for all types of batteries.

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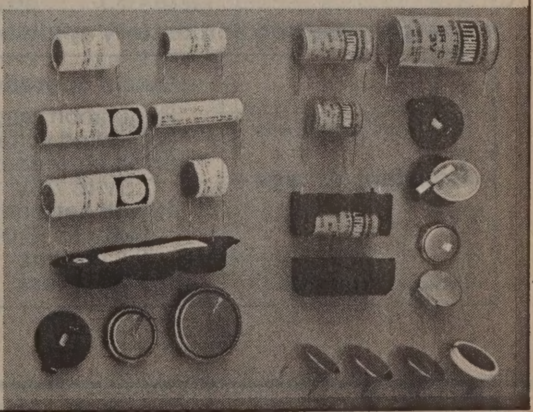

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RECHARGEABLE SEALED LEAD-ACID BATTERIES

The LCR Series is a sealed lead-acid rechargeable battery system. The lead-calcium rechargeable (LCR) battery, will stand up to tough operating conditions such as overcharge and deep discharge. In field service, troubles due to abnormal, improper operation or misuse are reduced to a minimum.

Suggested Applications

- Power sources for various portable equipment.
- Power sources for power failure back-up and/or emergency use.

Major Features

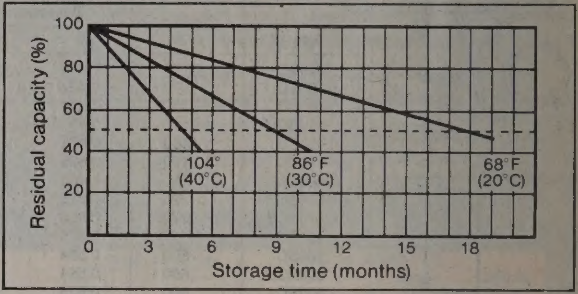
1. Exceptional deep discharge recovery.
2. Long service life; float or cyclic.
3. Gelled or starved electrolyte.
4. Maintenance-free operation.
5. Charge, discharge, or store in any position.
6. No corrosive gas generation.
7. Leakproof design.
8. No memory effect.
9. Approved as "dry cell" for airshipment by Department of Transportation and IATA.

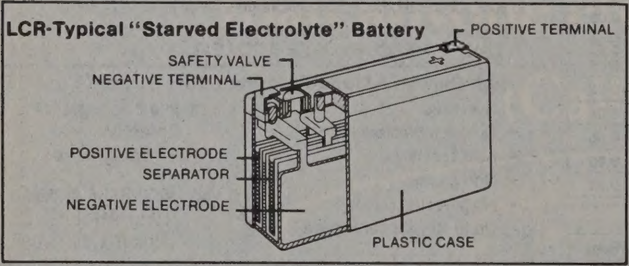
• Temperature Range Summary

Discharge: 5° ~ 122°F (-15° ~ 50°C)
Charge: 32° ~ 104°F (0° ~ 40°C)
Storage: 5° ~ 104°F (-15° ~ 40°C)

• "Shelf Life"

Self-discharge rate is very much dependent on the storage temperature as shown in the graph. Lower temperatures allow the battery to be stored for longer periods. (Each ten degree drop results in a halving of self-discharge rate and doubles storage time.)




LCR-Typical "Starved Electrolyte" Battery

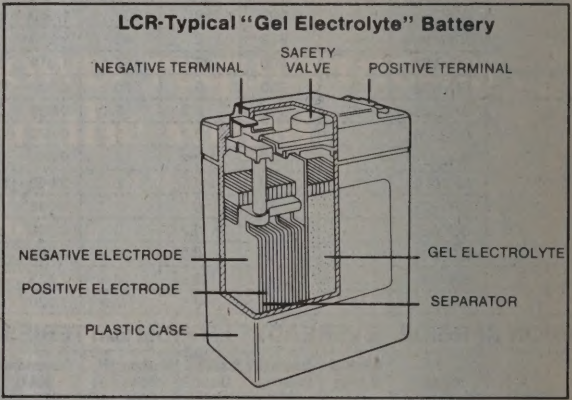
• Cycle Life

Cycle life is very much dependent on the depth of the discharge which the battery encounters during each cycle.

Discharge Depth	Resultant Cycle Life
100% discharge	200 ~ 250
60% discharge	600 ~ 700
30% discharge	1500 ~ 2000

• Standby Life

The expected float life at room temperature is estimated to be **more than 8 years** on the basis of accelerated tests.


LCR-Typical "Gel Electrolyte" Battery

• Charging method and battery application

	Cyclic operation	Trickle operation	Float operation
Constant Voltage (Note: all at 68°F, 20°C)	Regulation range of controlled voltage: 6 volt batteries: 7.3V to 7.5V 12 volt batteries: 14.6V to 15.0V Initial current: 0.4C or less	Regulation range of controlled voltage: 6 volt batteries: 6.8V to 6.9V 12 volt batteries: 13.6V to 13.8V Initial current: 0.4C or less	Regulation range of controlled voltage: 6 volt batteries: 6.8V to 6.9V 12 volt batteries: 13.6V to 13.8V Initial current: 0.4C or less

Panasonic Industrial Company • Battery Sales Division Offices

Headquarters
East Coast Office
P.O. Box 1511
Secaucus, N.J. 07094
(201) 348-5266

Panasonic
Dallas Office
1825 Walnut Hill Lane
Irving, TX 75062
(214) 257-0763 Ext. 380

Panasonic
West Coast Office
6550 Katella Ave.
Cypress, CA 90630
(714) 895-7315

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RECHARGEABLE SEALED LEAD-ACID BATTERIES

Model Number	Nominal Voltage	Nominal Capacity		Dimension				Weight (Approx.)	Standard Terminals or Connectors	Type
	(V)	10 hour rate (Ah)	20 hour rate (Ah)	Length inch (mm)	Width inch (mm)	Height inch (mm)	Total Height (including terminals) inch (mm)	lbs. (g)		
LCR-156P	6	1.5	1.6	2.60 (66)	1.30 (33)	3.35 (85)	3.35 (85)	0.84 (380)	FASTON Type 187	G
LCR-226P	6	2.2	2.4	2.60 (66)	1.30 (33)	4.11 (104.5)	4.11 (104.5)	1.15 (520)	"	G
LCR-306P	6	3.0	3.2	2.60 (66)	1.30 (33)	4.92 (125)	4.92 (125)	1.46 (660)	"	G
LCR-456P	6	4.5	4.8	3.70 (94)	1.30 (33)	4.92 (125)	4.92 (125)	2.03 (920)	"	G
LCR-606P	6	6.0	6.4	3.58 (91)	1.93 (49)	4.53 (115)	4.53 (115)	2.65 (1200)	FASTON Type 250	G
LCR-756P	6	7.5	8.0	4.53 (115)	1.93 (49)	4.53 (115)	4.53 (115)	3.31 (1500)	"	G
LCR-856P	6	8.5	9.2	4.53 (115)	1.93 (49)	4.53 (115)	4.53 (115)	3.53 (1600)	"	G
LCR-1512PF	12	1.5	1.6	2.60 (66)	2.64 (67)	3.35 (85)	3.35 (85)	1.68 (760)	FASTON Type 187	G
LCR-1512PS	12	1.5	1.6	5.24 (133)	1.34 (34)	3.39 (86)	3.39 (86)	1.70 (770)	"	G
LCR-2212PF	12	2.2	2.4	2.60 (66)	2.64 (67)	4.11 (104.5)	4.11 (104.5)	2.29 (1040)	"	G
LCR-2212PS	12	2.2	2.4	5.24 (133)	1.34 (34)	4.15 (105.5)	4.15 (105.5)	2.31 (1050)	"	G
LCR-3012PF	12	3.0	3.2	2.60 (66)	2.64 (67)	4.92 (125)	4.92 (125)	2.91 (1320)	"	G
LCR-3012PS	12	3.0	3.2	5.24 (133)	1.34 (34)	4.96 (126)	4.96 (126)	2.93 (1330)	"	G
LCR-4512PF	12	4.5	4.8	3.70 (94)	2.64 (67)	4.92 (125)	4.92 (125)	4.08 (1850)	"	G
LCR-4512PS	12	4.5	4.8	7.44 (189)	1.34 (34)	4.96 (126)	4.96 (126)	4.08 (1850)	"	G
LCR-6012PF	12	6.0	6.4	3.58 (91)	3.90 (99)	4.53 (115)	4.53 (115)	5.29 (2400)	FASTON Type 250	G
LCR-6012PS	12	6.0	6.4	7.20 (183)	1.97 (50)	4.57 (116)	4.57 (116)	5.29 (2400)	"	G
LCR-7512PF	12	7.5	8.0	4.53 (115)	3.90 (99)	4.53 (115)	4.53 (115)	6.61 (3000)	"	G
LCR-7512PS	12	7.5	8.0	9.09 (231)	1.97 (50)	4.57 (116)	4.57 (116)	6.61 (3000)	"	G
LCR-8512PF	12	8.5	9.2	4.53 (115)	3.90 (99)	4.53 (115)	4.53 (115)	7.05 (3200)	"	G
LCR-8512PS	12	8.5	9.2	9.09 (231)	1.97 (50)	4.57 (116)	4.57 (116)	7.05 (3200)	"	G
LCR-1812P	12	1.8	1.9	7.89 (200.5)	0.98 (24.8)	2.38 (60.5)	2.38 (60.5)	1.54 (700)	DC Plug	S
LCR-2012P	12	2.0	2.1	7.90 (200.7)	0.98 (24.8)	2.43 (61.8)	2.43 (61.8)	1.54 (700)	Pressure Contact	S
LCR-3012VBP	12	3.0	3.2	9.45 (240)	1.34 (34)	2.64 (67)	2.64 (67)	2.91 (1320)	DC Plug	G
LCR-6V1.2P	6	1.1	1.2	3.82 (97)	0.94 (24)	1.97 (50)	2.17 (56)	0.66 (300)	FASTON Type 187	S
LCR-6V3P	6	2.8	3.0	5.28 (134)	1.34 (34)	2.36 (60)	2.60 (66)	1.21 (550)	"	S
LCR-6V6.5P	6	6.0	6.5	5.95 (151)	1.36 (34.5)	3.70 (94)	3.94 (100)	2.65 (1200)	FASTON Type 187 or 250	S
LCR-6V8P	6	7.9	9.0	5.95 (151)	2.01 (51)	3.70 (94)	3.94 (100)	3.64 (1650)	"	S
LCR-6V10P	6	8.8	10.0	5.95 (151)	2.01 (51)	3.70 (94)	3.94 (100)	3.64 (1650)	"	S
LCR-12V1.9P	12	1.8	1.9	6.97 (177)	1.34 (34)	2.36 (60)	2.60 (66)	1.54 (700)	FASTON Type 187	S
LCR-12V3PF	12	2.8	3.0	5.84 (134)	2.72 (69)	2.36 (60)	2.60 (66)	2.43 (1100)	"	
LCR-12V6.5P	12	6.0	6.5	5.95 (151)	2.56 (65)	3.70 (94)	3.94 (100)	5.18 (2350)	FASTON Type 187 or 250	S
LCR-12V24P	12	22.0	24.0	6.89 (175)	6.50 (165)	4.92 (125)	4.92 (125)	19.2 (8.7kg)	M5 Bolt and Nut Type	S
LCR-12V40P	12	34.0	40.0	10.16 (258)	6.74 (171)	7.88 (200)	9.30 (236)	41.9 (19.0kg)	M6 Bolt and Nut Type	S
LCR-12V60P	12	50.0	60.0	11.97 (304)	6.74 (171)	7.88 (200)	9.30 (236)	52.9 (24.0kg)	"	S
LCR-12V80P	12	70.0	80.0	16.03 (407)	6.82 (173)	8.27 (210)	9.69 (246)	80.0 (36.0kg)	M8 Bolt and Nut Type	S
LCR-12V100P	12	86.0	100.0	19.77 (502)	7.09 (180)	8.27 (210)	10.04 (255)	100.0 (45.0kg)	"	S
LCR-12V120P	12	104.0	120.0	19.89 (505)	8.67 (220)	8.27 (210)	10.04 (255)	115.0 (52.0kg)	"	S
LCL-12V38P	12	34.0	38.0	7.76 (197)	6.50 (165)	6.89 (175)	6.89 (175)	31.3 (14.2kg)	M6 Bolt and Nut Type	S
LCL-12V65P	12	58.0	65.0	13.78 (350)	6.50 (165)	6.89 (175)	6.89 (175)	50.7 (23.0kg)	"	S

G: Gel Electrolyte

S: Starved Electrolyte

Panasonic Industrial Company • Battery Sales Division Offices

Headquarters
East Coast Office
P.O. Box 1511
Secaucus, N.J. 07094
(201) 348-5266

Panasonic
Dallas Office
1825 Walnut Hill Lane
Irving, TX 75062
(214) 257-0763 Ext. 380

Panasonic
West Coast Office
6550 Katella Ave.
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RECHARGEABLE NICKEL CADMIUM BATTERIES

Applications

For Cyclic Use

- Consumer Applications
- Office Equipment
- Tools
- Instruments and Medical Equipment
- Photography
- Toys and Hobby

For Trickle or Float Charge Use

- Emergency Devices
- Memory Back up

General Characteristics

Panasonic offers a wide range of cells for varying applications and requirements:

- Standard
- Rapid Charge "R"
- High Temperature "H"
  - Emergency Back Up
  - Memory Back Up
- High Capacity "E"
- High Rate Discharge "P"

Discharge

The discharge characteristics of the Panasonic Ni-Cd cell are extremely flat when compared to those of dry cells.

Discharge voltage characteristics depend upon discharge current and temperature.

Life

The Panasonic Ni-Cd cell can be charged and discharged hundreds of times.

Under normal conditions, more than 500 cycles (charge/discharge) can be expected. The cell has reached its end of life when capacity falls below 80% of original rating.

Life is decreased by charge/discharge cycles beyond the specified temperature or current range or by extended storage under conditions which exceed specified temperature limits, or by cell reversal.

Effects of Temperature upon Performance

The standard Panasonic Ni-Cd cell has excellent discharge characteristics at normal temperatures. If the temperature during charge and discharge is high, capacity tends to decrease. When cells are trickle-charged at a high temperature, this tendency is accelerated. Therefore, it is recommended that special high temperature cells be used for applications in high temperature ambients.

Special Purpose Batteries

Rapid-Charge "R" type

The "R" type cell has a specially improved negative plate with increased gas absorption characteristics. It can be subjected to uncontrolled charging at the 1 C, rate and a Rapid charge in 1 to 1.5 hours is possible.

High-Temperature "H" type

By using a polypropylene separator, the "H" type cell can withstand a temperature of 65°C (149°F) during use. When charging is conducted at a low charging current of C/20 to C/30 in a high-temperature ambient, the "H" type cell has sharply improved capacity compared to a standard cell.

Panasonic "H" type cells for high-temperature use can be classified into two types according to application: the emergency back-up type and the memory back-up type.

(A) Emergency back-up ("H" type)
Emergency back-up normally uses DH, CH, SCH, or AAH, and a trickle or float charge of C/20 to C/30 is usually applied.

(B) Memory back-up ("H" type)
This application requires less capacity, and normally uses AAH, 1/3AAH. In addition to excellent high-temperature characteristics, the charge/discharge characteristics for small currents in the μA range are excellent.

High-Capacity "E" type

These extra capacity cells combine a high-capacity density positive plate with a high-capacity paste negative plate. These cells have 20 ~ 30% more capacity than equivalent standard cells.

High-Rate Discharge "P" type

Using plates with low internal resistance, edge-welded plates and terminals, the resulting cell has sharply reduced internal resistance and improved voltage characteristics during high rate discharge.

Charging Methods

Standard charge

Panasonic Ni-Cd cells are charged using constant current or semi-constant current chargers. The rate of charge is dependent on the size and type of cell. Standard cells, sub C and smaller, can be charged at rates from C/3 ~ C/4 to C/20.

Rapid-charge "R" type

The "R" type Panasonic Ni-Cd cell can be rapidly charged in 1 ~ 1.5 hours using recommended charging circuits and controls. The cell is normally charged at the 1C rate for 1 ~ 1.5 hours, at which time charging current is reduced to C/10 (or less) to complete the charge.

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Headquarters
East Coast Office
P.O. Box 1511
Secaucus, N.J. 07094
(201) 348-5266

Panasonic
Dallas Office
1825 Walnut Hill Lane
Irving, TX 75062
(214) 257-0763 Ext. 380

Panasonic
West Coast Office
6550 Katella Ave.
Cypress, CA 90630
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RECHARGEABLE NICKEL CADMIUM BATTERIES

Temperature Conditions

Charge

Charging temperature ranges are:

- Standard charge: 0° ~ 45°C (32° ~ 113°F)
- C/3 quick charge: 10° ~ 45° (50° ~ 113°F)
- Trickle (float) charge: 0° ~ 65°C (32° ~ 149°F)
- "R" type Rapid charge (- ΔV method): 10° ~ 45°C (50° ~ 113°F)
- Temperature sensing system: 10° ~ 40°C (50° ~ 104°F)

Discharge

Discharge temperature ranges are -20° to +65°C (-4° to +140°F).

Storage

Panasonic cells can withstand very long storage time under typical conditions at a storage temperature range of -20° to +45°C (-4° ~ 113°F). If the cell must provide full capacity after storage, completely charge the cell before use. In addition, after prolonged storage, completely normal capacity can be returned within 1 ~ 3 charge/discharge cycles.

P.C. MOUNT (MEMORY) BATTERIES
"L" TYPE PACKS (STACKS)

Model (Former Model)	Terminals	Voltage (V)	Capacity (mAh)
P-01H-L2N2 (NR-⅓AAHL2-F1)	Tabs	2.4	110
P-01H-L2P2 (NR-⅓AAHL2-P1)	Pins	2.4	110
P-01H-L3N2 (NR-⅓AAHL3-F1)	Tabs	3.6	110
P-01H-L3P5 (NR-⅓AAHL3-P1)	Pins	3.6	110

P.C. MOUNT (MEMORY) BATTERIES
"F" TYPE (SIDE BY SIDE)

Model (Former Model)	Terminals	Voltage (V)	Capacity (mAh)
P-01H-F3P2 (NR-⅓AAHF3-P1)	Pins	3.6	110
P-01H-F3P9*	Pins	3.6	110

*Special Pin Location

STANDARD TYPE

Model	Former Model	Voltage (V)	Capacity (mAh)	Diameter (in.)	Height (in.)	Weight (oz.)	Internal Resistance mΩ
P-11AA	(NR-⅓AA)	1.2	110	0.55±0.02	0.65±0.02	0.24	60
P-15N	(NR-N)	1.2	150	0.45±0.02	1.16±0.02	0.29	40
P-18AAA	(NR-AAA)	1.2	180	0.39±0.02	1.74±0.02	0.35	30
P-25AA	(NR-⅔AA)	1.2	250	0.55±0.02	1.09±0.02	0.43	25
P-50AA/FT	(NR-AA)	1.2	500	0.55±0.02	1.88±0.02	0.78	18
P-50AA	(P-50AA)	1.2	500	0.55±0.02	1.95±0.02	0.78	18
P-60SC	(NR-⅔SC)	1.2	600	0.89±0.02	1.02±0.02	1.02	25
P-120SC	(NR-SC)	1.2	1200	0.89±0.02	1.67±0.02	1.8	13
P-180C	(NR-C)	1.2	1800	1.00±0.02	1.94±0.03	2.6	12
P-400D	(NR-D)	1.2	4000	1.27±0.03	2.36±0.04	4.7	8

HIGH CAPACITY TYPE (E)

Model	Former Model	Voltage (V)	Capacity (mAh)	Diameter (in.)	Height (in.)	Weight (oz.)	Internal Resistance mΩ
P-60AAE	(P-60AA)	1.2	600	0.55±0.02	1.88±0.02	0.78	18
P-150SCE	(P-150SC)	1.2	1500	0.89±0.02	1.67±0.02	1.8	13
P-220CE	(P-220C)	1.2	2200	1.00±0.02	1.94±0.03	2.65	12
P-440DE	(P-440D)	1.2	4400	1.27±0.03	2.36±0.04	4.9	8

HIGH RATE DISCHARGE TYPE (P)

Model	Former Model	Voltage (V)	Capacity (mAh)	Diameter (in.)	Height (in.)	Weight (oz.)	Internal Resistance mΩ
P-120SCP	—	1.2	1200	0.89±0.02	1.67±0.02	1.8	6

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Secaucus, N.J. 07094
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Panasonic
Dallas Office
1825 Walnut Hill Lane
Irving, TX 75062
(214) 257-0763 Ext. 380

Panasonic
West Coast Office
6550 Katella Ave.
Cypress, CA 90630
(714) 895-7315

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RECHARGEABLE NICKEL CADMIUM BATTERIES
PRIMARY LITHIUM BATTERIES

RECHARGEABLE NICKEL CADMIUM BATTERIES

HIGH TEMPERATURE TYPE (H)

Model	Former Model	Voltage (V)	Capacity (mAh)	Diameter (in.)	Height (in.)	Weight (oz.)	Internal Resistance mΩ
P-11AAH	(NR-⅓AAH)	1.2	110	0.55±0.02	0.65±0.02	0.24	80
P-50AAH	(NR-AAH)	1.2	500	0.55±0.02	1.88±0.02	0.78	18
P-180CH	(NR-CH)	1.2	1800	1.00±0.02	1.94±0.03	2.65	12
P-400DH	(NR-DH)	1.2	4000	1.27±0.03	2.36±0.04	4.7	10

RAPID CHARGE TYPE (R)

Model	Former Model	Voltage (V)	Capacity (mAh)	Diameter (in.)	Height (in.)	Weight (oz.)	Internal Resistance mΩ
P-40AR	—	1.2	400	0.65±0.02	1.11±0.03	0.62	18
P-70AR	—	1.2	700	0.65±0.02	1.68±0.03	0.95	15
P-80AAR	—	1.2	800	0.55±0.02	2.54±0.02	1.0	15
P-120SCR	—	1.2	1200	0.89±0.02	1.67±0.02	1.8	13
P-180CR	—	1.2	1800	1.00±0.02	1.94±0.03	2.5	10

PRIMARY LITHIUM BATTERIES

Versatile, Long-Life Lithium Batteries

Since 1971, Panasonic has pioneered the development of Lithium Batteries as an extremely long life, leakproof, high-energy power source for a wide range of electronic applications.

From watches, cameras, radios and other consumer products to dependable computer memory back-up systems, Panasonic Lithiums have proven themselves as an ideal solution for today's most demanding electronic requirements.

Using a solid-state polycarbon monofluoride as the cathode, Panasonic Lithiums are **inherently** safe, remaining both chemically and thermally stable. Corrosive liquid or poisonous gas discharge is never a problem, even during long storage periods.

Features

- Inherently safer than MnO_2/Li systems
- High voltage (3V); high energy density
- Excellent storage properties
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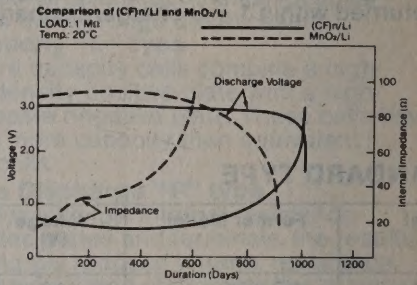
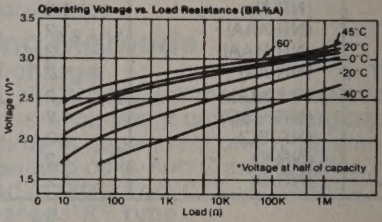
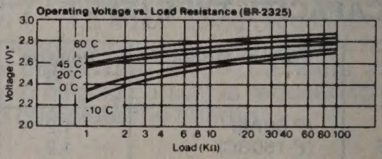
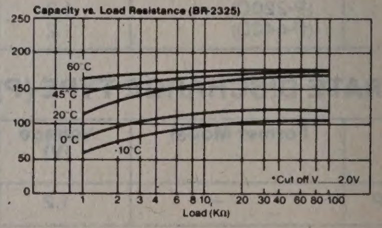

Comparison of (CF)n/Li and MnO₂/Li


Operating Voltage vs. Load Resistance (BR-⅓A)


Operating Voltage vs. Load Resistance (BR-2325)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PC MOUNTABLE CYLINDRICAL TYPE

Model	Former Model	Terminals	Voltage (V)	Capacity (mAh)
BR-CT2P	(BR-C-F1)	Tabs	3	5000
BR-CP3P	(BR-C-P1)	2 Pins	3	5000
BR-⅔AT2P	(BR-⅔A-F1)	Tabs	3	1200
BR-⅔AP3P	(BR-⅔A-P1)	2 Pins	3	1200
BR-⅔AE2P	(BR23AE2P)	3 Pins	3	1200
BR-½AT2P	(BR-½A-F1)	Tabs	3	600
BR-½AP2P	(BR-½A-P1)	2 Pins	3	600
BR-½AE2P	—	3 Pins	3	600
BR-⅔AAT2P	(BR-⅔AA-F1)	Tabs	3	600
BR-⅔AAE2P	—	3 Pins	3	600

PC MOUNTABLE COIN TYPE (HORIZONTAL MOUNT)

Model	Former Model	Terminals	Voltage (V)	Capacity (mAh)
BR-2325-1HB	—	2 Pins	3	160
BR-2325-1HE	—	2 Pins	3	160
BR-2325-1HG	—	3 Pins	3	160
BR-2032-1HB	—	2 Pins	3	180
BR-1225-1HB	—	2 Pins	3	38
BR-2325-2HA	—	2 Pins	6	160
BR-1225-2HA	—	2 Pins	6	38
BR-2325-HC	—	2 Pins	3	320

PC MOUNTABLE COIN TYPE (VERTICAL MOUNT)

Model	Former Model	Terminals	Voltage (V)	Capacity (mAh)
BR-2325-1VG	—	3 Pins	3	160
BR-2325-1VB	—	2 Pins	3	160
BR-1225-1VB	—	2 Pins	3	38
BR-2325-2VC	—	2 Pins	6	160

CYLINDRICAL TYPE

Model	Former Model	Terminals	Voltage (V)	Capacity (mAh)	Diameter (mm)	Height (mm)	Weight (gms)
BR-C	—	Flat Contacts	3	5000	26.0	50.0	47.0
BR-⅔A	—	Flat Contacts	3	1200	17.0	33.5	13.5
BR-½A	—	Flat Contacts	3	600	17.0	23.0	9.5
BR-⅔AA	—	Flat Contacts	3	600	14.5	33.5	9.5

COIN TYPE

Model	Former Model	Terminals	Voltage (V)	Capacity (mAh)	Diameter (mm)	Height (mm)	Weight (gms)
BR-2032	—	Flat Contacts	3	180	20.0	3.2	3.0
BR-2325	—	Flat Contacts	3	160	23.0	2.5	3.1
BR-2320	—	Flat Contacts	3	110	23.0	2.0	2.5
BR-2020	—	Flat Contacts	3	85	20.0	2.0	1.8
BR-2016	—	Flat Contacts	3	75	20.0	1.6	1.5
BR-1616	—	Flat Contacts	3	45	16.0	1.6	1.0
BR-1225	—	Flat Contacts	3	38	12.5	2.5	0.9

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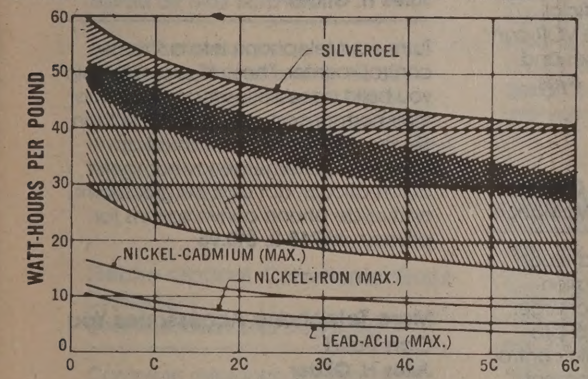

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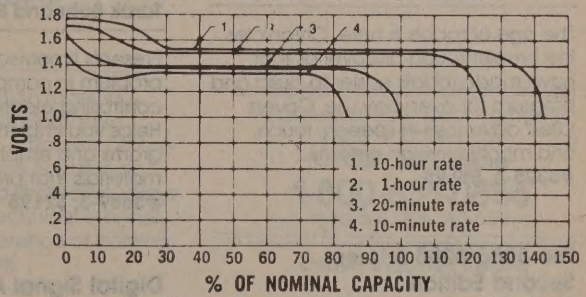

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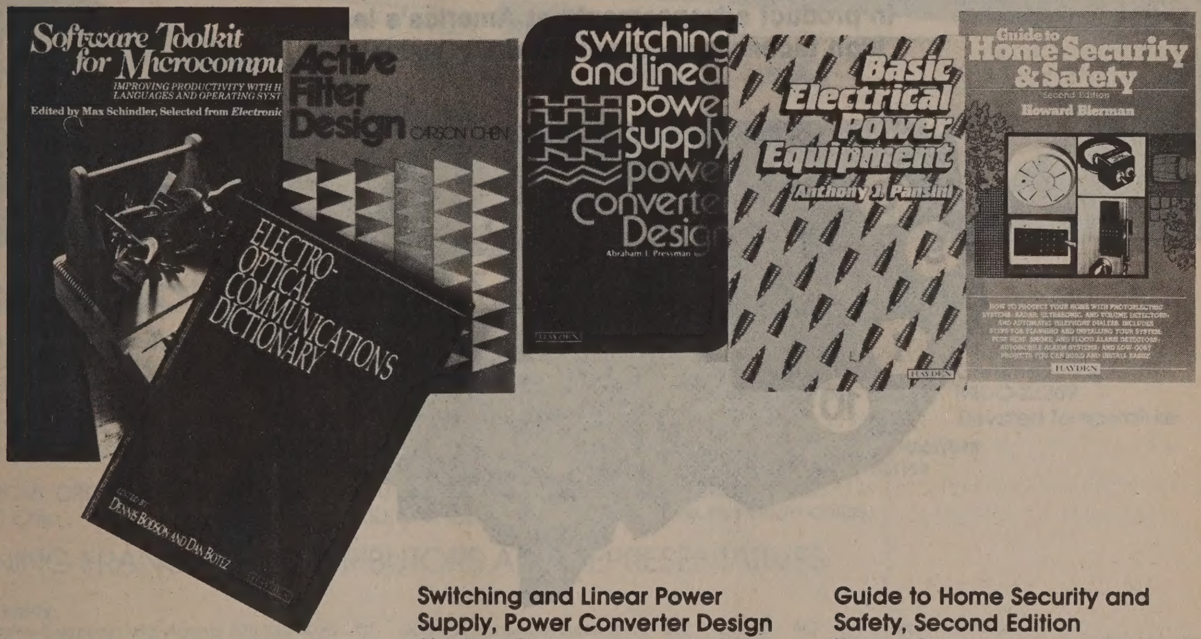
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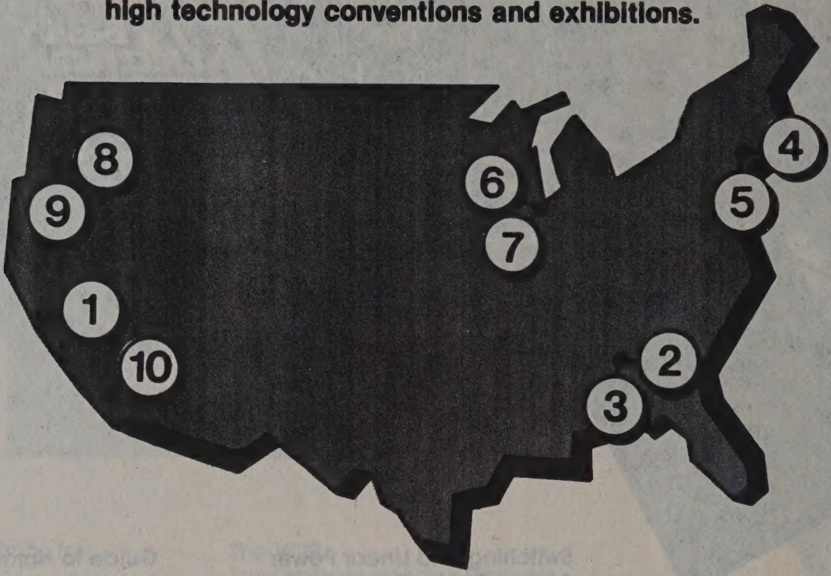

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Corning Electronics...All Systems "Go"!

CRC
COMPONENT RESEARCH CO.

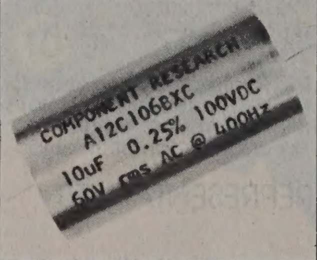
SHORT FORM CATALOG

ESTABLISHED RELIABILITY CAPACITORS

COMPONENT RESEARCH CAPACITORS

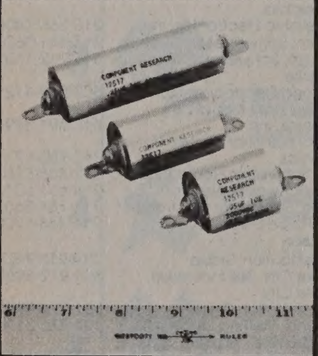
Component Research capacitors are used in critical applications where their reliability and performance can affect the success of an entire program involving years of preparation and billions of dollars of program cost. For over a decade, aerospace programs from Apollo to Space Shuttle have used CRC capacitors for timing circuits and other control circuits, essential for controlling spacecraft millions of miles from earth, after years of space travel.

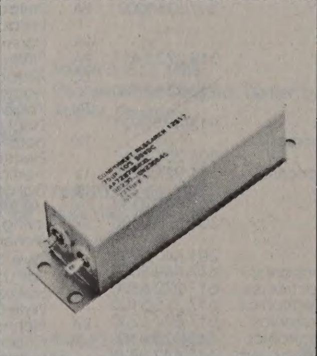
CRITICAL PROGRAMS QUALIFICATION



TRIDENT
LANCE MISSILE
F15 AIRCRAFT
F18 AIRCRAFT
SPACE SHUTTLE
ROLAND
MARK 46
MARK 48
SPARROW
NEARTIP
NOMI I
HARPOON
AND MANY OTHERS

CRC hermetically sealed plastic film capacitors are acknowledged world wide as the highest quality. Standard tubular metallized polycarbonate capacitor, AC rated to 40 KHz and qualified to MIL-C-83421/01 is shown above.





UPPER LEFT Type 55 foil polypropylene capacitors are used in power resonating applications up to 160KHz and with fast switching, high peak current devices. A typical 10uF capacitor measuring 1.25″ diameter x 3.375″ length can handle up to 50A rms under continuous duty operation. Its ESR at 100KHz is approximately 0.0016 ohms which is typical of the low loss inherent in these capacitors.

UPPER RIGHT This 75uF, 50VDC, metallized polycarbonate capacitor is 1″ square by 3¾″ long and is rated at 10A rms at 25KHz at 100°C. Each capacitor receives 168 hours of AC voltage at 25KHz to produce 10A rms in combination with 50VDC applied during burn-in at 100°C.

TYPE A12 & K12

DIELECTRIC: Metallized Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 30-400 VDC

A.C. RATING: 22 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +125° (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to 27uF, .1% to 10% tolerances

INSULATION RESISTANCE: 300,000 meg-uF (100,000 meg-uF for K12 @ 25°C)

DISSIPATION FACTOR: .15% max. @ 1KHz

DIELECTRIC ABSORPTION: .1% maximum

SCREENING: 100% Quality conformance inspection. Qualified to Failure Rate "S" of MIL-C-83421/01.

APPLICATIONS: Timing, filter and feed-back circuits, pulse-forming networks. A12 and K12 capacitors are used extensively in the Space Shuttle Program.

TYPE G12

DIELECTRIC: Miniaturized Metallized Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 30-200VDC

A.C. RATING: 22 to 120 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +125°C (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to 10uF, .1% to 10% tolerances

INSULATION RESISTANCE: 100,000 meg-uF @ 25°C

DISSIPATION FACTOR: .15% max. @ 1KHz

DIELECTRIC ABSORPTION: .1% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421.

APPLICATIONS: Timing, filter, feed-back circuits, and pulse-forming networks. Used where small size is critical. G12 capacitors are used in numerous Navy missile and torpedo projects.

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CRC
COMPONENT RESEARCH CO.

COMPARISON OF CAPACITOR TYPES

ESTABLISHED RELIABILITY CAPACITORS

TYPE J11 & K11

DIELECTRIC: Metallized Teflon

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-200VDC

OPERATING TEMPERATURE: −65°C to +125°C

CAPACITANCE RANGE: .001 to 2uF, .1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-uF

DISSIPATION FACTOR: .05% max. @ 1KHz

DIELECTRIC ABSORPTION: .01% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421. Will meet all environmental requirements of MIL-C-83421 except vibration at 20 g's and shock at 50 g's.

APPLICATIONS: Timing, sample and hold, integrating and tuning circuits. J11 and K11 are used in critical space, military applications which require lowest dielectric absorption and highest insulation resistance and low dielectric loss.

TYPE A52

DIELECTRIC: Foil Polycarbonate

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 100-400VDC

A.C. RATING: 60 to 240 VRMS @ 40KHz

OPERATING TEMPERATURE: −65°C to +125°C (Derate 50% from 100°C to 125°C)

CAPACITANCE RANGE: .001 to .47uF, 1% to 10% tolerances

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .1% max. @ 10KHz

DIELECTRIC ABSORPTION: .2% maximum

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber, high current pulse applications. **A52** capacitors are used in the F18 aircraft.

TYPE A91

DIELECTRIC: Foil Teflon

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-400VDC

A.C. RATING: 36 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +150°C

CAPACITANCE RANGE: .001 to 1.2uF, 1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-UF

DISSIPATION FACTOR: .02% max. @ 1KHz

DIELECTRIC ABSORPTION: .01% maximum

SCREENING: 100% Quality conformance inspection per applicable paragraphs of MIL-C-83421. Will meet all environmental requirements of MIL-C-83421 except vibration at 20 g's and shock at 60 g's.

APPLICATIONS: Pulse-forming networks, timing, sample and hold, integration and tuning circuits. A91 is used in hi-rel programs which require a rugged low loss capacitor with high insulation resistance and low dielectric absorption.

TYPE B55

DIELECTRIC: Foil Polypropylene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 600 & 800VDC

A.C. RATING: 400 & 600 VRMS @ 400Hz, high current ratings to 40KHz, low E.S.R.

OPERATING TEMPERATURE: −55°C to +85°C

CAPACITANCE RANGE: .033 to .82uF

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .05% @ 10KHz

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber circuits, switching power supplies and where high RMS and peak current ratings are required.

TYPE K93

DIELECTRIC: Polystyrene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 50-400VDC

A.C. RATING: 36 to 240 VRMS @ 400Hz, AC ratings to 40KHz

OPERATING TEMPERATURE: −65°C to +85°C

CAPACITANCE RANGE: .001 to 2.7uF, .1% to 10% tolerances

INSULATION RESISTANCE: 1,000,000 meg-uF

DISSIPATION FACTOR: .02% max. @ 1KHz

DIELECTRIC ABSORPTION: .02% maximum

SCREENING: 100% Quality conformance inspection

APPLICATIONS: Qualified for the Trident Program. Used in critical space and military applications that require stability, high insulation resistance, low dielectric absorption and low dissipation factor.

TYPE B15

DIELECTRIC: Metallized Polypropylene

CONSTRUCTION: Metal case hermetically sealed

VOLTAGE RATING: 600 & 800 VDC

A.C. RATING: 400 & 600 VRMS @ 400Hz, high current ratings to 40KHz, low E.S.R.

OPERATING TEMPERATURE: −55°C to +85°C

CAPACITANCE RANGE: .01 to 1.2uF

INSULATION RESISTANCE: 100,000 meg-uF

DISSIPATION FACTOR: .05% max. @ 10KHz

SCREENING: 100% Quality conformance inspection with 400Hz burn-in.

APPLICATIONS: Snubber circuits, switching power supplies and where high RMS and peak current ratings are required.

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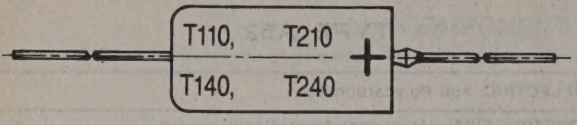
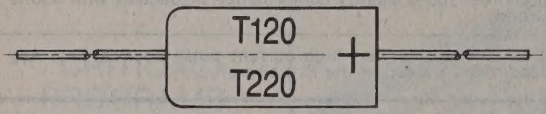
KEMET UNION CARBIDE-ELECTRONICS DIVISION TANTALUM, CERAMIC & FILM CAPACITORS

UNION CARBIDE



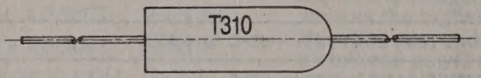
T212(CSR13), T242(CSR23), T252(CSR33), T262(CSR21) per MIL-C-39003 also available.

Standard MIL case; hermetically sealed; leading solid tantalum capacitors in use today; compact; rugged; for coupling bypass, filtering and R-C timing circuits; stable; low DC leakage; dissipation factor and impedance. Cap Values from .0047-330 uF; ±20%, ±10%, and ±5% tol., 6-125VDC. Higher CV values available in T140 series. T212 series per Mil-C-39003 also available. 4 case sizes T110 Available in lead tape & reel.

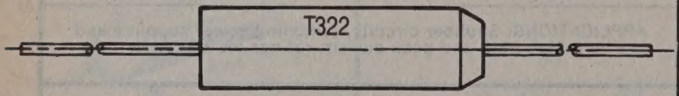


T222(CSR09) per MIL-C-39003 also available.

Ultra miniature, hermetically sealed, solid tantalum; ideal for cordwood construction. Hermetically seated; cap. Values from .0047 to 22uF ±20%;10% and ±5% tol., 6-125VDC.

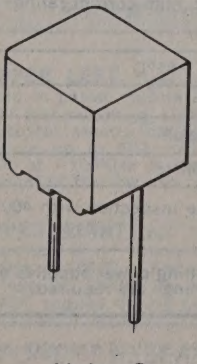


Plastic molded solid tantalum; low DC leakage; stable; excellent for use in automatic insertion equipment Cap. values from 0.10-330uF, 6-50VDC. 4 case sizes. Available in lead tape & reel.

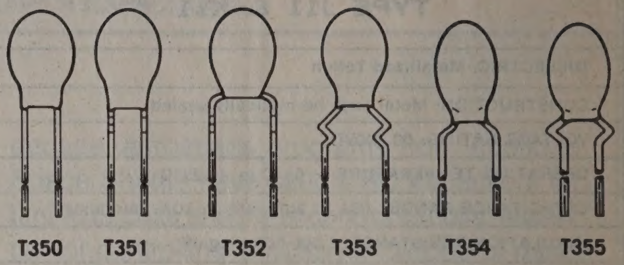


Miniature plastic molded solid tantalum; low impedance at high frequencies makes especially suitable for decoupling required by high speed computers. Cap. values from 0.1-68uF, 2-50 VDC. 4 case sizes. T323(CX01 & CX05) per MIL-C-49137 also available. Available in lead tape & reel.

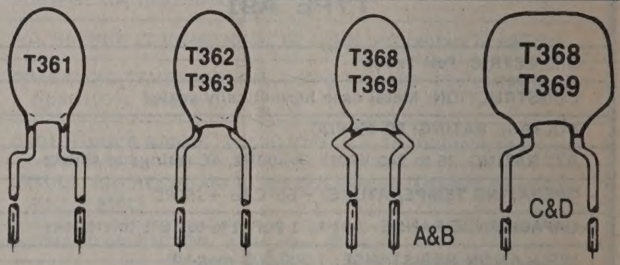
T340



Precision Plastic molded; solid tantalum rectangular with positive polarity identification molded in on top, plus a radius on positive side of case. Cap. values from 0.1-330uF, 6-50 VDC. 6 case sizes.114,

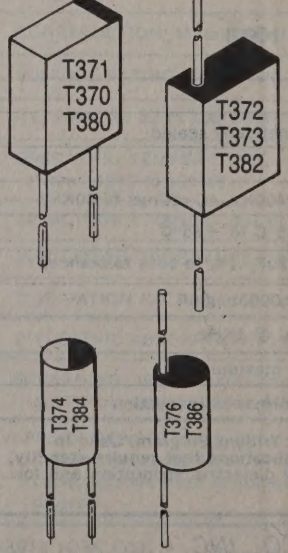


T35X 'UltraDip' II miniature dipped solid tantalum capacitors. New Gold Color Epoxy with Laser markings provides outstanding legibility. Compact design, plus low DC leakage and DF makes UltraDip capacitors ideal for filtering, bypassing, coupling, blocking and RC timing circuits. Cap. values from 0.1-680uF, 3-50VDC. 12 case sizes.



T363(CX02) & T369(CX12) per MIL-C-49137 also available.

Similar to 'UltraDip' Series above. Available capacitance ratings (0.1-330uF, 6-50 VDC. New gold color epoxy with laser markings. 8 case sizes. T361 also available in ARIS (Automatic Radial Insertion System) for automatic insertion machines. A & B case sizes only.



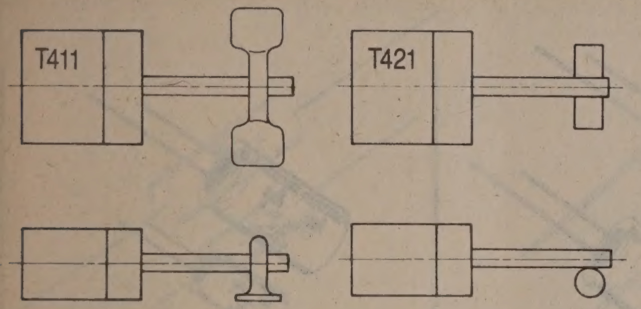
Microns: a complete line of micro-miniature solid tantalum capacitors designed to provide maximum electrical performance and capacitance-to-volume ratio for micro miniaturized, high density integrated circuits. Microns consist of ultra small anode assemblies encapsulated in epoxy. Cap. values from .0022-220uF, 2-50 VDC. Color coded Cap. value markings.

Union Carbide Corp., Electronics Div., P.O. Box 5928, Greenville, S.C. 29606 (803) 963-6300

For More Information. Circle No. 24

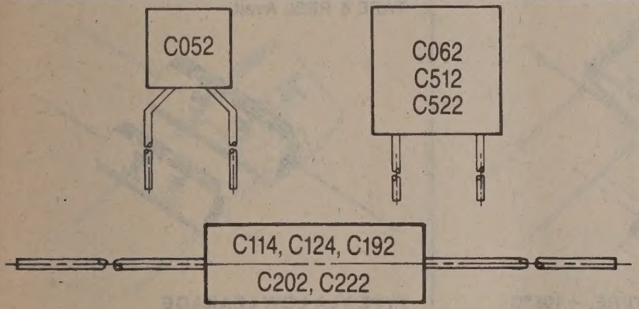
KEMET® UNION CARBIDE-ELECTRONICS DIVISION TANTALUM, CERAMIC & FILM CAPACITORS

UNION CARBIDE

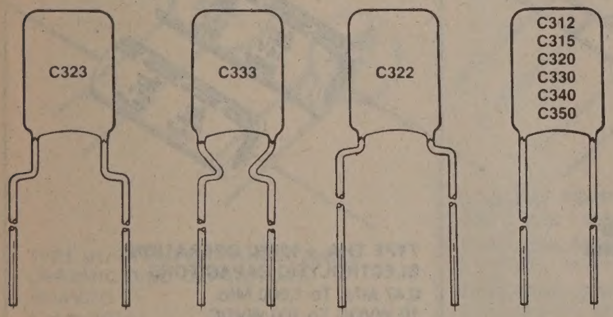


T412(CWR01) & T422(CWR02) per MIL-C-55365 also available.

KEMET Solid Tantalum Chip Capacitors afford maximum volumetric efficiency and high temperature capability at an economical price. Cap. values from 0.1-100uF, 4-50VDC. 5 case sizes.



Monolithic Multilayer Ceramic Capacitors. Available in ultra-stable (COG), stable (X7R) (Military BX or BR) or general purpose (Z5U) temperature characteristics. Military versions conform to MIL-C-39014, MIL-C-11015 and MIL-C-20 standards. Cap. values from: 10pF to 1,000,000pF. 50, 100 & 200 volts.

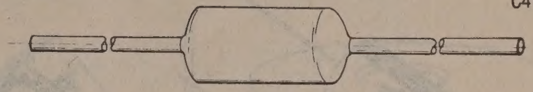


C323 and C333 size also available in KEMET's ARIS (Automatic Radio Insertion System) for automatic insertion machines.

Golden Max Plastic Dipped Monolithic Multilayer Ceramic Capacitors are the designer's choice for reliability at economical prices. Available in COG, X7R, or Z5U temperature characteristics and are dipped in the same new gold color plastic as KEMET's Ultra-Dip series, providing outstanding legibility of Laser markings. Cap. values from 1.0 pF-3.3 uF, 50, 100 & 200 volts; 6 case sizes.

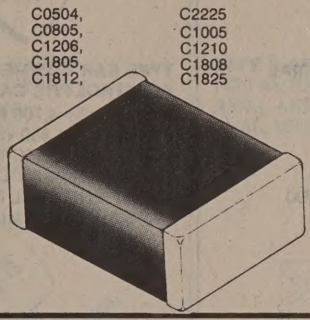
NEW

KEMET AXIMAX Capacitors
C410–C440



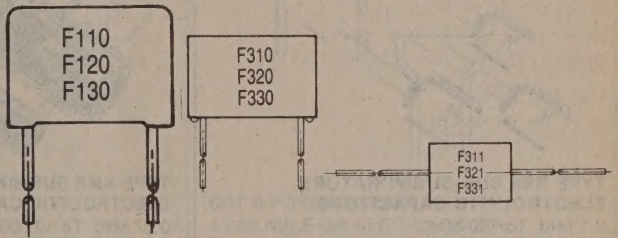
Maximum range, conformally-coated capacitors in three dielectrics—COG Ultra-Stable; X7R Stable and Z5U General Purpose. The 4 case sizes include over 138 CV values in a capacitance range of 10 pF to 1.0μF in 50 and 100 volts. Available in Lead Tape & Reel Configuration. Gold color epoxy with laser markings.

CDR01-CDR06 chips per MIL-C-55681 also available.



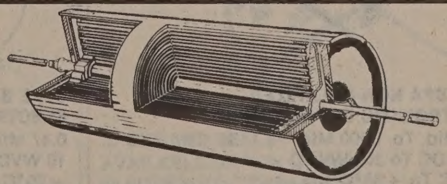
Monolithic Multilayer Ceramic Chips: Available in NPO, BX or Z5U Temperature Characteristics, Mil approved, KEMET GR900 or Commercial. Cap. values from 1pF-1,000,000 pF; 50, 100 and 200 volts, 9 chip sizes.

C0805 & C1206 sizes also available in CoPS (Component Placement System) 8mm or 12mm tape.



F310(CFR04R) & F311 (CFR04A) per MIL-C-55514 also available.

KEMET Parylene Flat Kaps are small ultra stable film capacitors ideally suited for filters, A/D converters, integrators, mulivibrator timing capacitors, and other applications where capacitance stability is essential, F310 & F311 styles available to MIL-C-55514. F110 is hermetically sealed in metal cases; 6 case sizes Cap. Values from .001 uF–0.15uF, 50 volts. F310-F331 are precision plastic molded. Cap. values from 0.001uF-0.12 uF, 50 volts; 8 case sizes.



METALLIZED POLYCARBONATE F241-F248 (CRH01-CHR10) per MIL-C-83421 & MIL-C-39022.

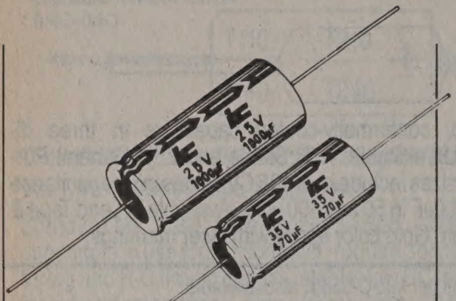
Metallized Polycarbonate Film capacitors are designed for circuits requiring stable performance characteristics over a wide temperature range, small size, and operational reliability. For filtering, by-pass, timing, SCR commutating and 400 Hz AC power circuits. Cap. values from .01 uF-22 uF with a DC voltage rating of 30 to 600 volts. Meet MIL-C-83421 and MIL-C-39022 requirements.

For immediate action, return the card in Vol. 4 or call 803-963-6348.

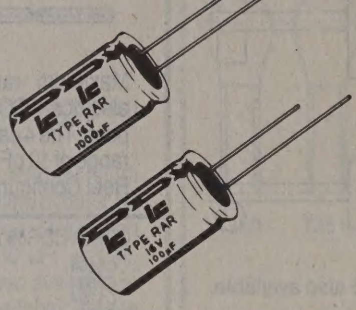
Union Carbide Corp., Electronics Div., P.O. Box 5928, Greenville, S.C. 29606 (803) 963-6300

For More Information. Circle No. 24

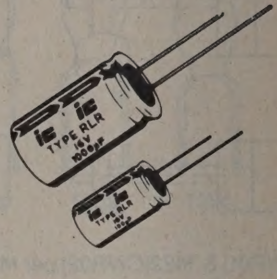
DEPENDABILITY



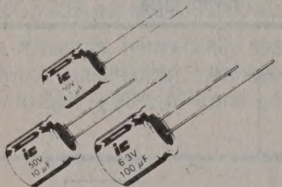
TYPE TTA COMMERCIAL/INDUSTRIAL ELECTROLYTIC CAPACITORS
0.47 Mfd. To 22,000 Mfd.
6.3 WVDC To 500 WVDC
− 40°C To + 85°C Min.
2000 HOUR + 85°C Rating
EPOXY END SEAL Optional (TTA-PX)
TAPE & REEL Avail.



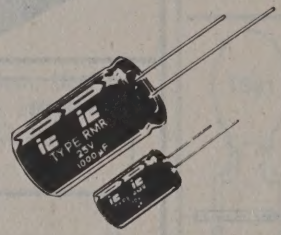
TYPE RAR COMMERCIAL/INDUSTRIAL ELECTROLYTIC CAPACITORS
0.47 Mfd. To 4,700 Mfd.
6.3 WVDC To 450 WVDC
− 40°C To + 85°C Min.
2000 HOUR, + 85°C Rating
EPOXY END SEAL Optional (RAR-PX)
TAPE & REEL Avail.



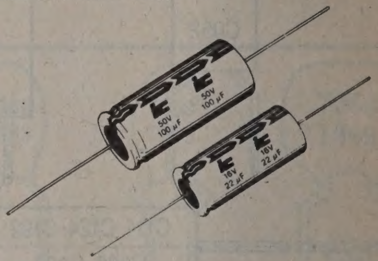
TYPE RLR LOW-LEAKAGE ELECTROLYTIC CAPACITORS,
0.1 Mfd. To 2,200 Mfd.
6.3 WVDC To 50 WVDC
− 40°C To + 85°C
Leakage Current:≤0.002CV or 0.4 uA min.
EPOXY END SEAL Optional (RLR-PX)
TAPE & REEL Avail.



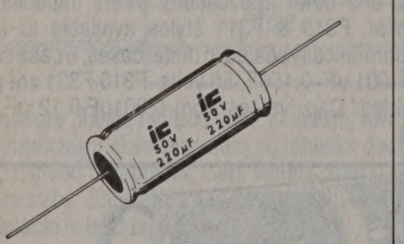
TYPE RSS SUB-SUBMINIATURE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 100 Mfd.
6.3 WVDC To 50 WVDC
Min. Dia. 0.15 in./4.0mm
Max. Length .28 in./7.0mm
−40° C To +85° C Min.
TAPE & REEL Avail.



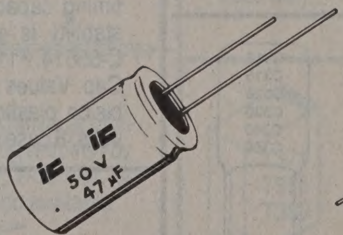
TYPE RMR SUBMINIATURE, + 105°C ELECTROLYTIC CAPACITORS
0.47 Mfd. To 10,000 Mfd.
6.3 WVDC To 250 WVDC
− 40°C To + 105°C Min.
2000 HOUR + 105°C Rating
EPOXY END SEAL Optional (RMR-PX)
TAPE & REEL Avail.



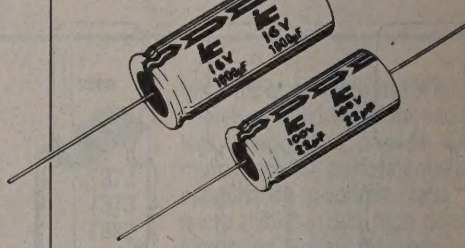
TYPE TLA LOW LEAKAGE ELECTROLYTIC CAPACITORS
0.1 Mfd. To 100 Mfd.
6.3 WVDC To 50 WVDC
−40° C To +85° C Min.
Leakage Current: ≤0.002 CV or 0.4 µA min.
EPOXY END SEAL Optional (TLA-PX)
TAPE & REEL Avail.



TYPE BPA NON-POLARIZED ELECTROLYTIC CAPACITORS
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 200 WVDC
− 25°C To + 85°C Min.
1000 HOUR + 85° Rating
EPOXY END SEAL Optional (BPA-PX)



TYPE BPR NON-POLARIZED ELECTROLYTIC CAPACITORS
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 50 WVDC
− 25°C To + 85°C Min.
1000 HOUR + 85°C Rating
EPOXY END SEAL Optional (BPR-PX)



TYPE THA + 125°C OPERATION ELECTROLYTIC CAPACITORS
0.47 Mfd. To 1,000 Mfd.
10 WVDC To 100 WVDC
− 40°C To + 125°C Min.
EPOXY END SEAL Optional (THA-PX)

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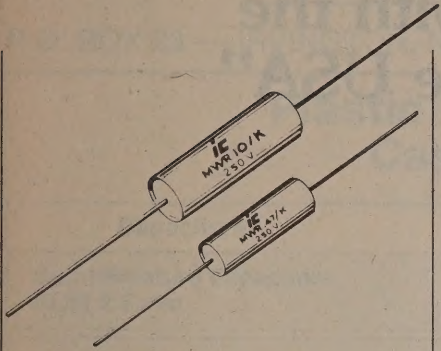
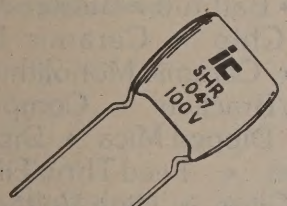
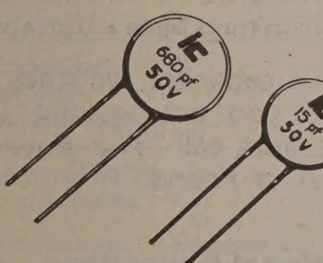
AVAILABILITY


ic
MWR 10/K
250 V
ic
MWR .47/K
250 V

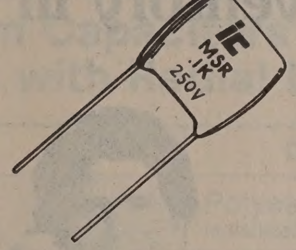
TYPE MWR METALLIZED MYLAR® POLYESTER FILM CAPACITORS
WRAP & FILLED CONSTRUCTION
NON-INDUCTIVE WINDING
100 WVDC To 1,000 WVDC
0.01 Mfd. To 22 Mfd.
TOLERANCE: ± 10% (± 5% Opt.)


ic
SHR
.047
100V

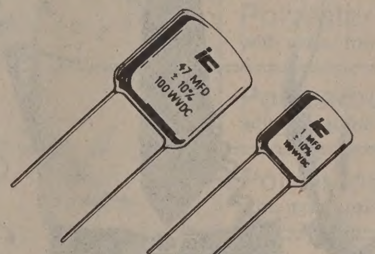
TYPE SHR POLYESTER FILM CAPACITORS
NON-INDUCTIVE WINDING
100 WVDC
0.001 Mfd. To .47 Mfd.
TOLERANCE: ± 10% (± 5% Opt.)


ic
680 pf
50V
ic
15 pf
50V

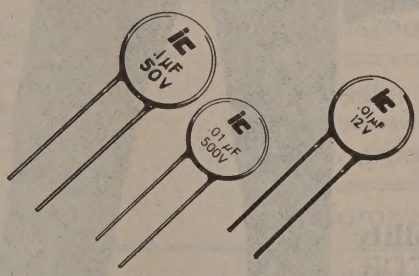
TYPE BCR TEMPERATURE STABLE CERAMIC DISC CAPACITORS
50 WVDC
1 pf to 680 pf
TEMP. CHAR.: Y5F
TOLERANCE: ±10%


ic
MSR
.1K
250V

TYPE MSR METALLIZED MYLAR® POLYESTER FILM CAPACITORS
NON-INDUCTIVE WINDING
250 WVDC To 1,000 WVDC
0.01 Mfd. To 10 Mfd.
TOLERANCE: ± 10% (± 5%, Opt.)


ic
.47 MFD
± 10%
100 WVDC
ic
.1 MFD
± 10%
100 WVDC

TYPE UMR POLYESTER FILM CAPACITORS
INDUCTIVE WINDING
100 WVDC
.001 Mfd. To .47 Mfd.
TOLERANCE: ± 10% (± 5%, Opt.)

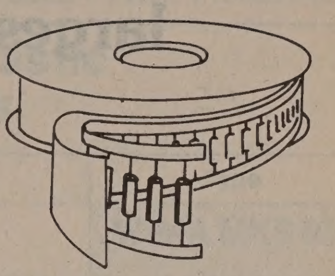

ic
.1µF
50V
ic
.01µF
500V
ic
.01µF
12V

GENERAL PURPOSE CERAMIC DISC
Tolerances: −20% +80%, ±20%

TYPE GCR: 50 WVDC
0.001 Mfd. To 0.1 Mfd. (Y5V, Y5S)

TYPE GMR: 12 WVDC
0.047 Mfd. To .47 Mfd. (Y5S)

TYPE GQR: 500 WVDC
.001 Mfd. To .01 Mfd. (Z5V)



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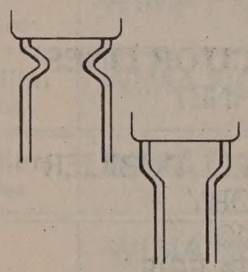
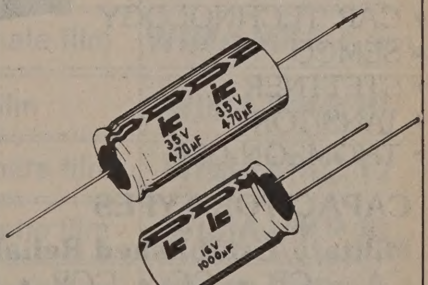
FOR AUTOMATIC INSERTION OF
AXIAL AND RADIAL LEAD PARTS
AVAILABLE ON SPECIAL ORDER



CUT & FORMED LEADS
AVAILABLE ON SPECIAL ORDER


ic
35V
470µF
ic
16V
1000µF

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HALOGENATED CLEANING SOLVENTS

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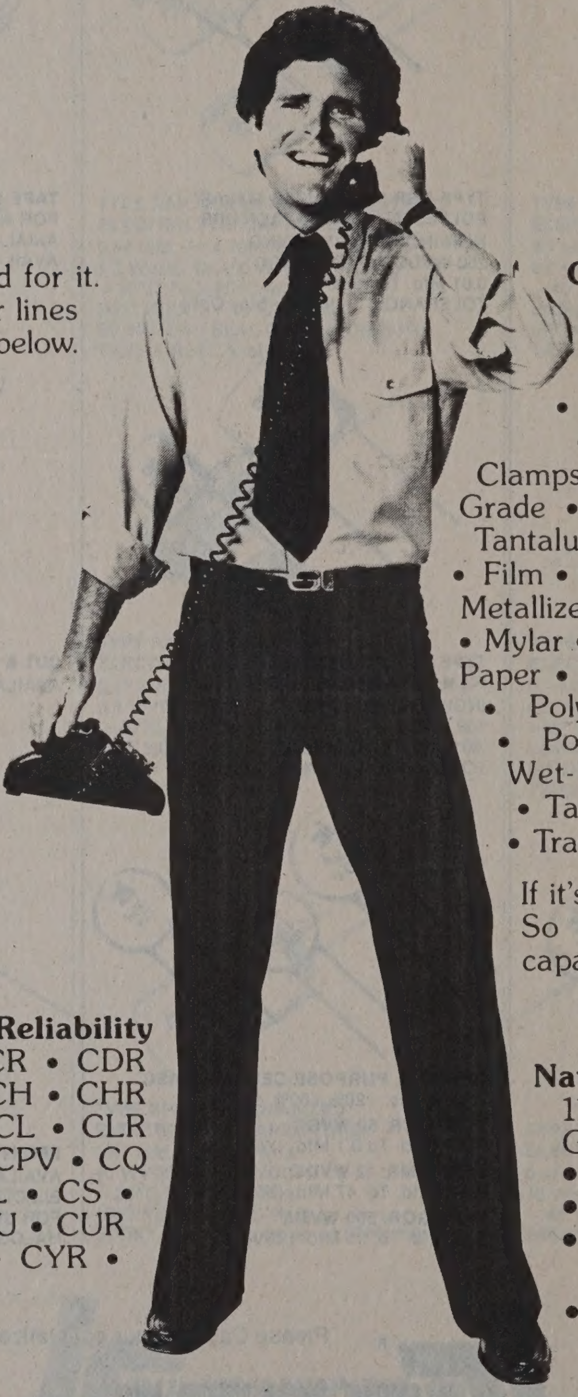

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- CAP. TECHNOLOGY
- SEMCO
- STETTNER
- TANSITOR
- THOMSON-CSF

CAPACITOR TYPES

Military/Established Reliability
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Commercial/Industrial
AC Motor Start/Run • Aluminum Electrolytic • Bathtub • Button Mica • Chip • Ceramic Disc • Ceramic Monolithic • Clamps/Brackets • Computer Grade • Dipped Mica • Dipped Tantalum • Feed-Thru/Filters • Film • Glass • High Voltage • Metallized Film • Mica Trimmers • Mylar • Nonpolar • Oil Filled • Paper • Piston • Polycarbonate • Polyester • Polypropylene • Polysulfone • Tantalum Wet-Slug • Tantalum-Solid • Tantalum-Foil • Trimmers • Transmitting Mica • Variables

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The Inter-Technical Group Inc. WIMA Division

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Plastic Film Capacitors in Plastic Cases with Radial Leads

Capacitors		Dielectric	Type
Sub-miniature capacitors **PCM 2.5 mm**		Polyester film metallized	**WIMA MKS 02**
Miniature type capacitors **PCM 5 mm** **available taped and reeled**	0.01 µF to 1.0 µF	Polyester film metallized	**WIMA MKS 2**
	for pulse duty, low ESR	Polyester film metallized	**WIMA MKS 20**
	1000 pF to 0.01 µ	Polyester film with metal foil electrodes	**WIMA FKS 2**
	220 pF to 0.01 µF	Polycarbonate film with metal foil electrodes	**WIMA FKC 2**
		Polypropylene film with metal foil electrodes	**WIMA FKP 2**
Semi-miniature capacitors **PCM 7.5 mm**		Polyester film metallized	**WIMA MKS 3**
Metallized capacitors for stringent requirements	CECC approval certificate Nr. 30 401-010	Polyester film	**WIMA MKS 4**
	CECC approval certificate Nr. 30 501-001	Polycarbonate film	**WIMA MKC 4**
	High reliability components	Polycarbonate film	**WIMA MKC 4 sv21**
Capacitors for high current ratings **High reliability components**	with double metallized film electrodes	Polyester film	**WIMA MKS 10**
		Polycarbonate film	**WIMA MKC 10**
		Polypropylene film	**WIMA MKP 10**
with two metal foil electrodes and a metallized plastic film electrode carrier (inner series connection)		Polypropylene film	**WIMA FKP 1**
Film capacitors with metal foil electrodes **PCM 7.5 to 22.5 mm**		Polyester film	**WIMA FKS 3**
		Polycarbonate film	**WIMA FKC 3**

Capacitors for special applications:

Radio Interference Suppression Capacitors in accordance with VDE 0565, part 1	inner series connection	Polyester film metallized	**WIMA MKS 4-R**
	epoxy resin impregnated	Paper metallized	**WIMA MP 3**

See last page for letter codes and case dimensions.

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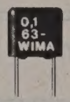
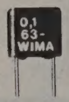
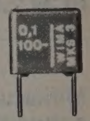
	Sub-miniature PCM 2.5 mm	Miniature capacitors 5 mm PCM/available taped and reeled									Semi-miniature PCM 7.5 mm	
												
	WIMA MKS 02	**WIMA MKS 2**			**WIMA MKS 20**	**WIMA MKC 2**		**WIMA FKS 2**	**WIMA FKC 2**	**WIMA FKP 2**	**WIMA MKS 3**	
Dielectric	Polyester film	Polyester film			Polyester film	Polycarbonate film		Polyester film	Polycarbonate film	Polypropylene film	Polyester film	
Capacitor electrodes	Vacuum deposited aluminum	Vacuum deposited aluminum			Double sided metallization	Vacuum deposited aluminum		Metal foil	Metal foil	Metal foil	Vacuum deposited aluminum	
Temperature ranges	−55°C to +100°C	−55°C to +100°C			−55°C to +100°C	−55°C to +100°C		−55°C to +100°C	−55°C to +100°C	−55°C to +85°C	−55°C to +100°C	
Insulation resistance at +20°C	1×10^4 MΩ	1×10^4 MΩ $>0.33\,\mu F$ / 3,300 sec.			1×10^4 MΩ	1×10^4 MΩ		5×10^5 MΩ	5×10^5 MΩ	5×10^5 MΩ	1×10^4 MΩ $>0.33\,\mu F$ / 3,300 sec.	
Power factor tan δ at 1 kHz and +20°C	5 to 8×10^{-3}	5 to 8×10^{-3}			5 to 7×10^{-3}	3×10^{-3}		5 to 8×10^{-3}	1 to 3×10^{-3}	2 to 4×10^{-4}	5 to 8×10^{-3}	
Voltage ranges	50 VDC	50 VDC	63 VDC	100 VDC	63 VDC	63 VDC	100 VDC	100 VDC	100 VDC	63 VDC	63 VDC	100 VDC
Capacitance tolerances	±20% ±10% ±5%	±20% ±10%			±20% ±10%	±20% ±10% ±5%		±20% ±10% ±5%	±20% ±10% ±5%	±10% ±5% ±2.5%	±20% ±10%	
100 pF												
220 pF									H	J		
680 pF									H	J		
1000 pF	A							H	H	J		
1500 pF	A							H	H	J		
2200 pF	A							H	H	J		
3300 pF	A							H	H	J		
4700 pF	A				C		C	H	E	K		
6800 pF	A				C		C	H	E	K		
0.01 µF	A		C	C	C		C	D	F	L		M
0.015 µF	A		C	C	C		C					M
0.022 µF	A		C	C	C		C					M
0.033 µF	A		C	C	D	C						M
0.047 µF	A		C	C	E	C						M
0.068 µF	B		C	E	F	E						M
0.1 µF	B	C	D	F	G	E						M
0.15 µF		C	E	QQ		F						M
0.22 µF		D	E	QQ		G					M	
0.33 µF		E	F	QQ		A/K					N	
0.47 µF		F	G	A/K		A/K					P	
0.68 µF		G									Q	
1.0 µF		QQ									R	
1.5 µF												

Encapsulation : Plastic Cases — All Types

See last page for letter codes and case dimensions.

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For More Information. Circle No. 27

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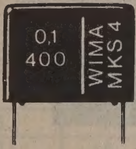
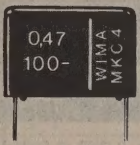
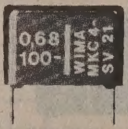
Metallized capacitors for stringent requirements

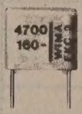
CECC approved

Film capacitors with metal foil electrodes









	WIMA MKS 4	WIMA MKC 4	Frequency limit 21 kHz WIMA MKC 4 SV 21	WIMA FKS 3	WIMA FKC 3
Dielectric	Polyester film	Polycarbonate film	Polycarbonate film flame-retardent	Polyester film	Polycarbonate film
Capacitor electrodes	Vacuum deposited aluminum	Vacuum deposited aluminum	Vacuum deposited aluminum	Metal foil	Metal foil
Temperature ranges	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C	−55°C to +100°C
Insulation resistance at +20°C	1.5 to 3 • 10⁴ MΩ >0.33 µF / 5,000 to 10,000 sec.	1.5 to 3 x 10⁴ MΩ >0.33 µF / 5,000 to 10,000 sec.	5,000 to 10,000 sec.	5 x 10⁵ MΩ >0.02 µF / 10,000 sec.	5 x 10⁵ MΩ >0.02 µF / 10,000 sec.
Power factor tan δ at 1 kHz and +20°C	5 to 8 x 10⁻³	1 to 3 x 10⁻³	1 to 3 • 10⁻³	5 to 8 x 10⁻³	1 to 2 x 10⁻³

	MKS 4						
Voltage ranges	63 VDC	100 VDC	160 VDC	250 VDC	400 VDC	630 VDC	1000 VDC
Capacitance tolerances	±20% ±10% ±5%						
100 pF							
220 pF							
680 pF							
1000 pF							
1500 pF							
2200 pF							
3300 pF							
4700 pF							
6800 pF							
0.01 µF		N		S/N	S	T	Y
0.015 µF		N		S	S	T	Z
0.022 µF		N		S	T	U	Z
0.033 µF		N		S	T	Y	PP
0.047 µF		N		S	Y	Z	KK
0.068 µF		N		S	Y	AA	LL
0.1 µF		N/S	S	T/Y	Z	PP	A/C
0.15 µF		N/S	T	Y	AA	KK	VV
0.22 µF	N/T	T	U	Y	PP	LL	WW
0.33 µF	P/T	Y	Y	Z	KK	ZZ	XX
0.47 µF	Q/T	Y	Z	KK	LL	VV	YY
0.68 µF	R/U	Z	AA	KK	VV	WW	
1.0 µF	U	AA	KK	LL	VV	YY	
1.5 µF	AA	KK	KK	ZZ	WW		
2.2 µF	BB	LL	LL	VV	YY		
3.3 µF	LL	MM	NN	WW			
4.7 µF	LL	VV	WW	YY			
6.8 µF	A/C	WW					
10 µF							

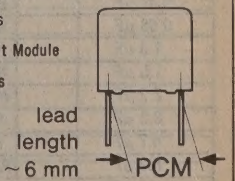
	MKC 4				MKC 4 SV 21		FKS 3			FKC 3		
Voltage ranges	63 VDC	100 VDC	250 VDC	400 VDC	100 VDC	250 VDC	100 VDC	160 VDC	400 VDC	160 VDC	400 VDC	1000 VDC
Capacitance tolerances	±20% ±10% ±5%				±20% ±10% ±5%		±20% ±10% ±5%			±20% ±10% ±5%		
100 pF										M	W	
220 pF										M	W	
680 pF										M	W	
1000 pF							M		W	M	W	W
1500 pF							M		W	M	W	CC
2200 pF							M		W	M	W	CC
3300 pF							M		W	M	W	CC
4700 pF							M	W	W	N/W	T	Y
6800 pF							M	W	W	N/T	U	Z
0.01 µF				S			W	W	T	T	X	AA
0.015 µF				S			M/W	W	U			
0.022 µF				S			M/W	W	V			
0.033 µF			T	T			T	T				
0.047 µF			T	Y			T	T				
0.068 µF			U	Y			U					
0.1 µF		T	U/Y	Z			V					
0.15 µF		T	Y	AA								
0.22 µF	T	U	Z	KK								
0.33 µF	T	Y	AA	LL								
0.47 µF	U	Y	KK	MM	Y	KK						
0.68 µF	Y	AA	KK	VV	AA	KK						
1.0 µF	Z	AA	LL	WW	AA	LL						
1.5 µF	AA	KK	ZZ	XX	KK	ZZ						
2.2 µF	BB	LL	VV	YY	LL	VV						
3.3 µF	KK	MM			MM	WW						
4.7 µF	LL	VV			VV	YY						
6.8 µF												
10 µF												

Encapsulation: Plastic Cases — All Types

Important dielectric characteristics of plastic films:

Polyester = high dielectric strength
Polycarbonate = linear temperature curve
Polypropylene = extremely low losses (tan δ)

The figures in the tables of capacitances refer to the PCM = Printed Circuit Module (lead spacing) at the lead exit points



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Capacitors for high current ratings* High reliability components

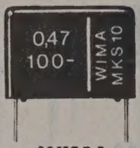
* Data regarding pulse ratings see general catalog

with double metallized film electrodes

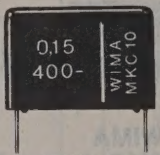
with two metal foil electrodes and a floating electrode of plastic film metallized on both sides (internal series connection)

Radio interference suppression capacitors

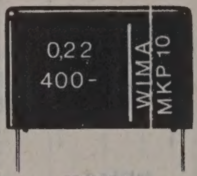
in accordance with VDE 0565-1 class X 2



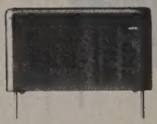
WIMA MKS 10



WIMA MKC 10



WIMA MKP 10



WIMA FKP 1

0,1
250~
WIMA MKS4-R

WIMA MKS 4-R

WIMA MP 3**

	WIMA MKS 10			WIMA MKC 10				WIMA MKP 10					WIMA FKP 1						WIMA MKS 4-R	WIMA MP 3**
Dielectric	Polyester film			Polycarbonate film				Polypropylene film					Polypropylene film						Polyester film	Paper, epoxy resin impregnated
Capacitor electrodes	Carrier film metallized on both sides, self-healing												Metal foil and carrier film metallized on both sides, self-healing						Vacuum deposited aluminum, self-healing	Metallized self-healing
Temperature ranges	−55°C to +100°C			−55°C to +100°C				−55°C to +85°C					−55°C to +85°C						−40°C to +85°C	−40°C to +85°C
Insulation resistance at +20°C	3 x 10^4 MΩ >0.33µF/10,000 sec.			3 x 10^4 MΩ >0.33µF /10,000 sec.				3 x 10^4 MΩ >0.33µF/10,000 sec.					1 x 10^5 MΩ >0.1µF/10,000 sec.						1.5 x 10^4 MΩ >0.33µF/ 5,000 sec.	6 x 10^3 MΩ >0.33µF/ 2,000 sec.
Power factor tan δ at 1 kHz and +20°C	5 to 6 x 10^{-3}			1 to 4 x 10^{-3}				1 to 3 x 10^{-4}					1 to 3 x 10^{-4}						5 to 8 x 10^{-3}	6 to 10 x 10^{-3}
Voltage ranges	63 VDC	100 VDC	250 VDC	250 VDC	400 VDC	630 VDC	1000 VDC	160 VDC 100 VAC	250 VDC 180 VAC	400 VDC 220 VAC	630 VDC 400 VAC	1000 VDC 400 VAC	400 VDC 250 VAC	630 VDC 300 VAC	1000 VDC 350 VAC	1000 VDC 400 VAC	1600 VDC 500 VAC	2000 VDC 600 VAC	250 VAC ÖVE Ⓢ	250/275 VAC Ⓢ Ⓢ Ⓓ ÖVE ÖVE
Capacitance tolerances	±20% ±10% ±5%			±20% ±10% ±5%				±20% ±10% ±5%					±20% ±10% ±5%						±20% ±10%	±20% ±10%
100 pF																				
220 pF																				
680 pF																				
1000 pF																Y	RR	RR		
1500 pF																Y	RR	PP		
2200 pF																Y	PP	KK		
3300 pF																Z	KK	LL		
4700 pF																AA	KK	ZZ		
6800 pF																BB	LL	VV		
0.01 µF			N			T	Z			T	Y	PP	Y	AA	PP	KK	MM	WW	Y	EE
0.015 µF			N			U	AA			U	Z	KK	Z	BB	KK	LL	VV		Y	EE
0.022 µF			N		U	Y	BB			U	AA	LL	AA	KK	LL	MM	WW		Z	EE
0.033 µF			P		V	Z	KK			Y	KK	MM	BB	LL	ZZ	VV			Z	FF
0.047 µF		P	S	U	Y	AA	LL	U	U	Z	LL	VV	KK	MM	VV	WW			AA	GG
0.068 µF	P	S	U	V	Z	KK	NN	V	Y	AA	MM	WW	LL	VV	A/J	A/J			BB	HH
0.1 µF	P	U	Y	Y	AA	KK	VV	Y	Z	BB	VV	A/E	MM	WW	A/E	A/F			DD	JJ
0.15 µF	U	V	Z	AA	KK	LL	WW	Z	AA	LL	WW	A/F	VV	A/E	A/F	A/H			LL	SS
0.22 µF	V	Y	BB	BB	LL	VV		AA	BB	LL	A/E	A/H	WW	A/F	A/G	A/G			NN	TT
0.33 µF	V	Z	KK	KK	NN	WW		BB	LL	MM	A/F								VV	UU
0.47 µF		BB	LL	LL	VV	XX		KK	LL	VV	A/G								WW	A/D
0.68 µF		KK	NN	MM	WW			LL	NN	XX									XX	
1.0 µF		LL	VV	VV				NN	WW	YY									YY	
1.5 µF		NN	WW	XX				WW	XX	A/B										
2.2 µF		WW	YY					XX	YY											
3.3 µF		XX	A/B					YY	A/B											
4.7 µF		YY																		
6.8 µF		A/B																		
10 µF																				

Encapsulation: Plastic Cases — All Types

** MP3 Encapsulation Surface-treated metal foil and epoxy resin

See last page for letter codes and case dimensions.

WIMA is a Registered Trademark of: Wilhelm Westermann, Mannheim, West Germany.

For More Information. Circle No. 27

The Inter-Technical Group Inc.
WIMA Division

P.O. BOX 23 — IRVINGTON, NY 10533 • TELEPHONE (914) 591-8822 • TWX: 710-564-0802

CASE DIMENSIONS

Code	W	H	L	PCM	Capacitor
A	2.5	7	4.6	2.5	MKS 02
B	3	7.5	4.6	2.5	MKS 02
C	2.5	7	7.2	5	MKS 2; MKS 20; MKC 2
D	3	7.5	7.2	5	MKS 2; FKS 2; MKS 20
E	3.5	8.5	7.2	5	MKS 2; MKS 20; FKC 2; MKC 2
F	4.5	9.5	7.2	5	MKS 2; MKS 20; FKC 2; MKC 2
G	5	10	7.2	5	MKS 2; MKS 20; MKC 2
H	2.5	6.5	7.2	5	FKS 2; FKC 2
J	4.5	6	7.2	5	FKP 2
K	5.5	7	7.2	5	FKP 2
L	6.5	8	7.2	5	FKP 2
M	3	8.5	10	7.5	MKS 3; FKS 3; FKC 3
N	4	9	10	7.5	MKS 3; MKS 4; MKS 10; FKC 3
P	4.5	9.5	10.3	7.5	MKS 3; MKS 4; MKS 10
Q	5	10.5	10.3	7.5	MKS 3; MKS 4
R	5.7	12.5	10.3	7.5	MKS 3; MKS 4
S	4	9	13	10	MKS 4; MKC 4; MKS 10
T	4	9.5	13	10	MKS 4; MKC 4; MKC 10; MKP 10; FKC 3; FKS 3
U	5	11	13	10	MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKS 3; FKC 3
V	6	12.5	13	10	MKS 10; MKC 10; MKP 10; FKS 3
W	3	9	13	10	FKS 3; FKC 3
X	6	12	13	10	FKC 3
Y	5	11	18	15	MKS 4; MKC 4; MKC4SV21; MKS 4-R; MKP 10; FKP 1; FKC 3; MKS 10; MKC 10
Z	6	12.5	18	15	MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKP 1; FKC 3; MKS 4-R
AA	7	14	18	15	MKC 10; MKS 4; MKC 4; MKC4SV21; FKP 1; FKC 3; MKS 4-R; MKP 10
BB	8	15	18	15	MKS 4-R; MKS 4; MKC 4; MKS 10; MKC 10; MKP 10; FKP 1
CC	4	10	18	15	FKC 3
DD	9	16	18	15	MKS 4-R
EE	5	13	19	15	MP 3
FF	6	14	19	15	MP 3
GG	7	15	19	15	MP 3
HH	8	17	19	15	MP 3
JJ	10	18	19	15	MP 3; FKP 1
KK	7	16.5	26.5	22.5	MKC 4; MKC4SV21; MKP 10; MKS 10; MKC 10; FKP 1; MKS 4
LL	8.5	18.5	26.5	22.5	MKS 4; MKC 4; MKC4SV21; MKP 10; FKP 1; MKC 10; MKS 10; MKS 4-R
MM	10.5	20.5	26.5	22.5	MKS 4; MKC4SV21; MKC 10; MKP 10; FKP 1; MKC 4
NN	11	21	26.5	22.5	MKS 4; MKS 10; MKC 10; MKP 10; MKS 4-R
PP	6	15	26.5	22.5	MKS 4; MKP 10; FKP 1
QQ	5.5	11.5	7.2	5	MKS 2
RR	5	14	26.5	22.5	FKP 1
SS	8	20	28	22.5	MP 3
TT	10	22	28	22.5	MP 3
UU	12	24	28	22.5	MP 3
VV	11	21	31.5	27.5	MKC 10; MKP 10; MKC4SV21; MKS 4-R; MKS 10; FKP 1; MKS 4 ; MKC 4
WW	13	24	31.5	27.5	MKS 4; MKS 4-R; MKS 10; MKC 10; MKP 10; MKC4SV21; FKP 1; MKC 4
XX	15	26	31.5	27.5	MKC 10; MKP 10; MKS 4-R; MKS 10; MKC 4; MKS 4
YY	17	34.5	31.5	27.5	MKS 10; MKP 10; MKS 4-R; MKC4SV21; MKS 4 ; MKC 4
ZZ	9	19	31.5	27.5	MKS 4; MKC 4; MKC4SV21; FKP 1
A/B	20	39.5	31.5	27.5	MKP 10; MKS 10
A/C	10.5	19	26.5	22.5	MKS 4
A/D	13	25	33	27.5	MP 3
A/E	13	24	41.5	37.5	MKP 10; FKP 1
A/F	15	26	41.5	37.5	MKP 10; FKP 1
A/G	19	32	41.5	37.5	MKP 10; FKP 1
A/H	17	29	41.5	37.5	MKP 10; FKP 1
A/J	11	22	41.5	37.5	FKP 1
A/K	7.2	13	7.2	5	MKC 2; MKS 2

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For More Information. Circle No. 27

ITT Components
A Unit of ITT Corporation

Aluminum Electrolytic Capacitors

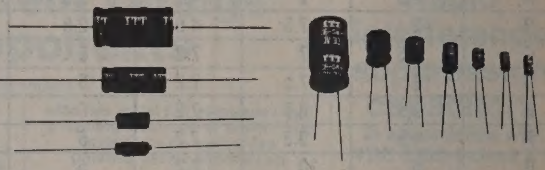
Miniature Radial
Miniature Axial

ORDERING INFORMATION:

SM 3.3 M 50 S

Series Designation (SM-Subminiature Radial)
Nominal Capacitance (Micro Farads)
Tolerance Designation (as specified)
Rated Voltage (DC)
Lead Style Designation
(AX-Miniature Axial) (CE04-W-Miniature Radial)
(SSM-Super Subminiature)

NOTE: For tape and reel packaging, use a T for the lead style designation. Available for case diameters through .315 (8.00).
For epoxy end sealing, use an E next to the lead style designation. Available for case diameters through .709 (18.00)



Standard Capacitance Range
(Case Diameters and Lengths in mm)

μf \ WV	6.3	10	16	25	35	50	63	100
0.1								5x11
0.22								5x11
0.33								5x11
0.47								5x11
1								5x11
2.2								5x11
3.3								5x11
4.7							5x11	6.3x11
10						5x11	6.3x11	8x11.5
22				5x11	6.3x11	6.3x11	8x11.5	10x12.5
33			5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x16
47		5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x12.5	10x20
100		6.3x11	8x11.5	8x11.5	10x12.5	10x16	10x20	13x20
220		8x11.5	10x12.5	10x16	10x20	13x20	13x20	16x25
330		10x12.5	10x16	10x20	13x20	13x20	13x25	16x31.5
470	10x12.5	10x16	10x20	13x20	13x25	16x25	16x25	18x35.5
1000	10x20	13x20	13x20	13x25	16x25	16x31.5	18x35.5	
2200	13x25	16x20	16x25	16x35.5	18x35.5			
3300	16x25	16x31.5	16x35.5	18x40				
4700	16x31.5	16x35.5	18x35.5					
10000	18x40							

PERFORMANCE SPECIFICATIONS:

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: Less than $3\mu a$ +.01 CV (measured after 3 minutes of applied voltage).
C = Nominal capacitance (μf)
V = Rated voltage

Capacitance Tolerance: ±20% (M) or 10% (K)
(measured at 20°C (68°F), 120Hz)

Dissipation Factor: (measured at 20°C (68°F), 120Hz)

Rated Voltage	6.3	10	16	25	35	50 to 100
0.1μf to 1000μf	0.24	0.20	0.17	0.15	0.12	0.10
1000μf to 10,000μf	Values above plus 0.02 for each 1000μf					

Impedance Ratio at Low Temperature: 120Hz

Rated Voltage	6.3	10	16	25	35	50 to 100
Z −25°C (−13°F)/Z @ 20°C (68°F)	4	3	2	2	2	2
Z −40°C (−40°F)/Z @ 20°C (68°F)	8	6	4	4	4	4

Surge Voltage:

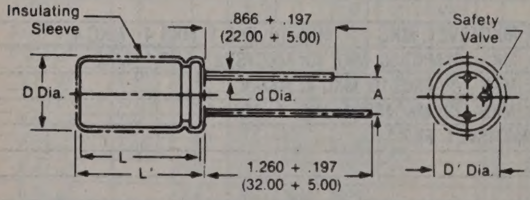
DC Rated Voltage	6.3	10	16	25	35	50	63	100
Surge Voltage	8	13	20	32	44	63	79	125

Load Life: 1000 ±12 hrs @ +85°C (+185°F) and rated voltage.
Leakage Current: Within values specified above
Dissipation Factor: With ±150% of specified value

Shelf Life: 1000 hrs. @ +85°C (+185°F), No voltage applied
Leakage Current: Within ±200% of values specified above
Dissipation Factor: Within ±150% of specified value
Capacitance Change Max.: ±20% from initial value

Case Sizes and Dimensions: All dimensions shown in inches (millimeters)

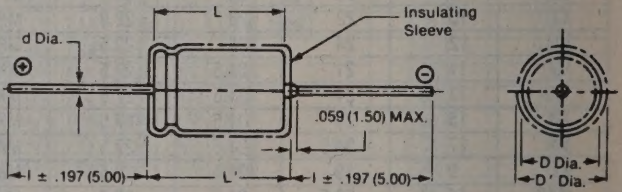
SM Series



D	.197(5.00)	.248(6.30)	.315(8.00)	.394(10.00)	.512(13.00)	.630(16.00)	.709(18.00)
A	.079(2.00)	.099(2.50)	.140(3.50)	.197(5.00)		.295(7.50)	
d	.020(0.50)			.024(0.60)		.026(0.65)	.032(0.80)

D′ = [D +.020(0.50)] Max.
L′ = [L +.039(1.00)] Max. at D ≤ .315(8.00)
L′ = [L +.079(2.00)] Max. at D ≥ .394(10.00)

AX Series



D	d	f
.248 ~ .315 (6.30 ~ 8.00)	.024 (0.60)	1.500 (38.00)
.394 ~ .512 (10.00 ~ 13.00)	.024 (0.60)	1.500 (38.00)
.630 ~ .870 (16.00 ~ 22.00)	.032 (0.80)	1.500 (38.00)
.984 (25.00)	.039 (1.00)	1.500 (38.00)

D′ = [D +.020(0.50)] Max.
L′ = [L +.039(1.00)] Max. at D ≤ .315(8.00)
L′ = [L +.079(2.00)] Max. at D ≥ .394(10.00)

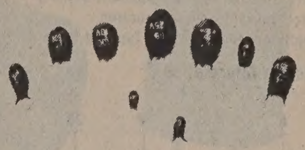
ITT COMPONENTS • 3201 South Standard Street • Santa Ana, California 92705 • Phone (714) 836-0351 • TWX 910-595-1744 • Telex 69-1389

ITT Components
A Unit of ITT Corporation

Epoxy Dipped Solid Tantalum Capacitors

TAP

- Extremely Low Leakage Current
- High Surge Capability
- Small Size
- High Component Density
- Rugged Construction
- Reliability-Long Term Stability
- Outstanding Performance Over Wide Frequency Range
- Wide Temperature Range



Catalog Ordering Information

TAP F 2.2 M 15 **General Specifications**

Voltage (15)
Tolerance (M)
M ±20%, K ±10%
Capacity in µF (2.2)
Lead Execution (F)
S = 0.100″ Lead Spacing
C = 0.200″ with Shoulder
D = 0.125″ Lead Spacing
B = 0.250″ Lead Spacing
F = Lock-In Leads 0.200″ Spacing
Y = Special
E = Tape and Reel

Packed in the following quantities:

Case Size	Quantity (units per bag)
1—8	500
9—12	100
13—15	50
1—5	1500 pcs/reel
6—8	1000 pcs/reel

Ratings

Capacitance: 0.1 to 330 µF (values up to 680 µF available on request)

Tolerance Range: ±20% (±10%)

Voltage: 3 to 50 volts

Temperature Range: Continuous operation between −55°C to +85°C

Standard Ratings

*Insert Lead Execution Letter & Tolerance Letter in the 2nd and 4th space to complete Ordering Code.

3 Volts — DC; 3.9 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_10_3	10	1	1	3	9.5	8
TAP_15_3	15	2	2	2	8.5	
TAP_22_3	22	3	2	1.5	5	
TAP_33_3	33	4	3	0.8	3.5	
TAP_47_3	47	5	4	0.6	2	
TAP_68_3	68	6	5	0.5	2	8
TAP_100_3	100	7	10	0.5	1.5	10
TAP_150_3	150	9	10	0.4	0.9	10
TAP_220_3	220	9	15	0.4	0.9	10
TAP_330_3	330	11	20	0.3	0.7	10

6.3 Volts — DC; 8 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_4.7_6.3	4.7	1	1	5.6	19	6
TAP_6.8_6.3	6.8	2	1	4	10	6
TAP_10_6.3	10	3	2	3	9.5	8
TAP_15_6.3	15	4	2	2.3	6.8	8
TAP_22_6.3	22	5	2	1.5	4	8
TAP_33_6.3	33	6	3	0.8	3.5	8
TAP_47_6.3	47	7	4	0.6	2	8
TAP_68_6.3	68	8	5	0.5	2	8
TAP_100_6.3	100	9	10	0.5	1.5	10
TAP_150_6.3	150	11	10	0.4	0.9	10
TAP_220_6.3	220	12	15	0.4	0.9	10
TAP_330_6.3	330	14	20	0.3	0.7	10

10 Volts — DC; 13 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_3.3_10	3.3	1	1	8	22	6
TAP_4.7_10	4.7	2	1	5	12	6
TAP_6.8_10	6.8	3	2	3	9.5	6
TAP_10_10	10	4	2	2.4	7	8
TAP_15_10	15	5	2	1.8	4.5	8
TAP_22_10	22	6	3	1	3.5	8
TAP_33_10	33	7	5	0.8	2.2	8
TAP_47_10	47	8	5	0.6	2.2	8
TAP_68_10	68	9	10	0.5	1.8	8
TAP_100_10	100	11	15	0.4	1	10
TAP_150_10	150	13	20	0.4	0.9	10
TAP_220_10	220	14	20	0.3	0.8	10

15(16)† Volts — DC; 20 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_2.2_15	2.2	1	1	10	25	6
TAP_3.3_16	3.3	2	1	6.5	13.5	6
TAP_4.7_16	4.7	3	2	5.8	12.8	6
TAP_6.8_16	6.8	4	2	5	12	6
TAP_10_16	10	5	2	2.5	5	8
TAP_15_16	15	6	3	1.5	4	8
TAP_22_16	22	7	5	1	2.5	
TAP_33_16	33	8	5	0.8	2.2	
TAP_47_16	47	10	10	0.6	1.5	
TAP_68_16	68	11	10	0.5	1.1	
TAP_100_16	100	13	15	0.4	0.9	10
TAP_150_16	150	15	20	0.3	0.8	10

20 Volts — DC; 26 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_15_20	15	7	4	1.7	3.5	8
TAP_22_20	22	7	5	1.2	2.5	
TAP_33_20	33	9	10	0.8	2	
TAP_47_20	47	11	15	0.7	1.4	
TAP_68_20	68	12	15	0.6	1.1	
TAP_100_20	100	14	20	0.5	1.1	10

25 Volts — DC; 32 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_1.5_25	1.5	1	1	12	25	4
TAP_2.2_25	2.2	2	1	9	15	6
TAP_3.3_25	3.3	3	1	6.5	14.5	6
TAP_4.7_25	4.7	4	2	4.5	7.5	6
TAP_6.8_25	6.8	5	3	3	5.5	6
TAP_10_25	10	6	4	2.4	4.2	8
TAP_15_25	15	7	5	1.7	2.8	
TAP_22_25	22	9	10	1.2	2.5	
TAP_33_25	33	10	10	0.8	1.8	
TAP_47_25	47	12	15	0.7	1.4	
TAP_68_25	68	13	15	0.6	1	8

35 Volts — DC; 46 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_0.1_35	0.1	1	1	165	270	4
TAP_0.15_35	0.15			110	160	
TAP_0.22_35	0.22			75	130	
TAP_0.33_35	0.33			51	85	
TAP_0.47_35	0.47			37	58	
TAP_0.68_35	0.68	1	1	27	40	4
TAP_1.0_35	1.0	1	1	18	28	4
TAP_1.5_35	1.5	2	1	13	20	4
TAP_2.2_35	2.2	3	1	9	13	6
TAP_3.3_35	3.3	4	2	6	10	6
TAP_4.7_35	4.7	5	2	4	7	6
TAP_6.8_35	6.8	6	3	3	4.5	6
TAP_10_35	10	7	5	2.5	3.2	8
TAP_15_35	15	9	5	1.2	2.5	8
TAP_22_35	22	11	10	1	2	8
TAP_33_35	33	12	10	0.8	1.6	8
TAP_47_35	47	14	10	0.6	1.2	8

50 Volts — DC; 65 Volts — DC Surge @ 85°C

Code*	Cap µF	Case Size	Max Leak µA @ 25°C	Impedance Ω @ 25°C		Max Diss Fac %
				Nom	Max	
TAP_0.1_50	0.1	1	1	170	270	4
TAP_0.15_50	0.15	1	1	105	160	
TAP_0.22_50	0.22	1	1	80	130	
TAP_0.33_50	0.33	1	1	50	85	
TAP_0.47_50	0.47	2	1	32	55	
TAP_0.68_50	0.68	3	1	25	38	4
TAP_1.0_50	1.0	4	1	16	26	4
TAP_1.5_50	1.5	5	2	13	18	4
TAP_2.2_50	2.2	6	2	8	12	6
TAP_3.3_50	3.3	7	3	6.2	9	6
TAP_4.7_50	4.7	8	3	3.5	6.5	6
TAP_6.8_50	6.8	9	4	2.2	4.2	6
TAP_10_50	10	11	6	1.8	3	8

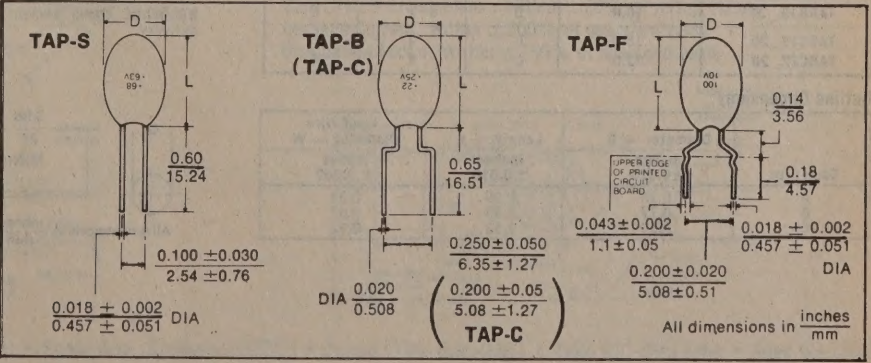
† Branded with voltage value in bracket.

For intermediate capacitance and voltage values, consult your local ITT representative.

Outline Dimensions (Maximum)

Case Size	Diameter-D Inches	Length-L Inches
1	0.157	0.275
2	0.177	0.275
3	0.196	0.314
4	0.196	0.334
5	0.216	0.354
6	0.236	0.374
7	0.255	0.393
8	0.334	0.452
9	0.374	0.531
10	0.374	0.551
11	0.393	0.551
12	0.413	0.591
13	0.413	0.630
14	0.433	0.650
15	0.433	0.669

TAP-S Standard Case Size 1-8
TAP-B Standard Case Size 1-15
TAP-F Standard Case Size 1-15



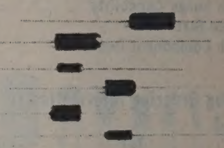
All dimensions in inches/mm

ITT COMPONENTS • 3201 South Standard Street • Santa Ana, California 92705 • Phone (714) 836-0351 • TWX 910-595-1744 • Telex 69-1389

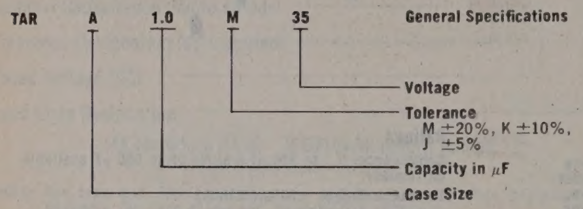
ITT Components
A Unit of ITT Corporation

Subminiature Epoxy Molded Solid Tantalum Capacitors

- Axial Leads For Automatic Insertion
- Subminiature Size For High Component Density
- Rugged Precision Molded Construction
- Polarity Positively Identified By Tapered Nose
- Extremely Low Leakage Current
- High Surge Capability
- Reliability-Long Term Stability
- Outstanding Performance Over Wide Temperature Range



Catalog Ordering Information



Standard Packaging is Tape and Reel

Case A 3000 pcs/reel
Case B 2000 pcs/reel
Case C 1000 pcs/reel

Standard Ratings

# Insert Tolerance Letter in the space to complete Ordering Code.

Code #	Capacitance µF	Case Size	Maximum Leakage µA @ 25°C	Maximum Dissipation Factor %
6.3 Volts — DC;	**8 volts — DC Surge @ 85°C**			
TARA8.2_6.3	8.2	A	1	6
TARA10_6.3	**10.0**	A	1	6
TARA12_6.3	12.0	A	1	6
TARB22_6.3	**22.0**	B	1	6
TARB27_6.3	27.0	B	2	6
TARB33_6.3	**33.0**	B	2	6
TARC56_6.3	56.0	C	4	6
TARC68_6.3	**68.0**	C	4	6
10 Volts — DC;	**13 volts — DC Surge @ 85°C**			
TARA4.7_10	**4.7**	A	1	6
TARA5.6_10	5.6	A	1	6
TARA6.8_10	**6.8**	A	1	6
TARA8.2_10	8.2	A	1	6
TARB18_10	**18.0**	B	1	6
TARB22_10	**22.0**	B	2	6
TARC39_10	39.0	C	4	6
TARC47_10	**47.0**	C	4	6
16 Volts — DC;	**20 Volts — DC Surge @ 85°C**			
TARA3.3_16	**3.3**	A	1	6
TARA3.9_16	3.9	A	1	6
TARA4.7_16	**4.7**	A	1	6
TARB12_16	12.0	B	2	6
TARB15_16	**15.0**	B	2	6
TARC27_16	27.0	C	4	6
TARC33_16	**33.0**	C	4	6
20 Volts — DC;	**26 Volts — DC Surge @ 85°C**			
TARA2.7_20	2.7	A	1	6
TARA3.3_20	**3.3**	A	1	6
TARA3.9_20	3.9	A	1	6
TARB8.2_20	8.2	B	2	6
TARB10_20	**10.0**	B	2	6
TARC18_20	18.0	C	4	6
TARC22_20	**22.0**	C	4	6

Outline Dimensions

Case Size	Diameter — D	Length — L	Lead Wire Diameter — W
	inches ±0.010	inches ±0.010	inches ±.0.002
A	0.10	0.29	0.02
B	0.17	0.34	0.02
C	0.19	0.53	0.02

Ratings

Capacitance: 0.1 to 68 µF
Tolerance Range: ±20%, ±10%, ±5%
Voltage: 6.3 to 35 volts DC
Temperature Range: Continuous operation between −55°C to +85°C
Impedance @ 100 kHz:

Case Size	Impedance maximum
A	< 06.8 µF = 26 ohms ≥ 0.68 µF = 10 ohms
B, C	5 ohms

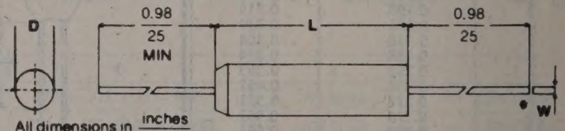
Temperature	−55°C	+85°C
% Change	−8	+12

Capacitance Change With Temperature: The change in capacitance from +25°C to a given temperature.

Code #	Capacitance µF	Case Size	Maximum Leakage µA @ 25°C	Maximum Dissipation Factor %
25 Volts — DC;	**33 Volts — DC Surge @ 85°C**			
TARA1.5_25	**1.5**	A	1	6
TARA1.8_25	1.8	A		
TARA2.2_25	**2.2**	A		
TARB2.7_25	2.7	A		
TARB3.3_25	**3.3**	A		
TARB3.9_25	3.9	B	1	6
TARB4.7_25	**4.7**	B	1	
TARB5.6_25	5.6	B	2	
TARB6.8_25	**6.8**	B	2	
TARC8.2_25	8.2	B	3	
TARC10_25	**10.0**	B	3	6
TARC12_25	12.0	C	4	
TARC15_25	**15.0**		4	
35 Volts — DC;	**46 Volts — DC Surge @ 85°C**			
TARA0.1_35	**0.1**	A	1	6
TAR0.12_35	0.12			
TARA0.15_35	**0.15**			
TARA0.18_35	0.18			
TARA0.22_35	**0.22**			
TARA0.27_35	0.27	A	1	6
TARA0.33_35	**0.33**			
TARA0.39_35	0.39			
TARA0.47_35	**0.47**			
TARA0.56_35	0.56			
TARA0.68_35	**0.68**	A	1	6
TARA0.82_35	0.82	A		
TARA1.0_35	**1.0**	A		
TARA1.2_35	1.2	A		
TARB1.5_35	**1.5**	A		
TARB1.8_35	1.8	B	1	6
TARB2.2_35	**2.2**		1	
TARB2.7_35	2.7		1	
TARB3.3_35	**3.3**		1	
TARB3.9_35	3.9		2	
TARB4.7_35	**4.7**	B	2	6
TARC5.6_35	5.6	C	3	
TARC6.8_35	**6.8**	C	3	
TARC8.2_35	8.2	C	4	
TARC10_35	**10.0**	C	4	

All capacitors are supplied in the highest voltage available at a given capacitance value and case size.

BOLDFACE items shown are preferred value (E6 range) readily available for delivery.



All dimensions in $\frac{\text{inches}}{\text{mm}}$

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ITT Components
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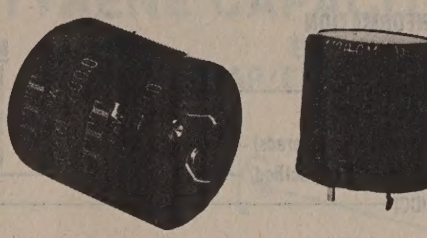
Aluminum Electrolytic Capacitors

PC Mount Power Filtering

ORDERING INFORMATION

FHW 470 M 200

Series Designation (FHW - Low Profile) — FHW
Nominal Capacitance (Micro Farads) — 470
Tolerance Designation (as specified) — M
Rated Voltage (DC) (FTW - small diameter) — 200

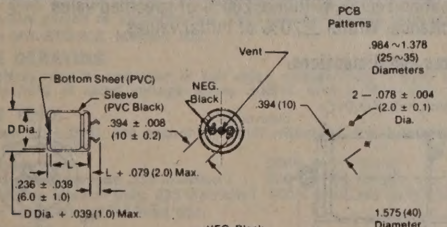


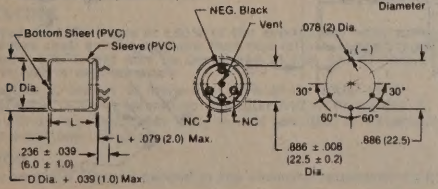
Standard Capacitance Range: FHW Series
(Case Diameters and Lengths in mm)

WV / μF	16	25	35	50	63	80	100	160	180	200	250
100										25x25	25x25
220								25x25	30x25	30x25	30x30
330								30x25	30x30	30x30	35x30
470								30x30	35x30	35x30	40x30
680								35x30	40x30	35x40	40x40
1000				25x25	25x25	30x25	30x30	40x30	40x40	51x40	
2200			25x25	30x25	30x30	30x30	40x30				
3300		25x25	30x25	30x30	35x30	40x30	51x40				
4700	25x25	30x25	30x30	35x30	40x30	51x40	51x40				
6800	30x25	30x30	35x30	40x40	51x40	51x40	63.5x40				
10000	30x30	35x30	40x40	51x40	63.5x40	63.5x40	63.5x40				
15000	35x30	40x40	51x40	63.5x40	63.5x40	63.5x50					
22000	40x40	51x40	63.5x40	63.5x50							

Standard Capacitance Range: FTW Series
(Case Diameters and Length in mm)

WV / μF	16	25	35	50	63	80	100	160	180	200	250
220									25x40	25x40	25x50
330								25x40	25x40	25x50	30x50
470					22.4x25	22.4x30	22.4x30	25x50	25x50	30x50	
680					22.4x30	22.4x40	22.4x40	30x50	30x50		
1000			22.4x25	22.4x25	22.4x30	22.4x40	25x40				
2200		22.4x25	22.4x30	22.4x40	25x40	25x50	30x50				
3300	22.4x25	22.4x30	22.4x40	25x40	25x50	30x50					
4700	22.4x30	22.4x40	25x40	25x50	30x50						
6800	22.4x40	25x40	25x50	30x50							
10000	25x40	25x50	30x50								
15000	30x50	30x50									


PCB Patterns
Vent
.984 ~ 1.378 (25 ~ 35) Diameters
Bottom Sheet (PVC)
Sleeve (PVC Black)
NEG. Black
.394 ± .008 (10 ± 0.2)
.394 (10)
2 — .078 ± .004 (2.0 ± 0.1) Dia.
D Dia.
L
L + .079 (2.0) Max.
.236 ± .039 (6.0 ± 1.0)
D Dia. + .039 (1.0) Max.


1.575 (40) Diameter
NEG. Black
Vent
.078 (2) Dia.
(−)
Bottom Sheet (PVC)
Sleeve (PVC)
D. Dia.
30°
30°
60°
60°
NC
NC
L
L + .079 (2.0) Max.
.236 ± .039 (6.0 ± 1.0)
D Dia. + .039 (1.0) Max.
.886 ± .008 (22.5 ± 0.2) Dia.
.886 (22.5)

PERFORMANCE SPECIFICATIONS:

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: 0.02 CV or 2 mA whichever is less
(measured after 3 minutes of rated voltage)
C = Nominal Capacitance
V = Rated Voltage

Capacitance Tolerance: ±20% (M)
(measured at 20°C (68°F), 120 Hz)

Dissipation Factor: (measured at 20°C (68°F), 120 Hz)

FHW Series:

Rated Voltage	16	25	35	50	63-100	160-250
Up to 2200μF	—	—	0.13	0.10	0.08	0.10
3300μF to 6800μF	0.20	0.18	0.15	0.13	0.15	—
10,000μF	0.25	0.20	0.18	0.18	0.18	—
15,000μF to 22,000μF	0.30	0.25	0.20	0.20	0.20	—

FTW Series:

Rated Voltage	16-25	36-63	80-100	160-250
Up to 2200μF	0.20	0.18	0.15	0.10
3300μF to 6800μF	0.25	0.20	0.20	—
10,000μF to 15,000μF	0.35	0.30	—	—

Impedance Ratio at Low Temperature: 120 Hz

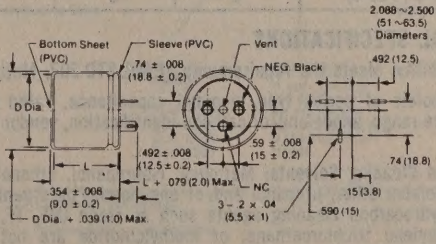
Ratio Z / WV	16	25-35	50-100	160-250
Z @ −25°C (−68°F)/Z @ +20°C (+68°F)	3	2	1.5	2
Z @ −40°C (−40°F)/Z @ +20°C (+68°F)	12	4	3	8

Surge Voltage:

DC Rated Voltage	16	25	35	50	63	80	100	160	180	200	250
Surge Voltage	20	32	44	63	79	100	125	200	225	250	300

Load Life: 1000 hrs @ +85°C (185°F), rated voltage
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within specified value
Dissipation Factor: Within ±150% of specified value

Shelf Life: 1000 hrs @ +85°C (+185°F), no voltage applied
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within ±200% of specified value
Dissipation Factor: Within ±150% of specified value


2.088 ~ 2.500 (51 ~ 63.5) Diameters
Bottom Sheet (PVC)
Sleeve (PVC)
Vent
NEG. Black
.74 ± .008 (18.8 ± 0.2)
.492 (12.5)
D Dia
.59 ± .008 (15 ± 0.2)
.492 ± .008 (12.5 ± 0.2)
.74 (18.8)
L
L + .079 (2.0) Max
NC
.15 (3.8)
.354 ± .008 (9.0 ± 0.2)
3 − .2 × .04 (5.5 × 1)
.590 (15)
D Dia. + .039 (1.0) Max.

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ITT Components
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FHR Aluminum Electrolytic Capacitors

Low ESR, High Ripple, PCB Mounting

ORDERING INFORMATION

FHR 470 M 200

- Series Designation (FHR Low Profile PC Mount) — FHR
- Nominal Capacitance (Micro Farads) — 470
- Tolerance Designation (As Specified) — M
- Rated Voltage (DC) — 200

Standard Item of FHR Series
(Case Diameters and Lengths in mm)

WV	160			200			250		
Cap (μF) \ D*	25	30	35	25	30	35	25	30	35
150	25x25			25x25			25x30	30x25	
220	25x30	30x25		25x35	30x25		25x40	30x30	
330	25x35	30x30			30x35		25x50	30x40	35x30
390	25x40			25x50	30x40	35x30			35x35
470	25x50	30x35	35x30		30x40	35x30		30x50	35x40
560		30x40			30x50	35x35			
680		30x50	35x35			35x40			35x50
820			35x40			35x50			
1000			35x50			35x50			

Ripple Current Max.
[In mA rms, 85°C (185°F) 120 Hz]

WV	180			200			250		
Cap (μF) \ D*	25	30	35	25	30	35	25	30	35
150	1000			1230			1300	1330	
220	1570	1610		1610	1610		1750	1700	
330	2000	2080			2200		2300	2300	2250
390	2300			2500	2450	2500			2600
470	2750	2600	2670		2730	2800		2940	2980
560		2980			3210	3060			
680		2500	3370			3600			3800
820			3950			4150			
1000			4200			4500			

ESR Maximum
[In ohms @ 25°C 120 Hz]

Cap.	150	220	330	390	470	560	680	820	1000
ESR	0.88	0.60	0.40	0.34	0.28	0.24	0.20	0.16	0.13

Impedance Ratio at Low Temperature: 120 Hz

Compartment Z \ WV	160	200	250
Z @ −25°C (−13°F)/ Z @ +20°C (+68°F)	2	2	2
Z @ −40°C (−40°F)/ Z @ +20°C (+85°F)	8	8	8

MECHANICAL SPECIFICATIONS

Lead Solderability: Meets the requirements of MIL-STD-202, Method 208.

Marking: Consists of series type, nominal capacitance, rated voltage, temperature range, anode and/or cathode identification, vendor identification.

Recommended Cleaning Solvents: Methanol, isopropanol, ethanol, isobutanol, petroleum ether, propanol and/or commercial detergents. Halogenated hydrocarbon cleaning agents such as freon (MF, TF, or TC), trichloroethylene trichloroethane, or methylchloride are not recommended as they may damage the capacitor.

PERFORMANCE SPECIFICATIONS

Operating Temperature Range: −40°C to +85°C (−40°F to +185°F)

Leakage Current: I = 0.02 CV or 2 mA maximum whichever is less (measured 3 minutes after application of rated voltage.)
I = Leakage current (μA)
C = Nominal capacitance (μF)
V = Rated voltage (V)

Capacitance Tolerance: ±20% (M)
[measured at 20°C (68°F), 120 Hz]

Dissipation Factor: 0.1 Max. [measured at 20°C (68°F), 120 Hz]

PERMISSIBLE RMS RIPPLE CURRENT

Where the -HR series capacitors are operated at a temperature other than +85°C, the ripple current may be increased by the following factor.

Maximum RMS Ripple Current (120 Hz)

45°C	60°C	70°C	85°C	105°C
1.36	1.30	1.15	1.0	0.5

Where the FHR series capacitors are operated at frequencies other than 120 Hz, the ripple current may be increased by the following factor.

Maximum RMS Ripple Current (85°C)

Rated Voltage (V DC)	50 Hz	120 Hz	300 Hz	1 KHz	10 KHz	50 KHz
160-200	0.75	1.00	1.18	1.30	1.45	1.50
1.36	0.84	1.00	1.15	1.20	1.30	1.35

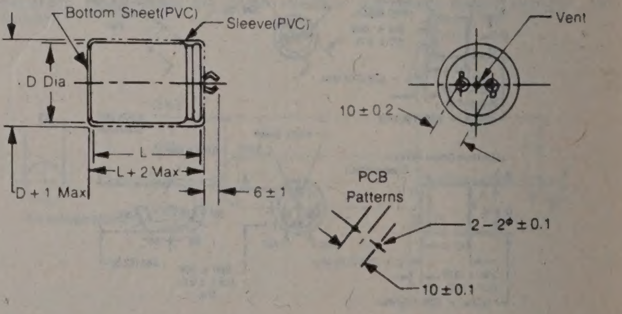
Surge Voltage:

DC Rated Voltage	160	200	250
Surge Voltage	200	250	300

Load Life: 1000 hrs @ +85°C (+185°F) and rated voltage, applied ripple current
Capacitance Change Max.: Within ±20% of initial value
Leakage Current: Within specified value
Dissipation Factor: Within 200% of specified value

Shelf Life: 1000 hrs @ +85°C (+185°F) No voltage applied
Leakage Current: Within ±200% of specified value
Dissipation Factor: Within ±200% of specified value
Capacitance: Within ±20% of initial values

Case Sizes and Dimensions:



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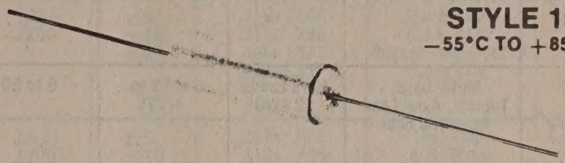
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 – TWX 810-665-2182

CAPACITORS
Polystyrene/Mylar

POLYSTYRENE CAPACITORS

EXTENDED FOIL
FILM WRAP/EPOXY END-FILL
STYLE 133
−55°C TO +85°C



ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

CAPACITANCE MEASUREMENTS
Capacitors of 1.0 μF or less shall be measured at a frequency of 1000 Hz.

Capacitors greater than 1.0 μF shall be measured at 60 Hz.

The standard capacitance tolerance is 20%. Other toleranoes are available upon request.

Reference: MIL-STD-202, Method 305.

TEMPERATURE CHARACTERISTICS AND STABILITY
When measured over the full operating range, the Temperature Coefficient shall be −120ppm/°C ±30ppm/°C.

There shall be less than 0.1% change per year in capacitance when operated between +20°C and +50°C.

After cycling from −55°C to +75°C, the capacitance shall not vary more than 0.2% from its initial measurement at +25°C.

DISSIPATION FACTOR
When measured as specified in Paragraph 1, the dissipation factor at +25°C shall not exceed 0.1%.

INSULATION RESISTANCE
When measured at +25°C, and rated voltage (or 500 VDC, whichever is less), the insulation resistance shall be a minimum of 200,000 megohm-microfarads, but need not exceed 500,000 megohms. The period of electrification shall not exceed two minutes.

Reference: MIL-STD-202, Method 302.

VOLTAGE DERATING
The capacitors may be operated at full rated voltage from −55°C to +65°C, or with linear derating to 60% of rated voltage above +65°C to the maximum operating temperature of +85°C.

VOLTAGE TEST
When tested at +25°C, the capacitors shall withstand the indicated DC test voltages for a period of one minute:

Terminal to terminal	200% of DC rating
Terminal to case (less than .235 diameter)	200% of DC rating
Terminal to case (greater than .235 diameter)	400% of DC rating or 2,000 VDC, whichever is less

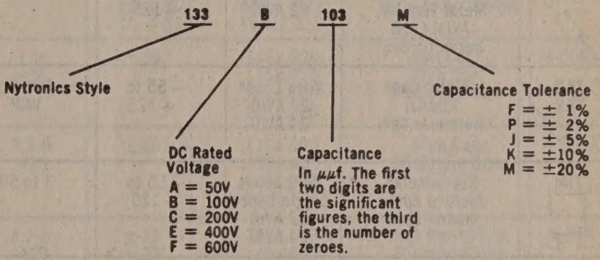
Reference: MIL-STD-202, Method 301.

LIFE TESTING
When tested at 85°C for 250 hours at full 65°C rated voltage, the capacitors shall exhibit no more than one failure in twelve pieces tested. A failure is defined as:

a) A capacitance change of more than 6% of its initial value;
b) A dissipation factor greater than that specified in Paragraph 3;
c) An insulation resistance less than 60% that specified in Paragraph 4; or
d) A permanent open or short.

VIBRATION
The capacitors will meet or exceed the vibration requirements of MIL-STD-202, Method 201.

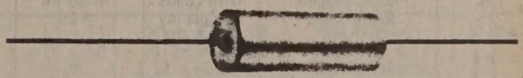
NYTRONICS CATALOG NUMBERING SYSTEM



Note: Special capacitance values, voltage ratings and sizes available to customer requirement.

POLYESTER FILM CAPACITORS

EXTENDED FOIL
FILM WRAP/EPOXY END FILL
STYLE 107
−55°C to +125°C



ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS

CAPACITANCE MEASUREMENTS
Capacitors of 1.0 μF or less shall be measured at a frequency of 1000 Hz. Capacitors greater than 1.0 μF shall be measured at 60 Hz. The standard capacitance tolerance is 20%. Other tolerances are available upon request.

Reference: MIL-STD-202, Method 305.

TEMPERATURE CHARACTERISTICS
The maximum change in capacitance from the measured value at +25°C shall be −5% at −55°C, and +15% at +125°C.

DISSIPATION FACTOR
When measured as specified in Paragraph 1, the dissipation factor at +25°C shall not exceed 0.6% for values up to 1.0 μF and shall not exceed 1.0% for greater capacitance values.

INSULATION RESISTANCE
When measured at +25°C, and rated voltage (or 500 VDC, whichever is less), the insulation resistance shall be a minimum of 50,000 megohm-microfarads, but need not exceed 100,000 megohms. The period of electrification shall not exceed two minutes.

Reference: MIL-STD-202, Method 302.

VOLTAGE DERATING
The capacitors may be operated at full rated voltage from −55°C to +85°C, or with linear derating to 50% of rated voltage above +85°C with a maximum temperature of +125°C.

VOLTAGE TEST
When tested at +25°C, the capacitors shall withstand the indicated DC test voltages for a period of one minute:

Terminal to terminal	200% of DC rating
Terminal to case (less than .235 diameter)	200% of DC rating
Terminal to case (greater than .235 diameter)	400% of DC rating or 2,000 VDC, whichever is less

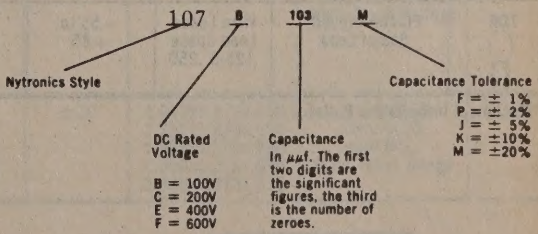
Reference: MIL-STD-202, Method 301.

LIFE TESTING
When tested for 1000 hours at 150% of the appropriate rated voltage for the test temperature, the capacitors shall exhibit no more than one failure in twelve pieces tested. Alternatively, an accelerated +125°C test may be performed at the +85°C voltage rating for a period of 250 hours. A failure is defined as:

a) A capacitance change of more than 10% of its initial value;
b) A dissipation factor greater than that specified in Paragraph 3;
c) An insulation resistance less than ⅓ that specified in Paragraph 4; or
d) A permanent open or short.

VIBRATION
The capacitors will meet or exceed in the vibration requirements of MIL-STD-202, Method 201.

NYTRONICS CATALOG NUMBERING SYSTEM



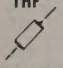
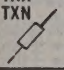
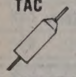
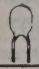
Note: Special capacitance values, voltage ratings and sizes available to customer requirement.

Intermediate value available.

1984/85 Product Catalog with complete details upon request – Dept. G

MALLORY

TANTALUM SOLID ELECTROLYTIC CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	Volt. Range (WVDC)	CAP. RANGE (μF)	STD. TOL. (% μF)	CASE SIZES DIA. x LGTH. (Inches) H x W x D (Inches)	FEATURES	TIB*
TAS TXA 	Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG 24 AWG	−80 to +125	6 to 100	.0047 to 1000	±5 ±10 ±20	.125x.250 .175x.438 .279x.650 .341x.750	Standard Capacitance - TAS Extended Capacitance - TXA Low DC Leakage Temperature Stable High Capacity, Long Shelf Life	4-801A
TFR 	Metal Case, Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG	−55 to +125	6 to 50	22 to 330	±5 ±10 ±20	.289x.686 .351x.786	MIL-C-39003 CSR21 High Frequency, High Ripple Capability, High Reliability	4-819A
TER TXE TXR 	Mylar Sleeved, Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 100	.0047 to 1000	±5 ±10 ±20	.135x.286 .185x.474 .289x.686 .351x.786	MIL-C-39003D CSR13, 23, 33 High Reliability	4-813A
TNR 	Metal Tubular, Axial Lead Non Polar	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 100	.0023 to 160	±5 ±10 ±20	.161x.575 .207x.955 .314x1.35 .376x1.55	MIL-C-39003D CSR 91 High Reliability, Non-Polar Application	4-815A
THF 	Mylar Sleeved, Metal Tubular, Axial Lead Hermetic Seal	Wire Leads 22 AWG	−80 to +125	6 to 50	5.6 to 330	±10 ±20	.289x.686 .351x.786	4.5 Amps Ripple Capability, Low ESR at High Freq. from 1 kHz-100 kHz	4-805B
TAN TXN 	Metal Case Tubular Hermetic Seal	Wire Leads 22 AWG 24 AWG	−55 to +125	6 to 50 VNP	2.8 to 500	±5 ±10 ±20	.161x .575 .207x .955 .314x1.350 .376x1.550	Non-Polar, Standard and Extended Range Capacity	4-817
TIM 	Rectangular, Molded Epoxy Radial Lead	Wire Leads Single Ended 22 AWG 24 AWG	−55 to +125	3 to 50	.082 to 220	±10 ±20	.340x.228x.105 .225x.285x.170 .335x.360x.170 .375x.600x.195	High Density Mounting, Automatic Insertion Capability	4-806B
TAC 	Molded Epoxy, Tubular, Axial Lead	Wire Leads 22 AWG 24 AWG	−55 to +125	3 to 50	.082 to 68	±10 ±20	.105x.300 .148x.350 .180x.350 .200x.540	Automatic Insertion Capability, High Shock & Vibration Capability	4-807D
TDM 	Epoxy Dipped, Rectangular Radial Lead	Wire Leads Single Ended 24 AWG	−55 to +85	6 to 50	.10 to 330	±10 ±20	.27x.27x.18 .33x.32x.21 .37x.40x.22 .40x.40x.25 .46x.48x.32 .56x.58x.32	Low Profile, Low Cost, High Volumetric Efficiency	4-810B
TDC 	Plastic Dipped, Radial Lead	Wire Leads LD Spacing .125 & .250	−55 to +85	6 to 50	.10 to 330	±10 ±20	.17x.35 .25x.50 .35x.65 .40x.75	Low Cost, Extended Capacitance, Temp. Stable, Long Storage Life	4-810B
TDL 	Plastic Dipped, Radial Lead	Wire Leads LD Spacing .10 & .20	−55 to +85	3 to 50	.10 to 330	±10 ±20	.18x.28 .20x.30 .26x.36 .34x.40 .40x.56 .44x.68	Low Cost, Low Profile, Long Storage Life	4-810B
TDR 	Plastic Dipped, Radial Lead	Wire Leads Lead Space .125 & .250	−55 to +85	6 to 50	.10 to 330	±10 ±20	.175x.350 .250x.500 .350x.650 .400x.750	MIL-C-49137/2 CX02 CX12	4-816

* Technical Information Bulletin

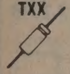
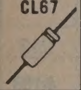
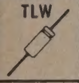
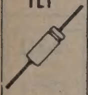
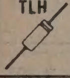
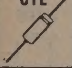
MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. GB, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

For More Information. Circle No. 30

MALLORY

TANTALUM WET SLUG CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	Volt. Range (WVDC)	CAP. RANGE (μF)	STD. TOL. (% μF)	CASE SIZES DIA. x LGTH. (Inches) H x W x D (Inches)	FEATURES	TIB*
TLX TXX 	Silver Tubular, Axial Lead, Hermetic Seal Mylar Sleeve	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-39006 CLR65 & CLR69 High CV, Long Life, High Reliability	4-612A
CL66 CL67 	Silver Tubular, Axial Lead, Hermetic Seal	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 ±20	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-3965 CL66, CL67 Rugged Construction Long Life	4-613
TLW 	Silver Tubular, Axial Lead, Hermetic Seal Kapton Sleeve	Wire Leads 22 AWG	−55 to +175	6 to 100	2.5 to 1200	±5 ±10 ±2	.219x .608 .312x .796 .406x .921 .406x1.217	High Cap, High Temp. to 175°C	4-611B
TLT 	Tantalum Case, Tubular, Axial Lead Hermetic Seal	Nickel Wire Heads 22 AWG	−55 to +125	6 to 100	2.5 to 1200	±5 ±10 ±20	.312x .796 .406x .921 .406x1.217	MIL-C-39006 CLR79 High CV Reverse Voltage Capability, High Reliability	4-616C
TLS TLH 	Silver Tubular, Axial Lead Elastomer Seal	Wire Leads 22 AWG	−55 to +125	6 to 125	1.7 to 2200	±5 ±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	MIL-C-3965 Styles CL64 & CL65, Low DCL, Wide Temp. Range	4-604
CTL 	Copper Alloy Tubular, Axial Lead Elastomer Seal	Wire Leads 22 AWG	−55 to +125	6 to 125	3.6 to 1200	±10 −15 +20 −15 +30 −15 +50	.219x .608 .312x .796 .406x .921 .406x1.217	Low Cost, Low DCL, Wide Temp. Range	4-610A
CMT	Copper Alloy Tubular, Red Plastic, Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	1 to 450	±20	.115x.300 .115x.403 .145x.600 .225x.778	Low Cost, High Cap, Miniature Size	4-609A
MTP	Silver Tubular, Red Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	3.3 to 470	±20	.115x.300 .115x.403 .145x.600 .225x.778	High Cap, Miniature Size	4-606A
MTPH	Silver Tubular, Red Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 60	4.7 to 470	±10 ±20	.115x.403 .145x.600 .225x.778	High Reliability, Miniature Size	4-614
TAP	Silver Tubular, Black Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	6 to 90	2 to 330	−15 +75 −15 +50 −15 +20 −10 +20 ±10	.226x.504 .226x.560 .226x.847	Low ESR, Miniature Size	4-602
TNT	Silver Tubular, Yellow Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +85	3 to 50	2 to 80	−15 +75	.163x.347 .163x.472	Low DCL, Miniature Size	4-601
TAH	Silver Tubular, Green Plastic, Axial Lead Case Insulated	Wire Leads 24 AWG	−55 to +125	4 to 60	2 to 330	−15 +75 ±10 −10 +20 −15 +20 −15 +50	.238x.470 .238x.600 .238x.810	Miniature Size, Wide Temp. Range, Low DCL	4-603
XTM XTK XTH XTL XTV	Metal Can, Single or Dual Ended, Hermetic Seal	Wire Leads, Screw, Stud, Solder Lug, Turret	−55 to +200	20 to 900	2 to 2200	−15 +75 −15 +50 ±20	.656x.438x1.78 .875x.540x4.06 1.13 x.600x2.81	MIL-C 39006 CLR10, 14 & 17 High Reliability, Rugged Construction Very High Temp., High Cap & Voltage	4-84A
TL	Metal Case, Rectangular, Glass to Metal Seal	Solder Lugs	−55 to +125	15 to 150	70 to 2400	±20	1.062x1.275x.690 1.375x1.275x.690 1.625x1.275x.690 2.000x1.275x.690 2.500x1.275x.690	MIL-C-3965 Style CL55, Low DCL, Wide Temp. Range	4-79A

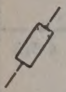
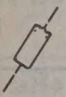
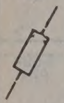
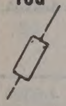
* Technical Information Bulletin

MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. GB, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

MALLORY

ALUMINUM ELECTROLYTIC CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	VOLTAGE RANGE (WVDC)	CAP. RANGE (µF)	STANDARD TOLERANCE (% µF)	CASE SIZES DIA.xLGTH. (INCHES) HxWxD (INCHES)	FEATURES	TIB*
TT 	Aluminum Tubular, Axial Lead	Wire Leads	−40 to +85	3 to 150	1 to 2400	±20%	.25 x .50 to .68 .312x .687 to .81 .375x .687 to 1.50 .438x1.25 to 1.5 .485x1.25 to 1.75	Miniature, All Welded Construction Low DCL, Low ESR	4-104B
TCW 	Aluminum Tubular, Axial Lead	Wire Leads	−20 to +85	3 to 450	2 to 36,000	−10 +75 −10 +50	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.75 .87x1.37 to 3.12 1.00x1.37 to 3.89	All Welded Construction	4-103
TCX 	Aluminum Tubular, Axial Lead	Wire Leads	−55 to +105	3 to 150	12 to 26,000	−10 +75 −10 +50	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.62 .87x1.12 to 3.12 1.00x1.12 to 3.62	High Temperature Computer Grade Low DCL, Low ESR All Welded Constructeion	0-311
TCG 	Aluminum Tubular, Axial Lead	Wire Leads	−40 to +85	6 to 450	3 to 23,000	−10 +75 −10 +50 −10 +100	.50x1.12 to 2.12 .62x1.12 to 2.62 .75x1.12 to 2.62 .87x1.12 to 3.12 1.00x1.12 to 3.62	Computer Grade High Cap, Low DCL, Low ESR All Welded Construction	4-307
VPR	Aluminum Can, Vertical Mount Single Ended	Wire Leads, Plug-in	−55 to +105	6 to 150	22 to 20,000	−10 +100 −10 +75 −10 +50	.50x1.00 to 1.62 .75x1.12 to 3.62 .87x1.12 to 3.62 1.00x1.12 to 3.62	Miniature, All Welded Low DCL, Low ESR Low ESL, High Temperature, High Ripple Current	4-106
FP PFP	Aluminum Can, Twist-Tab or PC Vertical Mount	Solder Lugs, Wire Wrap, PC Lugs	−30 to +85	6 to 450	22 to 20,000	−10 +150 −10 +100 −10 +50	.75x1.50 to 3.00 1.00x1.50 to 4.00 1.37x1.50x5.00	Single or Multi-Section	4-101
CGS	Aluminum Can, Bracket Mount	Solder Lugs, Screw Inserts	−40 to +85	3 to 450	10 to 920,000	−10 +75 −10 +50	1.00x1.75 to 4.12 1.37x1.75 to 5.62 1.75x2.12 to 5.62 2.00x2.12 to 5.62 2.50x3.12 to 5.62 3.00x3.62 to 8.62	Computer Grade Low DCL, Low ESR High Performance	4-303

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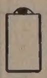
MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. GB, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

For More Information. Circle No. 30

MALLORY

ALUMINUM ELECTROLYTIC CAPACITORS

TYPE	DESCRIPTION	TERMINALS	TEMP. RANGE (°C)	VOLTAGE RANGE (WVDC)	CAP. RANGE (μF)	STANDARD TOLERANCE (% μF)	CASE SIZES DIA.xLGTH. (INCHES) HxWxD (INCHES)	FEATURES	TIB*
CGR	Aluminum Can, Bracket Mount	Low or High Post Screw Inserts	−55 to +85	3 to 150	140 to 320,000	−10 +75 −10 +50	1.37x1.75 to 5.62 1.75x2.12 to 5.62 2.00x2.12 to 5.62 2.50x3.12 to 5.62 3.00x3.62 to 5.62	Computer Grade Low DCL, Extremely Low ESR High Ripple Current	4-313
CGO	Aluminum Can Bracket Mount	Low or High Post Screw Inserts	−55° to +85	5 to 55	2800 to 67000	−20 +20	1.37 x 2.12 to 5.62	Low, Controlled ESR ±30% Symmetrical Capacitance Tolerance High Ripple Current	4-314
SFC	Aluminum Can, Bracket or Buss-Bar Mount	Buss-Bar Screw	−40 to +85	6 to 50	6800 to 100,000	−0 +100	3.00x4.12 3.00x5.62	Computer Grade Low DCL, Ultra-Low ESR, Ultra-High Ripple Capability Low ESL	4-310
HC NP 	Bakelite Case, Single Ended	Screw	−20 to +85	3 to 450 3 to 450NP	65 to 40,000 30 to 32,000	−10 +150 −10 +100 −10 +50 ±25%	1.44x2.75 to 2.06x4.37	Rugged Hi-Pot Case, Versatile Mounting NP—Non-Polar	4-301

MOTOR START & MOTOR RUN CAPACITORS

P	Bakelite Case, Round Single Ended	Screw, Solder Lugs, Quick Connect	−40 to +65	AC Volts 110 to 330	21 to 1326	−0 +20	1.44x2.75 to 4.37 1.81x3.37 to 4.37 2.06x3.37 to 4.37 2.56x4.37	Motor Start, Intermittent AC Duty EIA Type 1 & 2	4-401
CRN	Terne Plate Steel Can, Round, Oval & Rectangular, Single Ended	Quick Connect, Solder Lugs	−55 to +70 (PCB Free)	AC Volts 170 to 660	1 to 60	±10% ±6%	1.69x2.16x1.31 to 9.50x3.66x1.97	Motor Run, Continuous AC Duty Non-PCB	4-403A
MPD MPF	Terne Plate Steel Can, Round & Flat Oval Single Ended	Quick Connect Solder Lugs	−40 to +70 (PCB Free)	AC Volts ≤240V Dry 330V to 440V w/Fluid	3 to 70 μF	±10% ±6%	1¾″ Dia., 2″ Dia. 2½″ Dia. 2⅝″—5¾″ HT. plus Flat Ovals	Motor Run Continuous AC Duty Non-PCB Metallized Film	4-404B

*Technical Information Bulletin

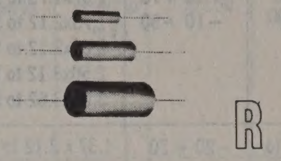
MALLORY CAPACITOR COMPANY, EMHART ELECTRICAL/ELECTRONIC GROUP
DEPT. GB, P.O. BOX 372, INDIANAPOLIS, IN 46206, U.S.A.
PHONE: (317) 636-5353

MALLORY
ELECTRICAL/ELECTRONIC GROUP
EMHART

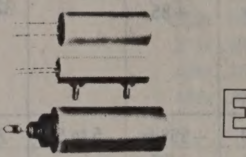
S&EI Manufacturing/Capacitors

18800 Parthenia Street, Northridge, California 91324 • (818) 349-4111 • TWX 910-493-1252

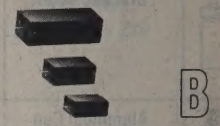
CASE STYLES→
FEATURES↓



Wrap and Fill, round



Hermetically, scaled, tubular



Molded, axial leads

ALL INTERMEDIATE VALUES NOT LISTED ARE AVAILABLE AS STANDARD PRODUCTS

17 SERIES METALIZED POLYESTER

Metalized Polyester is a thermosetting plastic dielectric better known as Mylar, a DuPont registered trade name, and is characterized by its high dielectric strength.

Since Metalized Polyester capacitors became a reality back in the middle 1950's they have earned an established recognition as an industry leader replacing most metalized paper requirements.

This series far surpasses the electrical characteristics of metalized paper and has set innumerable records for reliability.

Following are typical room temperature characteristics and voltage derating over the temperature range.

Temp Range 55° C to +105° C with 50% derating to +125° C

Insulation Resistance 50 K Meg X Mfd minimum at +25° C

Dissipation Factor Less than 1% measured at 1KHz at +25° C

Dielectric Strength 200% of rated voltage 1 Min Max. at +25° C

Dielectric Absorption .2% Max at +25° C

Capacity versus Temperature See curve at bottom of this page.

17R

CASE SIZE DIA.	LGTH	75 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.17	.40	.082	.033	.01	.0056	.001
.28	.40	.15	.039	.027	.01	.0047
.18	.54	.18	.047	.033	.012	.0056
.24	.54	.39	.18	.12	.047	.01.
.21	.67	.56	.22	.15		.015
.30	.67	.82	.50	.27	.10	
.24	.83		.56	.33		.018
.37	.83	2.0	.68	.39	.18	.047
.39	.97	4.0	.82	.47	.22	
.44	.97	5.0	1.5	.68	.27	
.45	1.17	6.0	2.0	.82	.33	.056
.57	1.17	10.0	5.0	1.5	.56	.18
.56	1.68	15.0	8.0	2.0	.68	.39
.64	1.68	20.0	15.0	5.0	1.0	.56
1.0	1.68	50.0	25.0	10.0	2.0	1.0

17E

CASE SIZE DIA.	LGTH	75 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.175	.500	.001	.001	.001	.001	.001
.175	.500	.022	.022	.0068	.0033	
.195	.500	.027	.039	.0082	.0082	.0047
.235	.500	.10		.027	.01	
.235	.625	.22	.12	.056	.012	.01
.312	.625	.39	.18	.12	.047	
.312	.750	.56	.22	.18	.056	
.400	.750	.82	.50	.27	.10	
.400	.875	2.0	.68	.39	.12	.047
.400	1.125		1.5	.68		
.400	1.375		2.0			1.0
.500	1.125	3.0			.27	
.500	1.375		4.0	1.5	.39	.15
.562	1.875			2.0	.82	.39
.670	1.375	10.0	5.0		.56	
.670	1.875	15.0	10.0	4.0	1.0	.56
.750	1.875	20.0		5.0	1.5	.82
1.0	1.875	30.0	20.0	10.0	2.0	1.0

17B

CASE SIZE T	W	L	75 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.17	.29	.42	.001	.001	.001	.001	.001
.17	.29	.42	.15	.047	.027	.01	.0047
.17	.29	.57	.27	.12	.039	.015	.01
.23	.36	.57	.39	.27	.082	.039	
.29	.42	.57		.39	.15	.056	
.29	.42	.67	.82	.68	.27	.10	.039
.29	.42	.82	1.5	.82			.056
.39	.54	.82	2.0	1.0	.50	.18	
.39	.54	1.04	4.0	2.0	.68	.27	.10
.56	.72	1.24	10.0	5.0	1.5	.68	.27
.56	.72	1.75	15.0		4.0	1.0	.50
.76	.97	1.75	30.0				
.56	.72	1.95		10.0	5.0	1.5	1.0
.76	.97	1.95		15.0	8.0	2.0	

22 SERIES METALIZED POLYCARBONATE

This capacitor series offers many electrical advantages over other dielectrics such as metalized polyester and polystyrene.

This size is exceptionally small similar to polyester with electrical characteristics that approach polystyrene, however, exceed polystyrene temperature limitations allowing operation to +125°C.

We have produced this series since 1963 and over this period of time it has become an established leader with unquestionable reliability.

Following are typical characteristics:

Temp Range: −55°C to +105°C–50% duration to +125°C

Insulation Resistance: 100K Meg X Mfd at +25°C

Dissipation Factor: Less than .3% at 1KHz at 25°C

Dielectric Strength: Will withstand 200% rated VDC at +25°C

Dielectric Abscrption: .08% Max at +25°C

22R

CASE SIZES D	L	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD
18	40	082	.039	01	0047
21	40	18	068	022	01
18	54	22	082	027	015
24	54	33	18	056	027
38	54	56	22	082	047
24	67		25	1	056
29	67	68	27	15	1
32	67	75	39	25	12
40	67	1 0	56		
32	83	1 5	82	27	15
39	83	2 0	1 0	39	18
41	97		1 5	47	22
48	97			56	33
38	1 16	4 0		68	39
45	1 16	5 0	2 0	1 0	5
50	1 16	8 0	2 5	1 5	68
62	1 16	12 0			
64	1 68	15 0	5 6		
68	1 68	20 0	8 0		
1 06	1 68	50 0	12 0		

22E

CASE SIZES D	L	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
175	50	033	018		0015	
195	50	082	039	022	0022	001
195	625	12	082		01	
235	625	18	1	033	027	
312	625	56	12	056	033	0082
312	750	68	27	18	056	022
400	750	1 0	50	25	082	027
40	875	2 0	56	39	1	039
50	875		68		18	056
40	1 125	3 0	1 0	47		
50	1 125	5 0	2 0	.56	25	12
562	1 125	6 8			33	
50	1 375	8 0	3 0	1 0	50	18
562	1 375			1 5		
670	1 375	10 0	5 0			27
562	1 875	15 0	6 8	2 0	82	33
670	1 875	18 0	8 0	3 0		50
75	1 875	20 0	12 0	4 0	1 0	56
1 0	1 875	40 0	20 0	5 0	1 5	1 0

22B

CASE SIZES T	W	L	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
17	29	42	1	047	022	01	0033
17	29	57	22	1	039	.022	0068
.23	36	.57	33	22	082	047	01
29	42	57	68	27	1		018
29	42	67			25		027
29	42	82	1 0	75	27	068	
39	54	82	1 5	1 0	50	12	082
39	54	1 04	2 0		68	18	
39	54	1 19	5 0	3 0	82	33	15
56	72	1 24	10 0	5 0	1 5	5	27
56	72	1 75	18 0	8 0	3 0	68	39
56	72	1 92	22 0				

25 SERIES METALIZED POLYSULFONE

This series is the most recent addition to our capacitor family and is the result of several years of experimentation. Conclusive test results demonstrate exceptional electrical characteristics over and above other dielectrics with an extended temperature range from −55°C to +150°C.

It is noted the capacitance versus temperature is substantially better than polycarbonate typically ±1.5% over the temperature range. In addition you will note the physical sizes are similar to polycarbonate.

Following are typical characteristics:

Temp Range: −55°C to +125°C and 50% derating to +150°C

Insulation Resistance. 100K Megs Mfd Min at +25°C

Dissipation Factor Less than 3% measured at 1KHz and 25 C

Dielectric Strength: Will withstand 200% of rated VDC at 25°C

Dielectric Absorption: .12% Max at 25 C

25R

CASE SIZE D	L	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
17	.40	.033	.01	.0022	.001
.22	.40	.047	.027	.0082	.0022
19	.54	.1	.033	.01	.0047
.35	.54	.18	.12	.047	.018
.29	.67	.50	15	.056	.022
.40	.67		.27	12	.027
27	.83	.68			
.48	83		.39	.18	.082
.35	1.17	2.0	.82		
.54	1.17	3.0	1.5	.50	.22
.45	1.68	5.0	2.0	.56	
.64	1.68	10.0	4.0	1.0	.39
.81	1.68	20.0	6.0	1.5	.68
.88	1.68		8.0		.82
.95	1.68		10.0	2.0	1.0

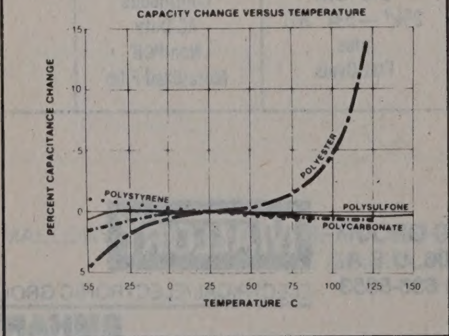
25E

CASE SIZE D	L	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.175	.500	.001	.001	.001	
.175	.500	.015	.0082		
.195	.500	.039	.01	.0022	.001
.235	.500		.022	.0047	
.195	.625	082			
.235	.625	12	.033	.0082	.0033
.312	.625	.22	082	.022	
.312	.750	33	.18	.033	.012
.400	.875	68	.39	.082	.039
.400	1.125	1.0	.47	.12	.047
.500	1.125	2.0	.56	18	.082
.500	1.375	4.0		33	
.562	1.875		2.0		
.670	1.875	3.0	82	.33	
.750	1.875		4.0	1.0	.50
1.000	1.875	20.0	8.0	2.0	82

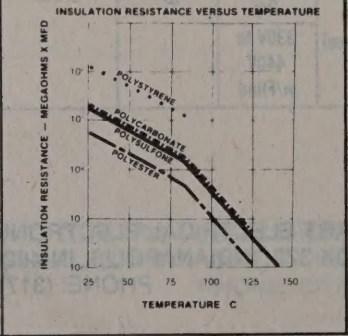
25B

CASE SIZE T	W	L	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
17	29	42	047	015	0056	0022
17	29	57	1	039	01	0033
23	36	57	18	056	018	0068
29	42	57	33	12	033	01
29	42	67	50	18	047	018
29	42	82	68	25	056	027
39	54	1 19	2 0	1 0	15	047
56	72	1 24	5 0	2 0	47	18
56	72	1 75	8 0	3 0	82	33

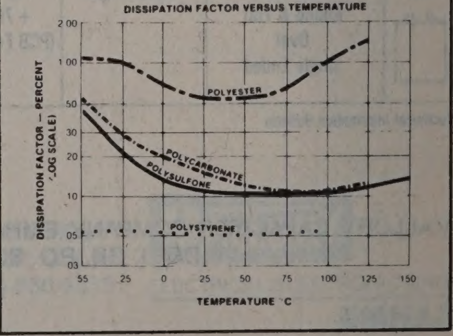
CAPACITY CHANGE VERSUS TEMPERATURE



INSULATION RESISTANCE VERSUS TEMPERATURE



DISSIPATION FACTOR VERSUS TEMPERATURE



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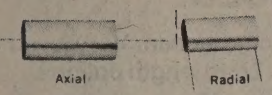


W U

Wrap and Fill, rectangular

N

Molded, radial leads

ALL INTERMEDIATE VALUES NOT LISTED ARE AVAILABLE AS STANDARD PRODUCTS

17W 17U

CASE SIZE T	W	L	75 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.12	.22	.40	.001	.001	.001	.001	.001
.12	.28	.40	.15	.039	.027	.01	.0047
.12	.24	.54	.18	.047	.033	.012	.0056
.18	.31	.54	.39	.18	.12	.047	.01
.16	.28	.67	.47	.22	.15	.056	.012
.23	.36	.67	.82	.50	.27	.1	.015
.20	.33	.83	1.0	.56	.33	.12	.018
.29	.42	.83	2.0	.68	.39	.18	.047
.33	.46	.97	3.0	.82	.47	.22	
.42	.55	.97	5.0	1.5	.68	.27	
.42	.55	1.17	6.0	2.0	.82	.33	.056
.50	.63	1.17	10.0	5.0	1.5	.56	.18
.51	.65	1.68	15.0	8.0	3.0	.68	.22
.83	1.1	1.68	50.0	20.0	10.0	5.0	2.0

17N

CASE SIZE L	T	H	75 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.395	.095	.295	.001	.001	.001	.001	.004
.395	.095	.296	.056	.039	.01	.0033	
.42	.16	.31	.15	.047	.027	.0068	.0047
.55	.16	.31	.27	.12	.033	.022	.012
.55	.185	.38	.33	.18	.056		
.55	.24	.38	39	.27	.12	.047	
.55	.30	.40		.39			
.68	.19	.50	.56	.68			
.67	.30	.50	.82		.27	.10	.018
.885	.25	.50	1.5	1.0	.39		.039
.82	.30	.40	2.0				
.82	.30	.70				.18	
1.0	.37	.50	3.0	2.0	.68	.27	.056
1.24	.40	.50			1.0	.39	.12
1.24	.40	.75		4.0	1.5	.68	.18
1.24	.57	.75	10.0	5.0		1.0	.39
1.75	.57	.75	15.0	10.0	3.0	1.5	.68
1.95	.75	1.0				2.0	1.0

S & E I Mfg. started business in the year 1963 with a very small group of approximately 5 employees.

Since that time we have enjoyed a very fine growth, and earning an excellent reputation with our customers for high quality products and on time deliveries. As we look back our customer list numbered 2 to 3 at the start and now is well in excess of 800 customers throughout the world. Most of these customers are involved in the manufacture of either military or hybrid instruments used in such applications as telecommunications, electro medical, computer, scientific exploration apparatus and many other applications that demand the ultimate in reliability at a reasonable cost. The product information displayed centers on our more popular catalogue series that satisfy most design requirements. This information is intended to cover a wide range however lacking in detail, therefore, we invite you to contact our representative located in your area or the factory direct. We will be pleased to answer any questions or furnish more detailed literature or samples to accommodate your interest.

Aside from our standard catalogue types we offer our special design capability to you. Over the years we have designed well over 2000 different capacitors that range from as many as 22 matched capacitors in one package to cylindrical units to fit into limited area not originally intended for capacitors.

Please note the following pictures of unusually configurated capacitors including the 14 pin dual in line package unit. This method has become very popular and allows up to 7 different values of capacitors. Should you have existing requirements or anticipate the need for a special design, please contact our representative or factory direct with your desired specifications.

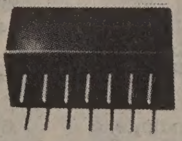
22W 22U

CASE SIZES L	T	W	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD
40	12	22	.047	018	01	.001
40	15	27	25	039	.022	01
54	13	23	27	082	027	015
54	16	28	39	1	.047	027
54	21	32	50	12	082	047
67	18	29	82	15	1	056
67	22	40	1 0	39	25	12
83	-28	38	1 5	56	30	15
83	32	45	2 0	68	39	18
97	33	48		1 0	47	27
97	10	55		1 2	56	36
1 16	32	43	5 0	1 5	68	50
1 16	437	55	10 0	2 5	1 5	
1 16	54	66	15 0	3 0		
1.68	51	64	30.0	5 0		

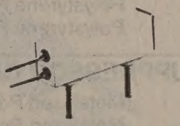
22N

CASE SIZES L	T	H	50 VDC MFD	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
.395	095	295	.068	01	0068	0015	
42	16	31	075	.047	01	0022	
42	18	31	1		022	0047	.0022
55	16	31		12	039	018	.0047
55	18	31	22	15	056	027	
55	185	38		18	068		
55	24	38	50	22	082	039	012
55	30	40	68	27		047	018
67	30	45		39	22		027
67	30	50		56		068	
82	30	42	1 0		27	1	039
82	40	50	1 5	1 0	39	15	068
1 0	37	50	3 0	1 5	68		1
1 24	40	50	5 0	2 0	82	22	
1 24	57	75	10 0	4 0	1 5	50	27
1 75	57	75	18 0	6 8	3 0	82	33
1 75	57	1 0	20 0	10 0			

TYPICAL SPECIAL CONFIGURATIONS AVAILABLE IN ADDITION TO OUR STANDARD PACKAGES



14 Pin Dip Package



Rectangular Hermetic

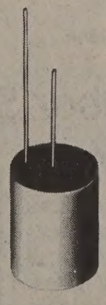
Rectangular Hermetic

25W 25U

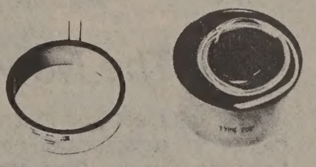
CASE SIZE T	W	L	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
09	21	40	033	01	0022	001
11	23	40	047	015	0047	
15	26	40		027	0082	0022
19	31	54	18	033	022	0082
29	41	.54		082	033	018
16	29	67	33	15		
18	31	67	39	18	056	
27	40	67	50	27	12	027
22	35	83	68	33		033
40	53	83		39	18	082
27	40	97	1 0	47		
48	61	97	1 5	68	33	
31	44	1 17	2 0	82		10
54	67	1 17	3 0	1 5	50	25
37	51	1.68	5.0	2 0		
50	65	1 68	10 0	3 0	82	33

25N

CASE SIZE L	T	H	100 VDC MFD	200 VDC MFD	400 VDC MFD	600 VDC MFD
392	095	295	01	0068	001	
42	16	31	047	012	0022	
42	18	31		027	0056	001
55	16	31	082	039		0033
55	18	31	12	056	012	0047
55	24	38	22	10		
55	30	40	33		022	012
67	30	45	47	18	047	022
82	30	42	68	27	056	027
82	40	50	1 0	39	12	047
1 00	37	50	1 5	68	15	082
1 24	40	50	2 0	1 0	22	10
1 24	57	75	5 0	1 5	47	22
1.75	57	75	8 0	3 0	82	33



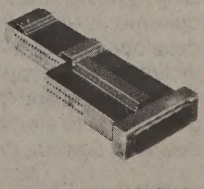
Special End Mounting



Special Shape Conforming For Limited Area

The production processes are designed to build a consistently high quality capacitor and are monitored by Quality Control personnel at all production steps in accordance with Mil-I-45208 requirements for quality systems. This insures the integrity of the processes as well as the quality of the individual capacitors. 100% inspection is performed on capacity, dissipation factor, insulation resistance and dielectric strength in accordance with Mil-STD-202 methods. In addition all hermetic seal encasements are 100% leak tested. Visual and mechanical characteristics are sampled per MIL-STD-105 procedures. Other tests and stabilization processes, such as, burn-in, temperature cycle, temperature shock, special hermetic leak tests, etc., may be performed as requested by the customer.

If other than normal shipping, handling and storage is anticipated, the capacitors may be packaged to Mil-Spec standards for long shelf life in severe environments; put up on reels to facilitate automatic insertion, or packaged per customer specifications.



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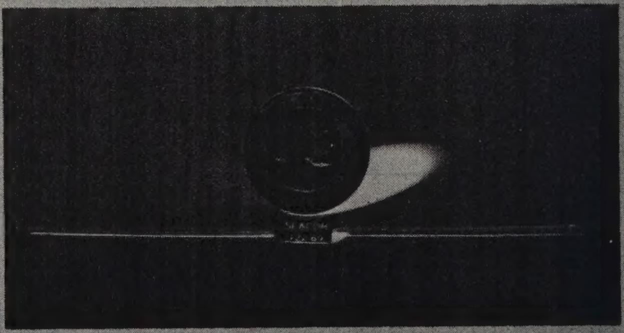
Type	Construction	Capacitance Range, MFD	Std. Tolerances, %	WVDC
AXIAL LEAD—WRAP AND FILL				
MMWA	Metallized Polyester	.01-10.0 Mfd	5, 10, 20	100/250/400/630
MFWA	Polyester Foil	.001-1.0 Mfd	5, 10, 20	100/200/400/630
PMWA	Metallized Polypropylene	.01-10.0 Mfd	1, 2, 5, 10, 20	250/400/630/1000
PFWA	Polypropylene Foil	.01-.12 Mfd	1, 2, 5, 10, 20	63/100/250
CMWA	Metallized Polycarbonate	.01-10.0 Mfd	1, 2, 5, 10, 20	100/250/400/630
SFWA	Polystyrene Foil	100-603,000 Pfd	1, 2, 5, 10, 20	63/100/250/400 630/1000
OVAL AXIAL—LEAD WRAP AND FILL				
CMWF	Metallized Polycarbonate	.001-22.0 Mfd	5, 10, 20	100/200/400/630
RADIAL LEAD—MOLDED CASE				
MMKR	Metallized Polyester	.01-6.8 Mfd	5, 10, 20	100/250/400/630
CMKR	Metallized Polycarbonate	.001-.33 Mfd	1, 2, 5, 10, 20	100/250/400
RADIAL LEAD—EPOXY-DIPPED				
MMDR	Metallized Polyester	.01-2.2 Mfd	5, 10, 20	250/400/630
MFDR	Polyester Foil	.001-.47 Mfd	5, 10, 20	100/200/400/630
MVDS	Polyester Foil-Inductive	.001-.47 Mfd	5, 10, 20	100
PFDR-S	Polypropylene Foil	.001-.18 Mfd	1, 2, 5, 10, 20	160/200/400/630
AXIAL LEAD—HEAT SEALED				
SVVO	Polystyrene Foil	22-100,000 Pfd	1, 2, 5, 10, 20	33/63/160/630
SVVA	Polystyrene Foil	140-150,000 Pfd	1, 2, 5, 10, 20	33/63/160
X&Y SUPPRESSOR CAPACITORS (VDE, SEV, DEMKO, NEKO Approvals)				
PNKR	Metallized Polypropylene	.01-1.0 Mfd	10, 20	250 Vac
PNKS	Metallized Polypropylene	.015-2.2 Mfd	10, 20	250 Vac
MNKR	Metallized Polyester	.001-1.5 Mfd	10, 20	250 Vac
PNKT	Metallized Polypropylene	.001-.022 Mfd	10, 20	250 Vac
MOTOR RUN CAPACITORS				
PNP	Metallized Polypropylene	1.0-65.0 Mfd	5, 10	115/250/400/450 Vac

The New Seacor Special Products Division

If you can't meet your much needed requirements in a standard capacitor, contact Seacor's Special Products Division. Non-standard capacitances, tolerances, and voltages, are just a few of our capabilities. Special lead configurations, sub-miniature sizes, special designs, as well as unique marking requirements are also features of our newly developed department. Our capabilities also include special capacitance sorting and matching abilities and MANY, MANY OTHERS. A good place to start or before giving up, check Seacor's Special Products Division!



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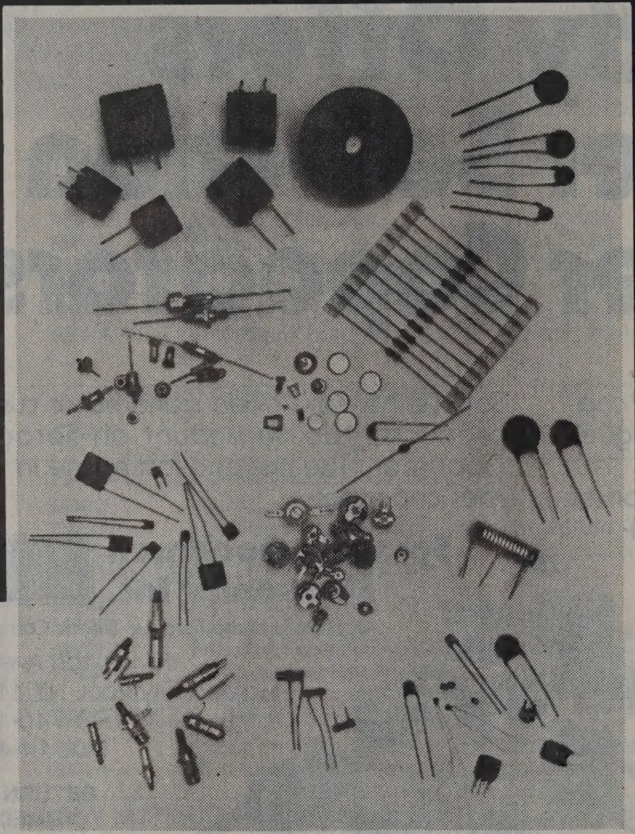

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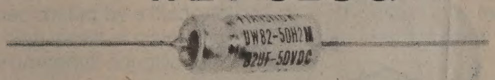
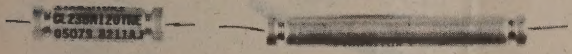

DW82-50H2M
82UF-50VDC

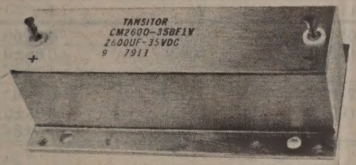
- CLR 79 (MIL C 39006/22)
- CLR 65 (MIL C 39006/09)
- CL64/65
- CL66/67, CL66/67

FOIL


CL23BN120THE
05079 8211AJ

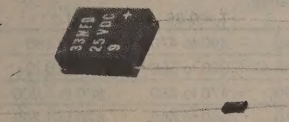
- CL20/21 - CL 22/23
- CL30/31 - CL32/33
- CL70/71 - CL72/73

ASSEMBLIES


TANSITOR
CM2600-35BF1V
2600UF-35VDC
9 7911
+

- Custom assemblies using any style or combination of Tantalum Capacitors

MINIATURE SOLID


33HFB
25VDC
9
+

- Epoxy cased — *Polar - Nonpolar*
- Chips
- Dips

TRIMMER CAPACITORS

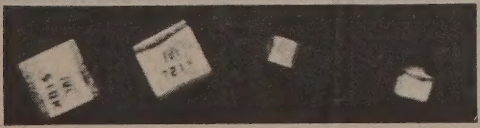
- MIL-C-14409
- COMMERCIAL

AIR
CLASS & QUARTZ
CERAMIC
SAPPHIRE *(for microwave and stripline)*

HIGH FREQUENCY -HIGH Q MONOLITHIC CAPACITORS

UHF & Microwave

High Temperature
Temperature Stable
Chips, Pellets, Axial or
Radial Leads



Power Ceramic

250 to 5000 volts, RMS
8 AMPS, RMS @ 25C
Low Inductance Ribbon Leads
10 to 3000pf

P.O. BOX 230-D, WEST ROAD, BENNINGTON, VERMONT 05201 — 802-442-5473

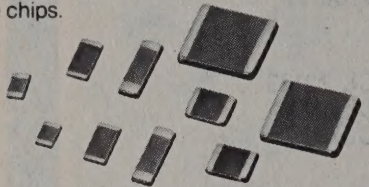
MULTILAYER CERAMIC CAPACITORS

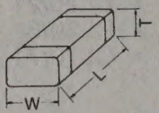
TDK®

TDK CORPORATION OF AMERICA 4711 West Golf Road, Suite 300, Skokie, Illinois 60076 U.S.A. Phone (312) 679-8200 **LOS ANGELES BRANCH** (213) 539-6631 **NEW YORK BRANCH** (516) 625-0100 **INDIANAPOLIS BRANCH** (317) 872-0370 **DETROIT OFFICE** (313) 353-9393 **TDK CORPORATION** 13-1, Nihonbashi 1-chome, Chuo-ku, Tokyo 103, Japan

CHIP CAPACITORS-C1508, C2012, C3225, C4532, C5650

Multilayer chip capacitors having a low residual inductance, an excellent frequency response and minimal stray capacitance since there are no leads. These characteristics enable specifications to be very close to the theoretical values of the chips.





Shapes and dimensions

Dimensions in mm (inches)

Type	L	W	T max.
C1508	1.5±0.2 (.059)	0.8±0.2 (.032)	1.0 (.039)
C2012	2.0±0.3 (.079)	1.25±0.2 (.049)	1.25 (.049)
C3225	3.2±0.4 (.126)	2.5±0.3 (.098)	1.9 (.075)
C4532	4.5±0.5 (.177)	3.2±0.4 (.126)	1.9 (.075)
C5650	5.6±0.5 (.220)	5.0±0.5 (.197)	1.9 (.075)

Temperature compensating Class I

C0G 50V, 100V

Type	Capacitance (pF) 50V (1H)	100V (2A)
C1508C0G	0.5 to 180	0.5 to 120
C2012C0G	0.5 to 560	0.5 to 390
C3225C0G	10 to 3,300	10 to 2,200
C4532C0G	1,000 to 5,600	1,000 to 3,900
C5650C0G	1,000 to 10,000	1,000 to 6,800
Capacitance tolerance	Up to 10pF: ±1pF (F) ±0.5pF (D), ±0.25pF (C)	Over 10pF: ±10% (K) ±5% (J)

SL 50V, 100V

Type	Capacitance (pF) 50V (1H7)	100V (2A)
C1508SL*	0.5 to 470	0.5 to 330
C2012SL	0.5 to 1,800	0.5 to 1,200
C3225SL	100 to 8,200	100 to 5,600
C4532SL	1,000 to 18,000	1,000 to 12,000
C5650SL	1,000 to 33,000	1,000 to 22,000
Capacitance tolerance	Up to 10_pF: $\pm 1_p$F (F) $\pm 0.5_p$F (D), $\pm 0.25_p$F (C)	Over 10_pF: ±10% (K) ±5% (J)

SL: Temperature coefficient, +350 to –1000 ppm/°C,
Temperature range, –30 to 85°C

Class II

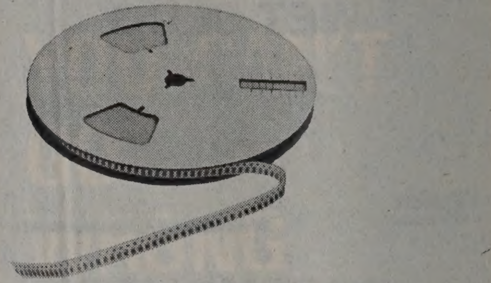
X7R 50V, 100V

Type	Capacitance (pF) 50V (1H)	100V (2A)
C1508X7R	47 to 5,600	47 to 3,900
C2012X7R	47 to 18,000	47 to 12,000
C3225X7R	1,000 to 150,000	1,000 to 82,000
C4532X7R	10,000 to 220,000	10,000 to 150,000
C5650X7R	100,000 to 470,000	100,000 to 330,000
Capacitance tolerance	±10% (K), ±20% (M)	

Y5V 50V, 100V

Type	Capacitance (pF) 50V (1H)	100 (2A)
C1508Y5V	2,200 to 22,000	2,220 to 10,000
C2012Y5V	2,200 to 100,000	2,200 to 47,000
C3225Y5V	10,000 to 470,000	10,000 to 220,000
C4532Y5V	22,000 to 1,000,000	22,000 to 470,000
C5650Y5V	470,000 to 1,500,000	470,000 to 1,000,000
Capacitance tolerance	$^{+80}_{-20}$ % (Z)	

CHIP CAPACITORS FOR AUTOMATIC MOUNTING-C3216, C2012



Dimensions in mm (inches)

Type	L	W	T
C3216	3.2±0.2 (.126)	1.6±0.15 (.063)	0.6±0.15 (.024) 0.85±0.15 (.034) 1.1±0.2 (.043)
C2012	$2.0^{+0.3}_{-0.1}$ (.0079)	$1.25^{+0.3}_{-0.1}$ (.049)	0.6±0.15 (.024) 0.85±0.15 (.034) 1.1±0.2 (.043)

Temperature compensating, Class I

50V

Type	TC	Capacitance T = 0.6	T = 0.85	T = 1.1
C3216CHIH	C0H	0.5 to 330	390 to 470	650 to 680
C3216PHIH	P2H	0.5 to 330	390 to 560	680 to 820
C3216RHIH	R2H	0.5 to 390	470 to 680	820 to 1,000
C3216SHIH	S2H	0.5 to 470	560 to 680	820 to 1,200
C3216THIH	T2H	0.5 to 560	680 to 820	1,000 to 1,200
C3216UJIH	U2J	0.5 to 560	680 to 1,000	1,200 to 1,500
C3216SLIH	SL*	0.5 to 1,200	1,500 to 1,800	2,200 to 2,700
C2012CHIH	C0H	0.5 to 180	200 to 330	360 to 430
C2012PHIH	P2H	0.5 to 220	240 to 390	430 to 560
C2012RHIH	R2H	0.5 to 240	270 to 510	560 to 680
C2012SHIH	S2H	0.5 to 270	300 to 560	620 to 750
C2012THIH	T2H	0.5 to 330	360 to 680	750 to 820
C2012UJIH	U2J	0.5 to 390	430 to 750	820 to 1,000
C2012SLIH	SL*	0.5 to 820	1,000 to 1,300	1,500 to 1,800
Capacitance tolerance		Up to 5_pF $\pm 0.5_p$F (D) $\pm 0.25_p$F (C)	Up to 10_pF $\pm 1_p$F (F) $\pm 0.5_p$F (D)	Over 10_pF ±10% (K) ±5% (J)

**Temperature coefficient, +350 to –1000 ppm/°C*
Temperature range, –30 to 85°C

Class II

50V, 25V

Type	TC	WV (V)	Capacitance (pF) T=0.6	T=0.85	T=1.1
C3216BIH C3216BIE	B	50 25	1,000 to 15,000 12,000 to 27,000	18,000 33,000 to 39,000	22,000 to 27,000 47,000
C3216DIH C3216DIE	D	50 25	1,000 to 22,000 33,000 to 47,000	33,000 68,000	47,000 100,000
C3216FIH C3216FIE	F	50 25	4,700 to 47,000 47,000 to 100,000	68,000 150,000	100,000 220,000
C2012BIH C2012BIE	B	50 25	470 to 5,600 6,800 to 10,000	6,800 to 10,000 12,000 to 18,000	12,000 to 15,000 22,000 to 27,000
C2012DIH C2012DIE	D	50 25	1,000 to 6,800 10,000 to 15,000	8,200 to 15,000 22,000 to 27,000	18,000 to 22,000 33,000 to 39,000
C2012FIH C2012FIE	F	50 25	3,300 to 15,000 22,000 to 33,000	22,000 to 33,000 47,000	47,000 100,000
Capacitance tolerance	TC: B, ±10% (K), ±20% (M) TC: D, ±20% (M) TC: F, $^{+80}_{-20}$% (Z)			Temperature coefficient	TC: B, ±15% (−55 to 125°C) TC: D, $^{+22}_{-33}$% (−30 to 85°C) TC: F, $^{+22}_{-82}$% (−30 to 85°C)

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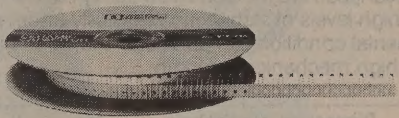
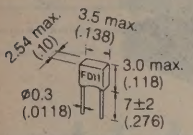
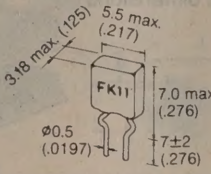
DIPPED RADIAL LEADS-FD11, FK11, FL-1, FK20, FK22, FD23, FL-2

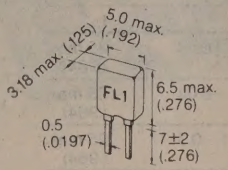
Multilayer capacitors having internal electrodes covered by ceramic dielectric to give them excellent resistance to dampness and humidity. Dipped radial leads, however, are further coated by a fluidized bed process so that they maintain high levels of stability and reliability under stringent environmental conditions.



Lead space 2.5 mm (.098)


2.54 max. (.10)
3.5 max. (.138)
FD11
3.0 max. (.118)
ø0.3 (.0118)
7±2 (.276)

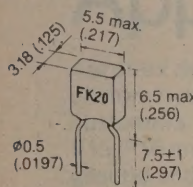

3.18 max. (.125)
5.5 max. (.217)
FK11
7.0 max. (.276)
ø0.5 (.0197)
7±2 (.276)

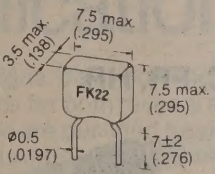

3.18 max. (.125)
5.0 max. (.192)
FL1
6.5 max. (.276)
0.5 (.0197)
7±2 (.276)

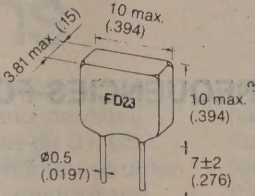
Dimensions in mm (inches)

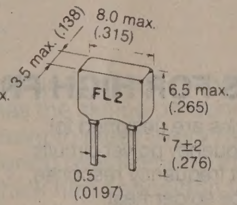
Type	Capacitance (pF)							
TC	C0G		SL		X7R		Y5V	
WV	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)
FD11	0.5 to 560	0.5 to 390	0.5 to 1,800	0.5 to 1,000	1,000 to 18,000	1,000 to 12,000	10,000 to 100,000	10,000 to 47,000
FK11	10 to 3,300	10 to 2,200	100 to 8,200	100 to 4,700	1,000 to 150,000	1,000 to 82,000	10,000 to 470,000	10,000 to 220,000
FL1	10 to 2,700	10 to 1,800	100 to 6,800	100 to 3,900	1,000 to 100,000	1,000 to 68,000	10,000 to 220,000	10,000 to 100,000
Capacitance tolerance	Up to 10_pF $\pm 0.5_pF$ (D), $\pm 0.25_pF$ (C)		Over 10_pF ±10% (K), ±5% (J)		±10% (K), ±20% (M)		$^{+80}_{-20}$ % (Z)	

Lead space 5.0 mm (.197)


3.18 (.125)
5.5 max. (.217)
FK20
6.5 max. (.256)
ø0.5 (.0197)
7.5±1 (.297)


3.5 max. (.138)
7.5 max. (.295)
FK22
7.5 max. (.295)
ø0.5 (.0197)
7±2 (.276)


3.81 max. (.15)
10 max. (.394)
FD23
10 max. (.394)
ø0.5 (.0197)
7±2 (.276)

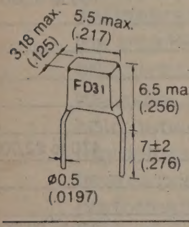

3.5 max. (.138)
8.0 max. (.315)
FL2
6.5 max. (.265)
0.5 (.0197)
7±2 (.276)

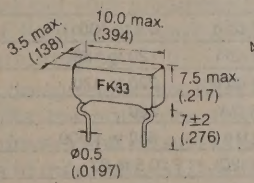
Dimensions in mm (inches)

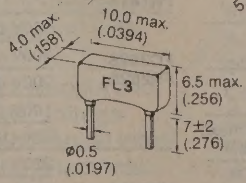
Type	Capacitance (pF)							
TC	C0G		SL		X7R		Y5V	
WV	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)
FK20	10 to 3,300	10 to 2,200	100 to 8,200	100 to 4,700	1,000 to 150,000	1,000 to 82,000	10,000 to 470,000	10,000 to 220,000
FK22	1,000 to 5,600	1,000 to 3,900	1,000 to 18,000	1,000 to 10,000	10,000 to 220,000	10,000 to 150,000	22,000 to 1,000,000	22,000 to 470,000
FD23	6,800 to 27,000	4,700 to 15,000	22,000 to 68,000	12,000 to 39,000	270,000 to 680,000	180,000 to 470,000	1,500,000 to 4,700,000	1,000,000 to 2,200,000
FL2	1,000 to 3,900	1,000 to 2,700	1,000 to 10,000	1,000 to 5,600	10,000 to 180,000	10,000 to 100,000	22,000 to 470,000	22,000 to 220,000
Capacitance tolerance	Up to 10pF ±0.5pF (D), ±0.25 pF (C)		Over 10pF ±10% (K), ±5% (J)		±10% (K), ±20% (M)		$^{+80}_{-20}$ % (Z)	

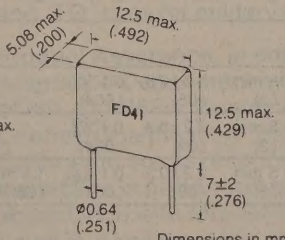
DIPPED RADIAL LEADS-FD31, FK33, FL3, FD41

Lead space 7.5 mm (.295)


3.18 max. (.125)
5.5 max. (.217)
FD31
6.5 max. (.256)
7±2 (.276)
ø0.5 (.0197)


3.5 max. (.138)
10.0 max. (.394)
FK33
7.5 max. (.217)
7±2 (.276)
ø0.5 (.0197)


4.0 max. (.158)
10.0 max. (.0394)
FL3
6.5 max. (.256)
7±2 (.276)
ø0.5 (.0197)


5.08 max. (.200)
12.5 max. (.492)
FD41
12.5 max. (.429)
7±2 (.276)
ø0.64 (.251)

Dimensions in mm (inches)

Type	Capacitance (pF)							
TC	C0G		SL		Y5R		Y5V	
WV	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)
FD31	330 to 3,900	330 to 2,200	33 to 8,200	33 to 4,700	2,200 to 120,000	2,200 to 68,000	10,000 to 470,000	100,000 to 220,000
FK33	1,000 to 5,600	1,000 to 3,900	1,000 to 22,000	1,000 to 12,000	10,000 to 330,000	10,000 to 180,000	22,000 to 1,000,000	22,000 to 470,000
FL3	1,000 to 12,000	1,000 to 6,800	1,000 to 4,700	1,000 to 3,300	10,000 to 220,000	10,000 to 120,000	22,000 to 470,000	22,000 to 220,000
FD41	1,000 to 33,000	1,000 to 15,000	10,000 to 82,000	10,000 to 47,000	100,000 to 1,000,000	100,000 to 680,000	1,000,000 to 6,800,000	1,000,000 to 4,700,000
Capacitance tolerance	±10% (K) ±5% (J)				±20% (M) ±10% (K)		$^{+80}_{-20}$ % (Z)	

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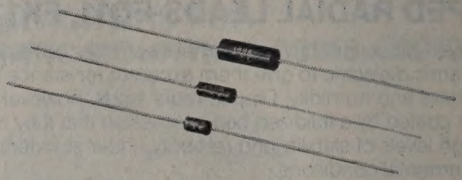
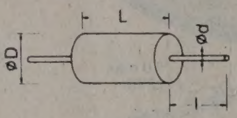
MOLDED AXIAL LEADS-MA12, MA13, MA14

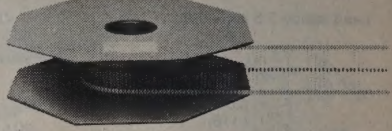
Molded axial leads are molded by an epoxy resin so that they maintain high levels of stability and reliability under stringent environmental conditions. In particular, they are characterized by a high mechanical strength.



Type	Dimensions, mm (inches)			
	L	D	d	l
MA12	4.06±0.25 (.16)	2.29±0.25 (.09)	0.5 +0.1 −0.03 (.02)	25 max. (.984)
MA13	6.35±0.25 (.25)	2.29±0.25 (.09)	0.5 +0.1 −0.03 (.02)	25 max. (.984)
MA14	9.91±0.25 (.39)	3.56±0.25 (.14)	0.64 +0.1 −0.3 (.025)	25 max. (.984)

Shape and dimensions

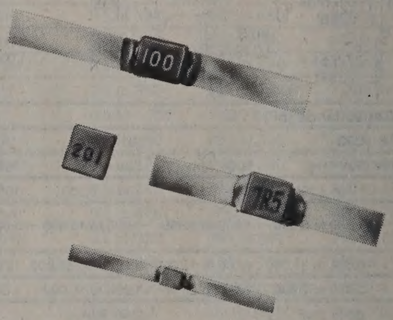




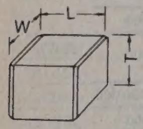
Type	Capacitance (pF)							
	TC C0G		SL		X7R		Y5V	
	WV 50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)	50V (1H)	100V (2A)
MA12	0.5 to 560	0.5 to 390	0.5 to 1,800	0.5 to 1,200	100 to 18,000	100 to 12,000	10,000 to 100,000	10,000 to 47,000
MA13	100 to 1,500	100 to 1,000	100 to 5,600	100 to 3,900	1,000 to 56,000	1,000 to 39,000	10,000 to 220,000	10,000 to 100,000
MA14	1,000 to 4,700	1,000 to 3,300	1,000 to 12,000	1,000 to 8,200	10,000 to 220,000	10,000 to 150,000	100,000 to 470,000	100,000 to 220,000
Capacitance tolerance	Up to 10pF ±0.5pF (D), ±0.25pF (C)		Over 10pF ±10% (K), ±5% (J)		±20% (K), ±10% (K)		$^{+80}_{-20}$ % (Z)	

LOW-LOSS CAPACITORS FOR HIGH FREQUENCIES-FC, FR, HR

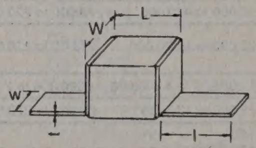
Low-loss capacitors for high frequencies are designed for application in 100 to 1000MHz high-frequency power circuits. They are characterized by an excellent frequency response, a high Q factor, and superior resistance solder heat.



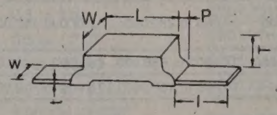
FC1414·FC2828



FR1414·FR2828



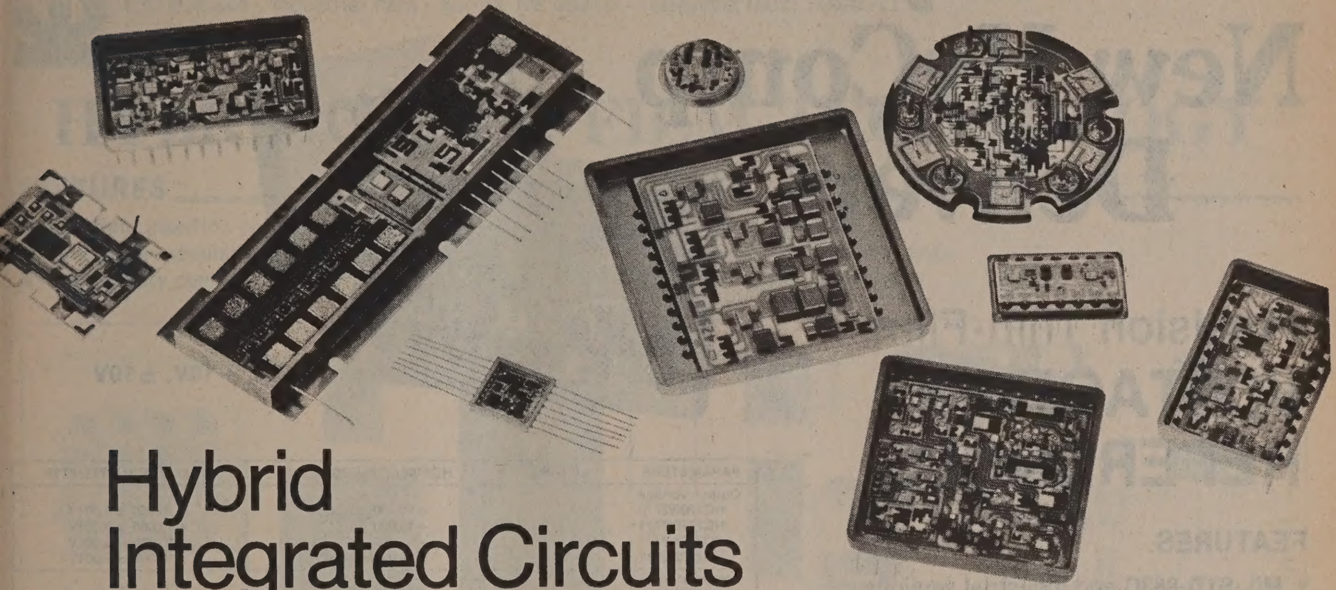
HR3225



Dimensions in mm (inches)

Type	L	W	T	l	w	t	p
FC1414	1.4±0.4 (.055)	1.4±0.3 (.055)	1.6 max. (.063)	–	–	–	–
FC2828	$2.8^{+0.5}_{-0.3}$ (.11)	2.8±0.4 (.11)	3.0 max. (.12)				
FR1414	1.4±0.4 (.055)	1.4±0.3 (.055)	1.6 max. (.063)	5 min. (.2)	1.3±0.3 (.05)	$0.1^{+0.3}_{-0.01}$ (.004)	–
FR2828	$2.8^{+0.5}_{-0.3}$ (.11)	$2.8^{+0.5}_{0.3}$ (.11)	3.0 max. (.12)	5 min. (.2)	2.2±0.3 (.09)	$0.1^{+0.3}_{-0.01}$ (.004)	–
HR3225	$3.5^{+0.5}_{-0.3}$ (.14)	$2.8^{+0.5}_{-0.3}$ (.055)	2.0 max. (.08)	5 min. (.2)	2.2±0.3 (.09)	$0.1^{+0.3}_{-0.01}$ (.004)	1.5 max. (.06)

Type	Rated voltage	Capacitance (pF)		
		C0G		X7R
FC1414 FR1414	50V (1H)	0.5 to 100		150 to 3,300
FC2828 FR2828	500V (2H)	0.5 to 100		–
	300V (2F)	120 to 180		–
	200V (2D)	220 to 470		–
	100V (2A)	560		–
	50V (1H)	680 to 1,000		470 to 22,000
HR3225	220V (2D)	0.5 to 82		–
	100V (2A)	100 to 220		–
	50V (1H)	270 to 1,000		680 to 22,000
Capacitance tolerance		Up to 10$_{p}$F ±0.5pF (D) ±0.25pF (C)	Over 10pF ±10% (K) ±5% (J)	±10% (K) ±20% (M)



Hybrid Integrated Circuits for Military and Industrial Applications

Aeroflex designs, develops and manufactures custom hybrids for both military and industrial customers. We are qualified for use on B1, B52, F15, F16 and LAMPS MK III, plus numerous other ground and airborne systems and medical and communications equipment.

Will a custom hybrid do your job? Hybrid technology combines the quick-response design and manufacturing economies of the printed circuit assembly with the reliability and small size of the monolithic IC. To help you determine when the method will be cost effective, Aeroflex's experienced engineers will consider the circuit itself, manufacturing lead time, and the quantities involved.

Once the decision has been made, Aeroflex has the technical and manufacturing support to meet your most exacting requirements. Our circuit designers will put your parameters together into the smallest, lightest package consistent with effective performance.

We excel in designing active filters, sample and hold networks, low noise pre-amps, voltage regulators, drivers and receivers and digital interface circuits to meet MIL-STD-1553. Electrical performance is guaranteed by our automatic test systems.

In our complete manufacturing facility, Aeroflex has the skilled personnel and production equipment to meet every hybrid design and manufacturing requirement. For most designs, we use thick film deposition for its great flexibility. On occasion, however, we will utilize thin film chip components in conjunction with thick film resistors and conductors. Gold conductors and various silver alloys are often employed, as well as a variety of resistor inks to cover the full range of resistor values. We have and use both laser, for active trimming, and airbrasive trimming systems.

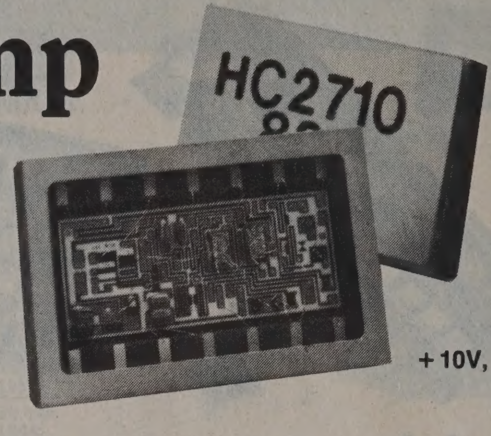
Packaging for all environments. Aeroflex commercial hybrids are often epoxy sealed in ceramic for industrial applications. Heavy duty packaging options include welded hermetically sealed all-metal cases including flat packs, dips, plug-ins and "TO" cans for military requirements.

Product Assurance, in and out. Our Product Assurance Department meets the requirements of MIL-Q-9858A. Quality Assurance, Quality Control, Qualification Testing and Equipment Calibration are its responsibilities. Incoming inspection is performed on semiconductors in accordance with MIL-STD-883, Method 2010.1 Level B. Similar criteria are applied to hybrid inspection. Screening and qualification testing to MIL-STD-883B, Method 5008 and MIL-M-38510 are also available.

Microelectronics Division
AEROFLEX LABORATORIES INC.

35 South Service Road
Plainview, New York 11803
Tel. 516-694-6700 TWX 510-224-6417

Today's New HyComp Delivers



+ 10V, − 10V, ± 10V

Precision Thin-Film VOLTAGE REFERENCES

FEATURES

- **MIL-STD-883C** and industrial versions
- Excellent **thermal stability** over temperature (to ± 1 ppm/°C)
- **Fully guaranteed** to ± 10mA output over full operating temperature range
- Short circuit **protected**
- **No need** for external temperature-stabilizing elements
- Available in **several packages** (hermetically sealed 14 pin DIP, leadless chip carrier, flatpacks)
- Proprietary **Nichrome** resistors, **laser** trimming and **stabilization**

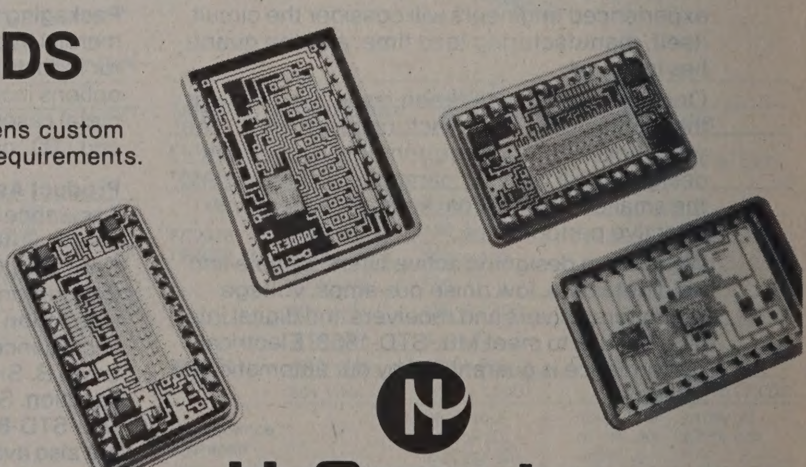
PARAMETERS MODEL→	HC2700/2720/2701/2702	HC2710/2721/2711/2712
Output Voltage		
HC2700/2710	+ 10.000 ± 0.005V	+ 10.000 ± 0.001V
HC2720/2721	+ 10.000 ± 0.002V	+ 10.000 ± 0.001V
HC2701/2711	− 10.000 ± 0.005V	− 10.000 ± 0.001V
HC2702/2712	± 10.000 ± 0.005V	± 10.000 ± 0.001V
Temperature Drift (1)		
HC2700/2710	± 3ppm/°C max.	± 1ppm/°C max. (2)
HC2720/2721	± 4ppm/°C max.	± 1ppm/°C max. (2)
HC2701/2711	± 5ppm/°C max.	± 1ppm/°C max. (2)
HC2702/2712 + 10V Output	± 5ppm/°C max.	± 1ppm/°C max. (2)
− 10V Output	± 5ppm/°C max.	± 2ppm/°C max. (2)
Line Regulation		
HC2720/2721	200μV/V max.	200μV/V max.
All Others	250μV/V max.	200μV/V max.
Load Regulation		
HC2720/2721	50μv/mA. typ.	50μV/mA. typ.
All Others	100μV/mA. max.	50μV/mA. max.
Output Current (3)		
HC2720/2721	5mA	5mA
All Others (Over Temp.)	± 10mA	± 10mA
Long Term Stability	25ppm/1000 Hours. All Models	
Operating Temperature (4)		
HC27XX	− 25°C to + 85°C	
HC27XX-883	− 55°C to + 125°C	
Package Style		
HC2720/2721	T0-99	T0-99
HC2720/2721-LCC	Leadless Chip Carrier	Leadless Chip Carrier
All Others	14-Pin DIP	14-Pin DIP

NOTES:
1. Measured from 25°C to T (min) and 25°C to T (max).
2. Temperature drift ± 5ppm/°C outside the − 25°C to + 85°C range.
3. For specified load regulation.
4. For specified temperature drift.

Thin-Film CUSTOM HYBRIDS

HyComp designs, manufactures and screens custom hybrids for industrial and MIL-STD-883C requirements. Whatever you need, including:

- **Stable Instrumentation Amplifiers:** Variable gain; accurate to 0.01%
- **Complete A/D and D/A Converters:** 8-, thru 12-bit models
- **Precision Signal Filtering:** Anti-Alias, Low Pass, High Pass and Bandpass precision filters
- **Specialized signal gain functions:** Computer-controlled amplifiers



Bring us **your** hybrid circuit application. If our standard hybrids won't do the job, we'll design and build the exact circuit required. **Call us today for fast results.**

HyComp, Inc.

Union Ave., Sudbury, MA 01776-0377
Tel: (617) 443-4631 • TWX: 710-347-0385

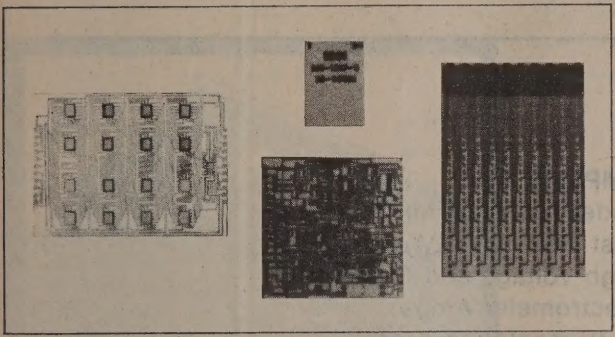
For More Information. Circle No. 38

INTERNATIONAL SENSOR SYSTEMS INC.
P.O. Box 345 - Industrial Park - Aurora, NE 68818 - Telephone (402) 694-6111

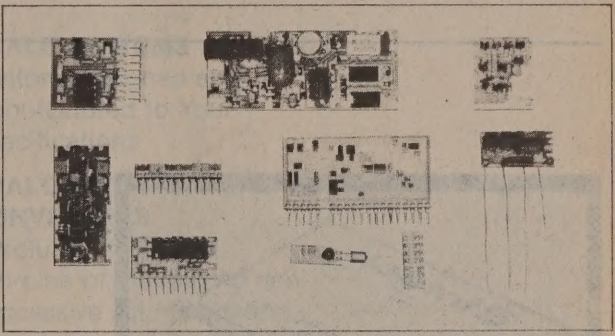
HYBRID THICK FILM TECHNOLOGY

FEATURES

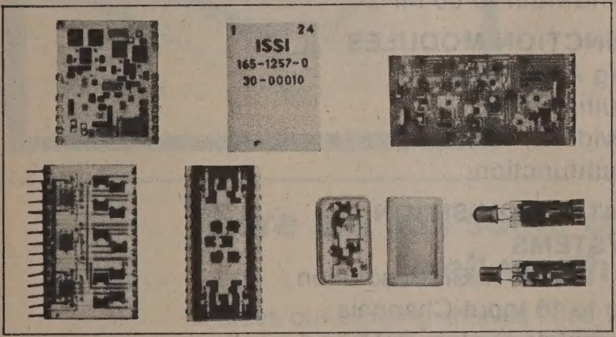
- one time insertion costs
- functional modularity
- high quality components
- compact
- low profile
- low mass
- high performance
- small
- extreme temperature operating range
- military specification capabilities



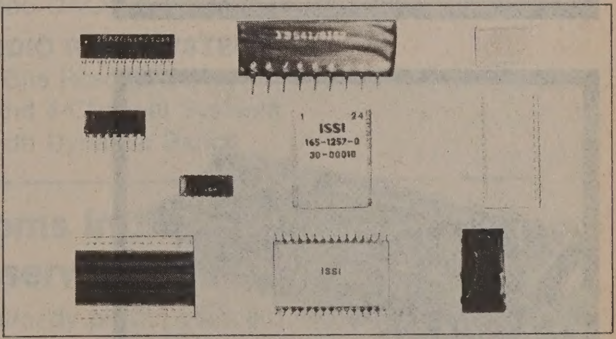
METALIZED SUBSTRATES—Simple or complex, single or multi-layer conductor patterns with Pd. Ag (Palladium Silver), Pt. Ag. (Platinum Silver), Au, (Gold), Pt. Au. (Platinum Gold) inks. Insulation with high temperature glass dielectric or low temperature glaze. Film Resistors from 1 ohm to 150 megohm, tolerances to ±0.1%, T.C.R. to 50 ppm, 1/10 w to 10 watt power dissipation, laser or abrasive trimming.



SOLDER REFLOW TECHNOLOGY—Compact networks with thick film resistors, IC packages, chip capacitors, inductors, discrete components, SOT package, diode bridge assembly, high and low temperature solder, standard or custom pinouts. Special devices with photo-transistors, LED's and functional sub-assemblies.



CHIP AND WIRE TECHNOLOGY—Microcircuit assembly of functional thin film integrated circuit or component chips into operational devices. All available IC & component chips assembled to a thick film circuit by solder or epoxy bonding. Chips wired into circuit with either gold or aluminum wire. (Thermocompression or thermosonic wire bonding). Special handling for static control. Components actively or passively trimmed to guarantee functional specifications.



CUSTOM PACKAGES—Single-in-line or Dual-in-line pinout packages, conformally coated, metal can, plastic or ceramic covered and sealed. Customer markings as well as manufacturer's identification for traceability. Leak tested, temperature cycling and burn-in before final test to insure reliability. Heat sink attached to either alumina or beryllium oxide to obtain maximum power dissipation.

TECHNICAL SERVICES

• Circuit design • layout (including conversion of existing circuitry to thick film technology) • material selection • rubylith production • screen fabrication • product tooling • product testing • and building to print. Testing includes functional electrical and mechanical parameters • burn-in • leak testing • and temperature cycling.

APPLICATIONS

• Memory • logic • linear circuits • A-D • D-A • timing • filters • isolation • pulse shaping • impedance matching • signal generation • switching • sequencing • and many other medium range energy dissipation functions or a combination thereof.

ISSI MILITARY SPECIFICATION CAPABILITIES

MIL-I-45208 Inspection System Requirements
MIL-C-45662 Calibration System Requirements
MIL-STD-883 Test Methods & Procedures for Microelectronics
Certificate of Compliance furnished upon request.

INTECH SPECIALISTS IN:

- — DATA CONVERSION PRODUCTS
- — SIGNAL CONDITIONING PRODUCTS
- — DATA AQUISITION SYSTEMS
- — HYBRID CIRCUITS
- — CUSTOM PRODUCTS

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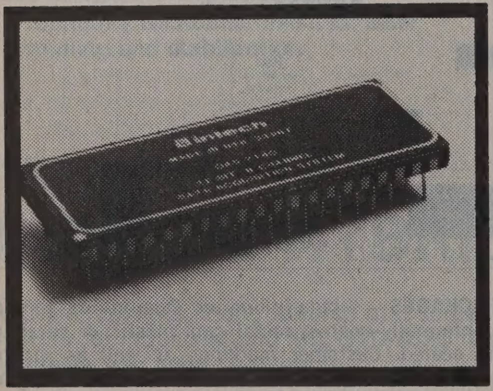
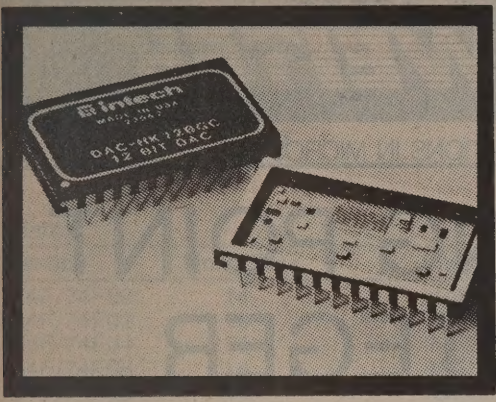
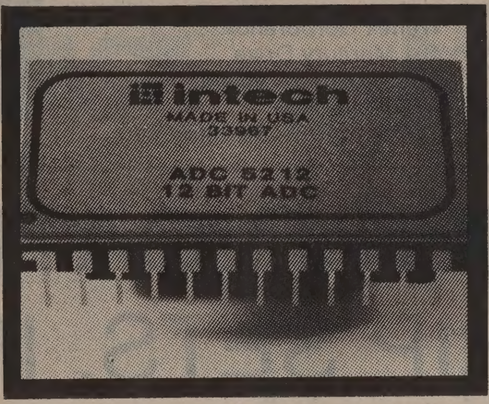
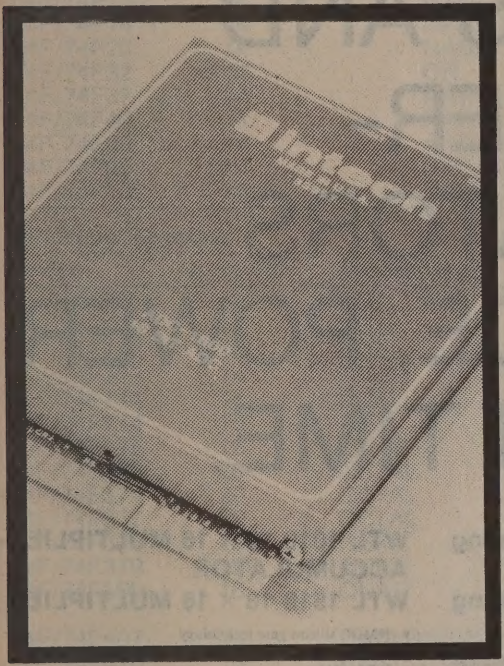
intech
VDAC 8308 TTL
8 BIT DAC



- **AMPLIFIERS**
- Wideband to 50 MHz
- Fast Slew to 1 KV/μsec
- High Voltage and Current
- Electrometer Amps
- Instrumentation Amps
- Chopper Stabilized
- **SAMPLE & HOLD AMPLIFIERS**
- Acquisition Times to 15 ns
- Aperture Times to 0.2 ns
- Bandwidth to 60 MHz
- **FUNCTION MODULES**
- Log Amplifiers
- Multipliers
- Dividers
- Multifunction
- **DATA ACQUISITION SYSTEMS**
- 12, 14 and 16 Bit Resolution
- Up to 16 Input Channels
- Complete System in Hybrid or Module
- **MONOLITHIC V/F/V**
- Frequency to 1 MHz
- Single Ended Supply
- 14 Pin Dip Package
- **V/F'S and F/V'S**
- To 1 MHz, ±.03%
- To +10 Volts
- **PINCUSHION MODULE**
- Corrects Pincushion Error in Flat Tube Faces
- **POWER SUPPLIES**
- +5V @ 1 A
- ±15V @ ±100 mA
- DC/DC Converters







- **SCALE SYSTEMS**
- Custom Designed and Manufactured to Your Specifications
- **ANALOG-TO-DIGITAL CONVERTERS**
- Resolution to 16 Bits
- Full Line of Integrating and Successive Approximation Types
- **DIGITAL-TO-ANALOG CONVERTERS**
- Resolution to 18 Bits
- Settling Times to 7.5 ns
- Multiplying DACs
- Video DACs to 100 MHz
- **AUDIO P.C.M. SYSTEMS**
- 16 Bits Resolution
- 2 and 4 Channel Systems
- 97 db Dynamic Range

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Besides our bulging shelves filled with already proven standard items, we have produced hundreds of custom designs for industrial and military applications.

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WEITEK

INNOVATIONS IN MICROSYSTEM TECHNOLOGY

WEITEK FLOATING POINT CHIP SETS, INTEGER MULTIPLIERS AND MULTIPLIER-ACCUMULATORS CUT COST, SPACE, POWER AND DESIGN TIME.

WTL1032 32-Bit IEEE Floating Point Multiplier

WTL1033 32-Bit IEEE Floating Point ALU

- A complete floating-point arithmetic solution for high-speed processors
- Full 32-bit floating-point conforming to the new IEEE Standard 754, Version 8.0 or 10.0
- High Speed:
    - 10 megaflops (WTL 1032/1033-10), 8 megaflops (WTL 1032/1033-8) and 5 megaflops (WTL 1032/1033-5) in three-stage pipeline mode
    - 2.2 megaflops (WTL 1032/1033-10), 1.8 megaflops (WTL 1032/1033-8) and 1.1 megaflops (WTL 1032/1033-5), in low latency flowthrough mode
- Low power NMOS:
    - 1.5 watts typical (WTL 1032/1033-5)
    - 2 watts typical (WTL 1032/1033-8 and WTL 1032/1033-10)
- Fast:
    - Two 16-bit data input and one data output operation every cycle
    - Pipeline mode provides full 32-bit throughput every two cycles for ALU and Multiplier vector operation
    - Flowthrough mode provides full 32-bit delay time of nine cycles for ALU and Multiplier scalar operation
    - Cycle times are 50ns (WTL 1032/1033-10), 62.5ns (WTL 1032/1033-8), 100ns (WTL 1032/1033-5)
- Full function
    - Add
    - Subtract
    - Multiply
    - Conversion to and from 24-bit fixed-point
    - Absolute value
- Flexible control interface:
    - Single edge-trigger clock
    - Function control is included in three stage pipeline—no wasted cycles when changing function
    - Fully registered inputs and outputs with separate load and unload controls
    - Three-state TTL outputs with high drive capability
- Standard 64-pin DIP and 68-pin leadless packages with common pin-out for both ALU and Multiplier

WTL 1064 64-Bit IEEE Floating Point Multiplier

WTL 1065 64-Bit IEEE Floating Point ALU

- A complete floating-point arithmetic solution for high-speed processors and co-processors
- Full 32-bit and 64-bit floating-point formats and operations, conforming to the proposed IEEE standard 754, version 10.0
- Full 32-bit and 64-bit DEC floating-point formats and operations.
- Conversion between 32-bit two's complement integers and any floating-point format
- High Speed:
    - 8 megaflops (120ns) pipelined add/subtract/convert/compare
    - 4 megaflops (240ns) pipelined 32-bit multiply
    - 2 megaflops (480ns) pipelined 64-bit multiply
    - 1.3 to 1.9 megaflops in low-latency flowthrough mode
    - Two 32-bit data input and one 32-bit data output operation every 60ns
- Full Function:
    - Add
    - Subtract
    - Multiply
    - Conversion to and from 32-bit two's complement integers
    - Absolute value
    - Compare
- Interfaces directly to 16-bit, 32-bit, and 64-bit buses
- One, two, or three-port architectures supported
- Low-power NMOS technology—2.0 watts typical power dissipation
- Single phase, edge-triggered clocked interface, with fully registered inputs and outputs. TTL compatible inputs and outputs.
- Standard 144 pin grid array package

WTL 1010 16 × 16 MULTIPLIER-ACCUMULATOR

WTL 1516 16 × 16 MULTIPLIER

- NMOS silicon gate technology
- Low power, 0.8W typical WTL 1010, 0.9 W typical WTL 1516
- Single 5V supply
- Standard TTL compatible I/O levels
- Processed to MIL-STD-883
- Available in DIP, flatpack, pingrid array and leadless chip carrier

WTL 1516/1516A/1516B

- 16×16 parallel array multiplier
- High speed, 50ns typical WTL 1516B, 65ns typical WTL 1516A, 100ns WTL 1516 typical multiply time.
- Output latch mode selectable for clocked or transparent operation.
- Mixed mode two's complement and unsigned magnitude multiplication
- Pin-for-pin functional replacement for TRW MPY16HJ and AMD Am29516
- Full product multiplexed at output

WTL 1010/1010A/1010B

- 16×16 parallel multiplication and product accumulation
- High speed, 65ns typical time WTL 1010B, 80ns typical time WTL 1010A, 115 ns WTL 1010 typical multiply-accumulate time.
- Performs subtraction and double precision addition and multiplication
- Round control
- Pin-for-pin functional replacement for TRW 1010J

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FAST™

Product Selection Guide

Gates

Device	No. of Pins	Function	No. of Inputs/Gate	No. of Gates	Schmitt Trigger
54F/74F00	14	NAND	2	4	
54F/74F02	14	NOR	2	4	
54F/74F04	14	INVERTER	1	6	
54F/74F08	14	AND	2	4	
54F/74F10	14	NAND	3	3	
54F/74F11	14	AND	3	3	
54F/74F13	14	NAND	4	2	X
54F/74F14	14	INVERTER	1	6	X
54F/74F20	14	NAND	4	2	
54F/74F32	14	OR	2	4	
54F/74F37	14	NAND	2	4	
54F/74F40	14	NAND	4	2	
54F/74F64	14	AND/NOR	4/2/3/2		
54F/74F86	14	EXCLUSIVE OR	2	4	
54F/74F132	14	NAND	2	4	X

Flip-Flops/Registers

Device	No. of Pins	Configuration	FF Type	3-State Outputs	Master Reset	Broadside Pinout
54F/74F74	14	DUAL	D			
54F/74F109	16	DUAL	J$\overline{K}$			
54F/74F112	16	DUAL	JK			
54F/74F113	14	DUAL	JK			
54F/74F114	14	DUAL	JK			
54F/74F174	16	HEX	D		X	
54F/74F175	16	QUAD	D		X	
54F/74F273	20	OCTAL	D		X	
54F/74F374	20	OCTAL	D	X		
54F/74F377	20	OCTAL	D			
54F/74F378	16	HEX	D			
54F/74F379	16	QUAD	D			
54F/74F399	16	QUAD	2-PORT REGISTER			
54F/74F407	24	DATA REGISTER				
54F/74F410	18	REGISTER STACK				
54F/74F534	20	OCTAL	D	X		
54F/74F564	20	OCTAL	D	X		X
54F/74F574	20	OCTAL	D	X		X
54F/74F604	28		D			
54F/74F821	24	10-BIT	D	X	X	X
54F/74F823	24	9-BIT	D	X	X	X
54F/74F825	24	8-BIT	D	X	X	X

Latches

Device	No. of Pins	Broadside Pinout	Transparent	3-State Outputs	No. of Bits	Inverting
54F/74F256	16				4	
54F/74F259	16				8	
54F/74F373	20			X	8	
54F/74F412	24			X	8	
54F/74F432	24			X	8	X
54F/74F533	20			X	8	X
54F/74F563	20	X		X	8	X
54F/74F573	20	X		X	8	
54F/74F841	24	X	X	X	10	X
54F/74F843	24	X	X	X	9	X
54F/74F845	24	X	X	X	8	X

Fairchild Digital Products Division
333 Western Avenue
South Portland, Maine 04106

FAST (Fairchild Advanced Schottky TTL) is a trademark of Fairchild Camera and Instrument Corporation.

For local sales outlet see volume 1-a.

For more information use Action Card in Volume 4.

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FAST™

Product Selection Guide

Counters

Device	No. of Pins	Type	Up/Down	3-State Outputs	Reset
54F/74F160A	16	4-BIT BCD DECADE			ASYNC
54F/74F161A	16	4-BIT BINARY			ASYNC
54F/74F162A	16	4-BIT BCD DECADE			SYNC
54F/74F163A	16	4-BIT BINARY			SYNC
54F/74F168	16	4-BIT BCD DECADE	X		
54F/74F169	16	4-BIT BINARY	X		
54F/74F190	16	4-BIT BCD DECADE	X		
54F/74F191	16	4-BIT BINARY	X		
54F/74F192	16	4-BIT BCD DECADE	X		ASYNC
54F/74F193	16	4-BIT BINARY	X		ASYNC
54F/74F269	24	8-BIT BINARY	X		
54F/74F525	28	16-STAGE PROGRAMMABLE			ASYNC
54F/74F568	20	4-BIT BCD DECADE	X	X	SYNC/ASYNC
54F/74F569	20	4-BIT BINARY		X	SYNC/ASYNC
54F/74F579	20	8-BIT BINARY	X		
54F/74F779	16	8-BIT BINARY	X		

Shift Registers

Device	No. of Pins	No. of Bits	Serial Inputs	Parallel Inputs	3-State Outputs
54F/74F164	14	8	2		
54F/74F194	16	4	2	X	
54F/74F195	16	4	2	X	
54F/74F299	20	8	2		X
54F/74F322	20	8	2		X
54F/74F323	20	8	2		X
54F/74F395	16	4	1	X	X
54F/74F673	24	16	1		X
54F/74F674	24	16	1	X	X
54F/74F675	24	16	1		
54F/74F676	24	16	1	X	

Bit Slice AND Support

Device	No. of Pins	Function
29F01	40	4-BIT MICROPROCESSOR SLICE W/16X4 RAM & 8-FUNCTION ALU
29F10	40	MICROPROGRAM CONTROLLER-4K ADDRESSING & 5 DEEP LIFO STACK

Microprocessor Support

Device	No. of Pins	Function
54F/74F146	40	PRIORITY INTERRUPT CONTROLLER
54F/74F148	16	8-BIT PRIORITY ENCODER

ALUs

Device	No. of Pins	Arithmetic Functions	Logic Functions	Features
54F/74F181	24	16	16	CARRY GENERATE/ PROPAGATE OUTPUTS
54F/74F381	20	3	3	CARRY GENERATE/ PROPAGATE OUTPUTS
54F/74F382	20	3	3	RIPPLE CARRY EXPANSION
54F/74F582	24	2		LOOKAHEAD & RIPPLE CARRY EXPANSION

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Adders/Subtractors

Device	No. of Pins	Type	Master Reset	Carry Lookahead
54F/74F283	16	BINARY FULL ADDER		X
54F/74F385	20	QUAD ADDER/SUBTRACTOR	X	
54F/74F583	16	BCD ADDER		X

Multipliers

Device	No. of Pins	Serial/Parallel	Features
54F/74F384	16	S/P	
54F/74F557	40	P	OUTPUT LATCHES
54F/74F558	40	P	
54F/74F784	20	S/P	WITH ADDER/SUBTRACTOR

Comparators

Device	No. of Pins	No. of Bits	Type	Features
54F/74F85	16	4	MAGNITUDE	
54F/74F521	20	8	IDENTITY	EXPANDABLE
54F/74F524	20	8	MAGNITUDE OR COMPLEMENT	EXPANDABLE, REGISTERED

Divider

Device	No. of Pins	Type	Features
54F/74F525	28	16-STAGE	CRYSTAL OSCILLATOR CIRCUIT

ALU Support

Device	No. of Pins	Type
54F/74F182	16	CARRY LOOKAHEAD GENERATOR
54F/74F350	16	4-BIT SHIFTER

Buffers/Line Drivers

Device	No. of Pins	No. of Bits	Inverting/Noninverting	Broadside Pinout
54F/74F240	20	8	INVERTING	
54F/74F241	20	8	NONINVERTING	
54F/74F244	20	8	NONINVERTING	
54F/74F365	16	6	NONINVERTING	
54F/74F366	16	6	INVERTING	
54F/74F367	16	6	NONINVERTING	
54F/74F368	16	6	INVERTING	
54F/74F540	20	8	INVERTING	X
54F/74F541	20	8	NONINVERTING	X
54F/74F655	24	8	NONINVERTING	
54F/74F656	24	8	NONINVERTING	
54F/74F827	24	10	NONINVERTING	X
54F/74F828	24	10	INVERTING	X

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Transceivers/Registered Transceivers

Device	No. of Pins	No. of Transceivers	Registered	Features	3-State Outputs	Inverting
54F/74F242	14	4			X	X
54F/74F243	14	4			X	
54F/74F245	20	8			X	
54F/74F543	24	8			X	
54F/74F544	24	8			X	X
54F/74F545	20	8			X	
54F/74F550	28	8	X	STATUS FLAGS	X	
54F/74F551	28	8	X	STATUS FLAGS	X	X
54F/74F552	28	8	X	PARITY AND FLAG		
54F/74F588	20	8		GPIB COMPATIBLE	X	
54F/74F620	20	8			X	X
54F/74F623	20	8			X	
54F/74F646	24	8		W/REGISTER	X	
54F/74F648	24	8		W/REGISTER	X	X
54F/74F657	24	8		PARITY		
29F52	24	8	X		X	
29F53	24	8	X		X	X

Multiplexers

Device	No. of Pins	Configuration	True Output	Complement Output
54F/74F151	16	8-INPUT	X	X
54F/74F153	16	DUAL, 4-INPUT	X	
54F/74F157	16	QUAD, 2-INPUT	X	
54F/74F158	16	QUAD, 2-INPUT		
54F/74F251	16	8-INPUT	X	
54F/74F253	16	DUAL, 4-INPUT	X	
54F/74F257	16	QUAD, 2-INPUT	X	
54F/74F258	16	QUAD, 2-INPUT		X
54F/74F298	16	QUAD, 2-INPUT W/STORAGE	X	
54F/74F350	16	4-INPUT W/SHIFT	X	
54F/74F352	16	DUAL, 4-INPUT		X
54F/74F353	16	DUAL, 4-INPUT		X
54F/74F398	20	QUAD, 2-INPUT W/FLIP-FLOP	X	X
54F/74F399	16	QUAD, 2-INPUT W/FLIP-FLOP	X	

Decoders/Demultiplexers

Device	No. of Pins	Function	3-State Outputs	Latched Input	Acknowledge Output
54F/74F138	16	1-OF-8			
54F/74F139	16	DUAL 1-OF-4			
54F/74F537	20	1-OF-10	X		
54F/74F538	20	1-OF-8	X		
54F/74F539	20	DUAL 1-OF-4	X		
54F/74F547	20	3-TO-8		X	X
54F/74F548	20	3-TO-8			X

Memories

Device	No. of Pins	Organization	Latch
54F/74F189	16	16 X 4	
54F/74F211	20	16 X 9	X
54F/74F212	20	16 X 9	
54F/74F213	20	16 X 12	
54F/74F219	16	16 X 4	

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Cyclic Redundancy Checker Generators

Device	No. of Pins	Polynomial Length	Expandable
54F/74F401	14	16	
54F/74F402	16	64	X

Parallel EDACs

Device	No. of Pins	Error Detect Single	Error Detect Double	Error Correct Single	Error Detect Speed (Single)
54F/74F418	48	X	X	X	30 ns
54F/74F420	48	X	X		20 ns

Parity Generator/Checker

Device	No. of Pins	Features
54F/74F280	14	ODD/EVEN OUTPUTS, 9 BITS IN

A/D Converters

Device	No. of Pins	No. of Bits	Type
54F/74F500	24	6	FLASH CONVERTER
54F/74F505	20	8	SUCCESSIVE APPROXIMATION

FIFOs

Device	No. of Pins	Organization Bits	I/O
54F/74F403	24	16 X 4	SERIAL/PARALLEL
54F/74F413	16	64 X 4	SERIAL/PARALLEL
54F/74F433	24	64 X 4	SERIAL/PARALLEL

Memory Support

Device	No. of Pins	Function	Features
54F/74F407	24	DATA ACCESS REGISTER	
54F/74F410	18	REGISTER STACK	
54F/74F411	40	FIFO RAM CONTROLLER	CONVERTS SRAM TO FIFO
54F/74F610	40	MEMORY MAPPER	LATCHED, 3-STATE OUTPUTS
54F/74F612	40	MEMORY MAPPER	3-STATE OUTPUTS
54F/74F630	28	EDAC	
29F68	48	DYNAMIC RAM CONTROLLER	

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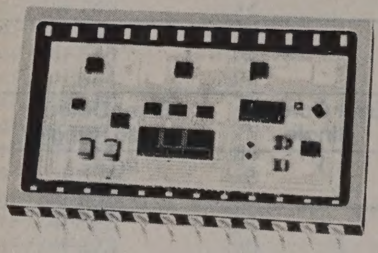
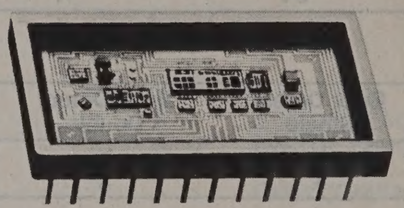
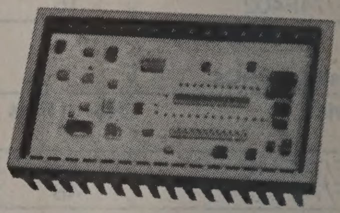
DATA ACQUISITION



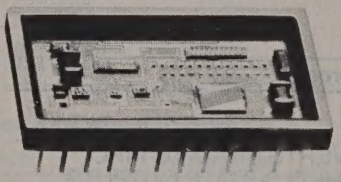
12 BIT D/A WITH INPUT REGISTER
5 Output Voltage Ranges
Binary, BCD, or
Two's Complement
Voltage Output
20 ppm/°C Gain Tempco
DAC-HK12BGC



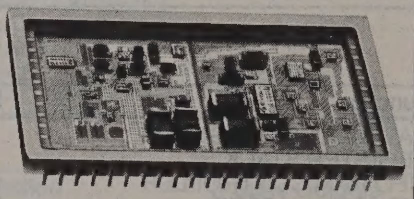
16 BIT D/A WITH 0.003% LINEARITY
15 μsec max. Output Voltage Settling
15 ppm/°C Max. Gain Tempco
Internal Output Amplifier
Binary or BCD Models
DAC-HP16BGC



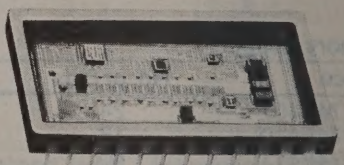
HIGH SPEED 12-BIT A/D CONVERTER
2 μS Conversion Time
Internal Input Buffer
Industry Standard Pin-Out
ADC-810MC



ULTRA-FAST D/A CONVERTERS
8, 10 and 12 Bit Resolution
25, 25 and 50 nsec max.
Settling Time
5 mA Current Output
DAC-HF SERIES



12 BIT DATA ACQUISITION SYSTEM
16 Single Ended or
8 Differential Channels
50 kHz Throughput Rate
3-State Byte-Organized
Outputs
HDAS-16MC



ULTRA-FAST 8 BIT A/D
700 nsec Maximum
Conversion Time
6 Input Voltage Ranges
No Calibration Required
ADC-815MC

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• Santa Ana, CA (714) 835-2751 • Sunnyvale, CA (408) 733-2424 • Los Angeles, CA (213) 933-7256
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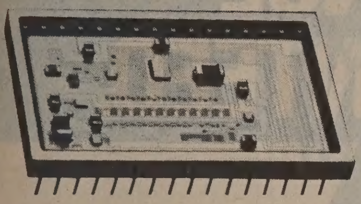
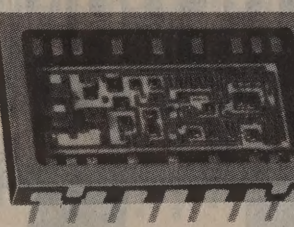
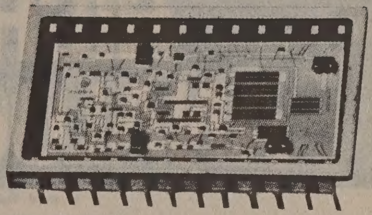
HYBRID COMPONENTS



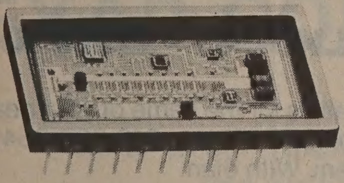
ULTRA-FAST 10 BIT A/D
800 nsec. Max. Conversion Time
6 Input Voltage Ranges
Parallel & Serial Outputs
32 Pin Package
ADC-816MC



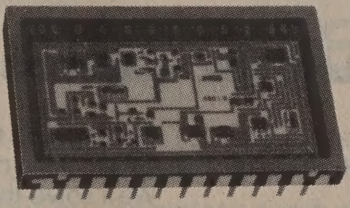
ULTRA HIGH SPEED WIDEBAND OPERATIONAL AMPLIFIER
70 nS Settling to 0.01%
1GHz Gain Bandwidth Product
80 dB Minimum CMRR
AM-1435MC



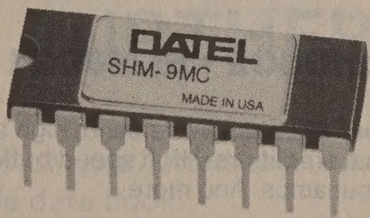
VIDEO SPEED 0.1% SAMPLE-HOLD
40 nsec Acquisition Time (2V Step)
Dual Buffered, Outputs
40 MHz Bandwidth
Low-Cost
SHM-7MC



ULTRA-FAST 12 BIT A/D
2.0 μsec Maximum Conversion Time
6 Programmable Input Ranges
12 Bit Resolution
Internal Input Buffer
ADC-817MC



HIGH SPEED 0.01% SAMPLE-HOLD
200 nsec. max. Acquisition Time
16 MHz Bandwidth
24 Pin — DIP Package
SHM-4860MC



LOW COST, COMPLETE SAMPLE-HOLD
Internal 1000 pF Hold Capacitor
0.01% Accuracy
16 Pin DIP Package
SHM-9MC

DATEL

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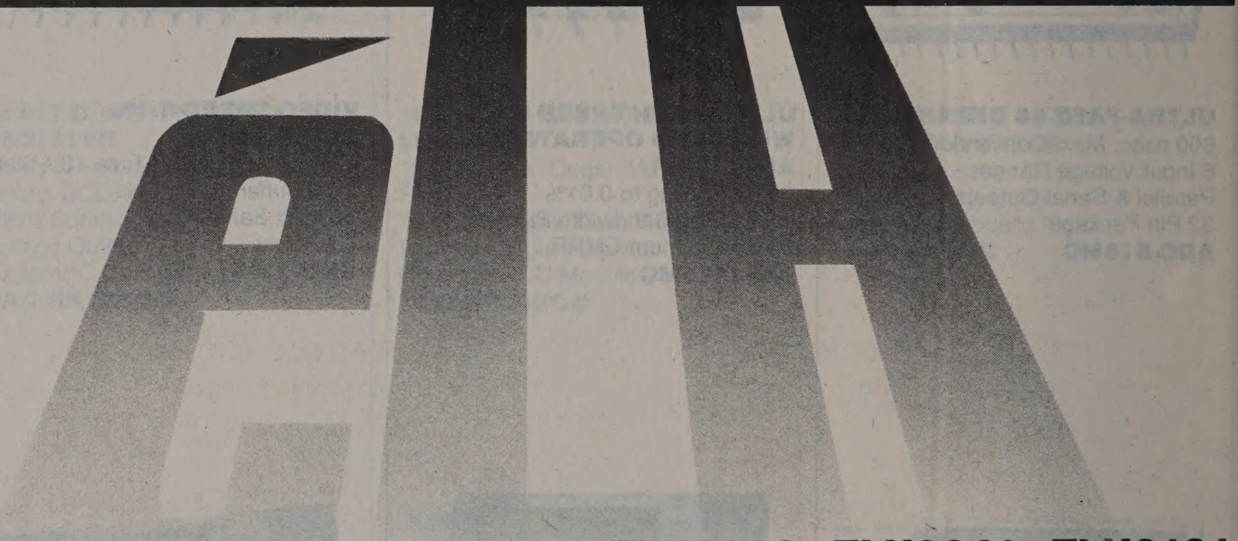

ELH0002 • ELH0021 • ELH0032 • ELH0033 • ELH0041 • ELH0101

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CA	213-883-7606	NJ	201-263-1535
CO	303-779-0666	NY	516-757-1606
CT	203-269-7964	NC	704-541-2628
FL	305-368-7373	NC	919-784-7304
FL	813-584-8110	OH	513-521-8800
FL	305-724-8294	OH	513-293-4044
GA	404-329-0530	OH	216-942-3407
IL	312-956-1000	OR	503-642-1818
IN	219-486-1912	PA	215-638-4850
IN	317-271-5183	PA	412-963-0727
IA	319-393-5763	TN	615-883-1411
MD	301-944-8262	TN	615-753-8081
MA	617-444-8071	TX	512-250-0320
MI	616-468-4200	TX	713-772-4988
MI	313-348-3811	TX	214-867-0592
MN	612-888-8088	UT	801-973-7969
MO	816-763-5385	WA	206-451-0568
MO	314-434-1678	WI	414-782-1171

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- Voltage Regulators

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Fujitsu Bubble Memory Cassette

FUJITSU

Portable. Detachable. Non-volatile

Bubble memories with the convenience of cassettes.

The Fujitsu bubble cassette is an all-new accomplishment in bubble memories: a portable, detachable bubble memory offering excellent reliability and outstanding environmental characteristics plus the convenience of cassette Using solid-state bubble memory devices, Fujitsu bubble cassettes can be connected to an 8-bit microprocessor bus through a cassette holder and a card incorporating a monitor program. They are suitable for use in low-spee files and program memories.

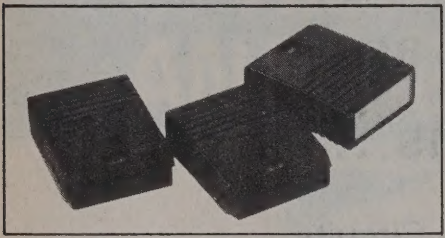
Features • Portable and detachable • Non-volatile data maintained even if power off, due to magnetic memory • Preventive maintenance unnecessary, because of absence of moving parts • Easy to read and writ

Applications • Replacement for paper tapes, paper cards and MT cassettes • Program loader for testing equipment and numerical control systems • Voice announcer

Convenient to use — anywhere.

Bubble Cassette FBM31CA/FBM43CA)

Fujitsu FBM31CA and FBM43CA Bubble Cassettes are portable and detachable bubble memories. FBM31CA has the memory capability equivalent to 20 meters of paper tape and can be transferred in as little as 0.74 se FBM43CA has a capacity 4 times that of FBM31CA and an average access time is 6ms.



Engineering Data

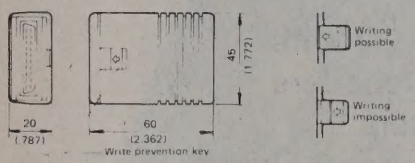
	FBM31CA	FBM43CA
Organization	Serial loop	Major-minor loop (Block replicator transfer)
Capacity	74,032 bits(total) 65,536 bits(effective)	273,745 bits (1,033 bits x 265 loops)
Drive frequency	100KHz	100KHz
Transfer rate	100K bits/sec	100K bits/sec
Access time	740 ms max.	6 ms average
Power consumption	500mW(operating)	700mW(operating)

Temperature range Operating Storage	 0~+55°C –40~+100°C
External magnetic field	50 Oe max.
Physical structure	24-pin cassette
Dimensions	60 x 45 x 20mm
Weight	50g

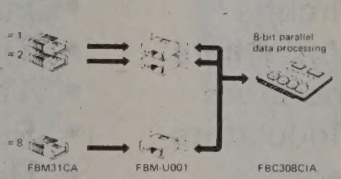
Note
- The function gates may be destroyed if the conductive check or resistance measurement between the terminals is performed by a tester or potentiometer through which a large current may flow.
- Care should be taken to ensure that no ferro-magnetics comes close to the devices.

Dimensions

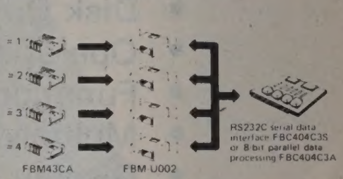
Unit: mm(inch)


45
(1.772)
20
(.787)
60
(2.362)
Write prevention key
Writing possible
Writing impossible

8k-byte Bubble Cassette System Configuration


≡1
≡2
≡8
8-bit parallel data processing
FBM31CA
FBM-U001
FBC308C1A

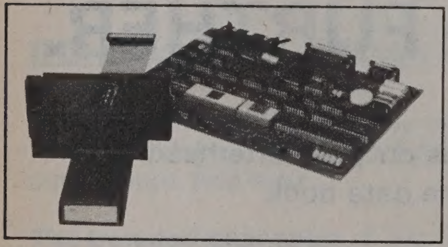
32k-byte Bubble Cassette System Configuration


≡1
≡2
≡3
≡4
RS232C serial data interface FBC404C3S or 8-bit parallel data processing FBC404C3A
FBM43CA
FBM-U002

32k-byte Bubble Memory Cassette for RS232C Interface

Holder unit (FBM-U002)/Card (FBC404C3S)

The holder unit FBM-U002 has memory peripheral circuits at its rear. The number of holder units per card can be increased up to 4, according to system. Since the RS232C interface is adopted, the bubble cassette unit can be connected to an existing system.

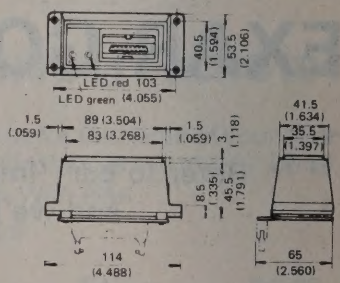


Applicable holder unit	FBM-U002
Number of holder units connectable to controller	4 max.
Interface	RS232C Interface
Baud rate	2400, 4800, 9600, 19,200 bits/second
Supply voltages	+12V (±5%) 0.5A max. -12V (±5%) 0.1A max. +5V (±5%) 1.4A max.
Temperature range Operating Storage	 0°C ~ 50°C -40°C ~ 85°C
Card size	230 x 160mm

Note: Free from power sequence.

Dimensions

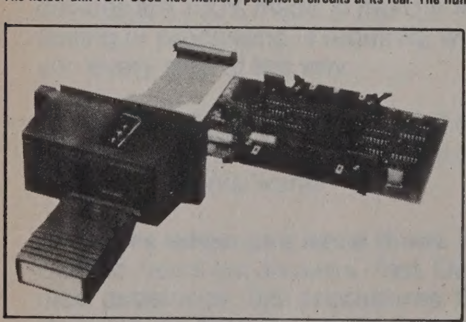
Unit: mm (inch)


40.5
(1.594)
53.5
(2.106)
LED red 103
LED green (4.055)
41.5
(1.634)
35.5
(1.397)
1.5
(.059)
89 (3.504)
83 (3.268)
1.5
(.059)
3
(.118)
8.5
(.335)
45.5
(1.791)
114
(4.488)
65
(2.560)

32k-byte Bubble Memory Cassette for 8-bit Parallel Interface

Holder unit (FBM-U002)/Card (FBC404C3A)

The holder unit FBM-U002 has memory peripheral circuits at its rear. The number of holder units per card can be increased up to 4, according to system. Flexible interface makes it possible to apply to various OEM systems.

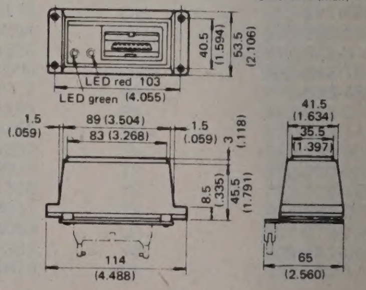


Control card	FBC404C3A
Applicable cassette	FBM43CA
Applicable holder unit	FBM-U002
Number of holder units connectable to controller	4 max.
Interface	TTL-compatible 8-bit parallel data can be processed (DMA possible)
Supply voltages	+12V (+5%) 0.5A max. -12V (+5%) 0.1A max. +5V (±5%) 0.6A max.
Temperature range Operating Storage	 0°C ~ +50°C -40°C ~ 85°C
Card size	100 x 160mm

Note: Free from power sequence.

Dimensions

Unit: mm (inch)


40.5
(1.594)
53.5
(2.106)
LED red 103
LED green (4.055)
41.5
(1.634)
35.5
(1.397)
1.5
(.059)
89 (3.504)
83 (3.268)
1.5
(.059)
3
(.118)
8.5
(.335)
45.5
(1.791)
114
(4.488)
65
(2.560)

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Component Division Fujitsu America, Inc.
918 Sherwood Drive, Lake Bluff, IL 60044
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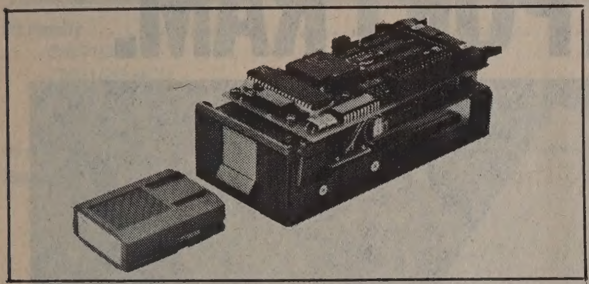
For More Information. Circle No. 46

Fujitsu 32K–Byte Bubble Cassette System

FBM-U404 • FBM43CA, FBM-U404P • FBM43CB

FUJITSU

Fujitsu's 32K byte bubble cassette system is now in a new powerful configuration—convenient cassettes and a unique modular-type holder with built-in control card. Featuring high reliability and outstanding environmental characteristics, this maintenance-free system is ideal for external memory applications.



ENGINEERING DATA

- Specifications

		FBM-U404	FBM-U404P
Applicable cassette		FBM43CA	FBM43CB
Memory capacity	Total	273,745 bits	
	User area	262,144 bits (32KB)	
Transfer rate		100 bits/s	
Transfer method		32byte block transfer	
Access time		7.5ms (average)	
Interface		TTL-compatible 8-bit parallel data can be processed (DMA possible)	
Operating temperature range		0°C ~ 50°C	-30°C ~ 70°C*
Storage temperature range		-40°C ~ 85°C	
Expandability		up to three FBM-U004	Not possible

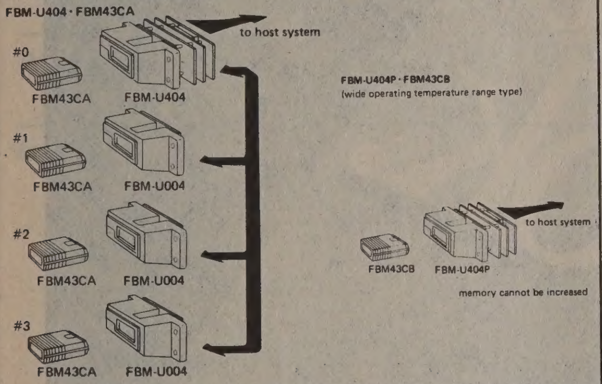
* Access duty is restricted between −30°C and −15°C and between 50°C and 70°C.

- Power supply capacity

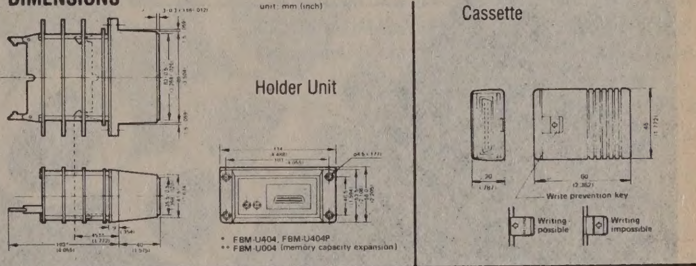
[mA]

			FBM-U404				FBM-U404P			
			Stand-by		Operating		Stand-by		Operating	
			TYP	MAX	TYP	MAX	TYP	MAX	TYP	MAX
V_1		5V ± 5%	560	700	560	700	560	700	560	700
V_2 (pre-heat)		5V ± 5%	–	–	–	–	15	35	15	35
V_3		12V ± 5%	110	150	110	150	110	150	110	150
V_4	pre-heat not operating	-12V ± 5%	80	120	230	300	80	120	230	300
	when pre-heating		–	–	–	–	300	400	–	–

SYSTEM CONFIGURATION


FBM-U404 · FBM43CA
to host system
#0
FBM43CA
FBM-U404
#1
FBM43CA
FBM-U004
#2
FBM43CA
FBM-U004
#3
FBM43CA
FBM-U004
FBM-U404P · FBM43CB
(wide operating temperature range type)
to host system
FBM43CB
FBM-U404P
memory cannot be increased

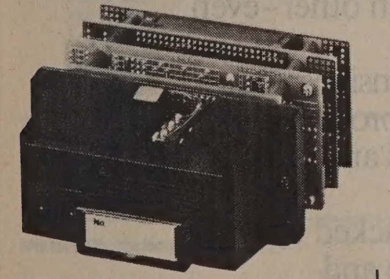
DIMENSIONS


unit: mm (inch)
Holder Unit
Cassette
* FBM-U404, FBM-U404P
** FBM-U004 (memory capacity expansion)
Write prevention key
Writing possible
Writing impossible

Fujitsu 1 Megabit bubble Cassette System

• FBM-C128GA 1 Megabit bubble cassette • FBM-U502GA 8-bit parallel interface•triple power source•holder unit • FBM-U502GU 8-bit parallel interface•single power source•holder unit • FBM-U502AA Expansion holder unit

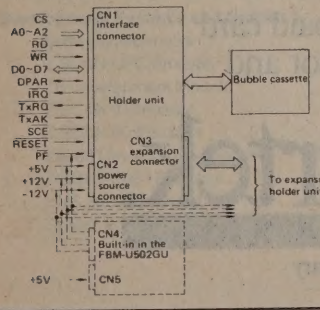
The Fujitsu 1 Megabit bubble Cassette System is an entirely new type of external memory system. The system is completely maintenance-free, and features high-speed average access time of 12.5 ms. The cassette itself is compact, lightweight, and easy to install and operate.



SPECIFICATIONS

Holder unit	FBM-U502GA	FBM-U502GU	FBM-U502AA
Appliable cassette	FBM-C128GA		
Memory capacity (user area) Data area Sub-pages	128K bytes (64 bytes/page x 2048 pages) 192 bytes		
Mean access time	12.5 ms (2.6 ms with SEEK command)		
Transfer rate	100K bits per second (maximum)		
Transfer method	64 bytes block transfer		
Interface	8-bit parallel (DMA capability)		Expansion use
Temperature range Operation Non-volatile storage	0°C to 50°C -40°C to 85°C		
Withstanding external magnetic field Operation Non-volatile storage	20Oe (max) 50Oe (max)		

INTERFACE SIGNALS


$\overline{CS}$
A0~A2
$\overline{RD}$
$\overline{WR}$
D0~D7
DPAR
$\overline{IRQ}$
$\overline{TxRQ}$
$\overline{TxAK}$
SCE
$\overline{RESET}$
$\overline{PF}$
+5V
+12V
-12V
CN1 interface connector
Holder unit
Bubble cassette
CN3 expansion connector
CN2 power source connector
To expansion holder unit
CN4 Built-in in the FBM-U502GU
+5V
CN5

POWER REQUIREMENTS

Power supply capacity (maximum)

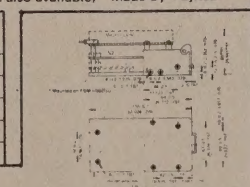
	FBM-U502GA	FBM-U502GU	FBM-U502AA
+ 5V ± 5%	750 mA [500 mA]	2.8A [1.3A]	210 mA [150 mA]
+12V ± 5%	70 mA [40 mA]	–	70 mA [40 mA]
-12V ± 5%	330 mA [80 mA]	–	110 mA [80 mA]

Note: Values in parentheses are typical values at standby.
In case of single power source units, current for the FBM-U502AA is supplied from the FBM-U502GU. So current for the FBM-U502GU increases by A [A] for each FBM-U502AA connected.

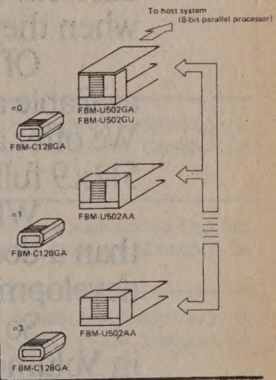
CONNECTORS

* Soldering type (wire wrap and solderless types also available) Made by Fujitsu

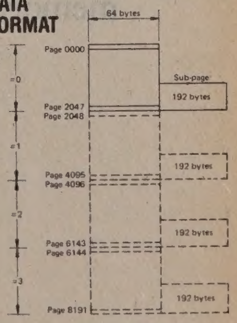
	Header (printed circuit board side)	Socket (cable side)
CN1	FCN-705P034-AU/M	FCN-707J034-AU/B
CN2	FCN-365P016-AU	FCN-361J016-AU *
CN3	FCN-744P034-AU/R	FCN-747J034-AU/0
CN4		
CN5		



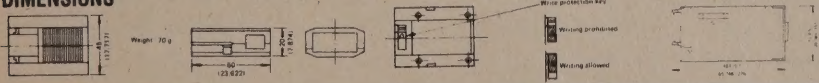
SYSTEM CONFIGURATION


To host system
(8-bit parallel processor)
#0
FBM-U502GA
FBM-U502GU
FBM-C128GA
#1
FBM-U502AA
FBM-C128GA
#3
FBM-U502AA
FBM-C128GA

DATA FORMAT


64 bytes
Page 0000
#0
Sub-page
192 bytes
Page 2047
Page 2048
#1
192 bytes
Page 4095
Page 4096
#2
192 bytes
Page 6143
Page 6144
#3
192 bytes
Page 8191

DIMENSIONS


Weight 70 g
80
(23.622)
Write protection key
Writing prohibited
Writing allowed

Unit: mm (inch)

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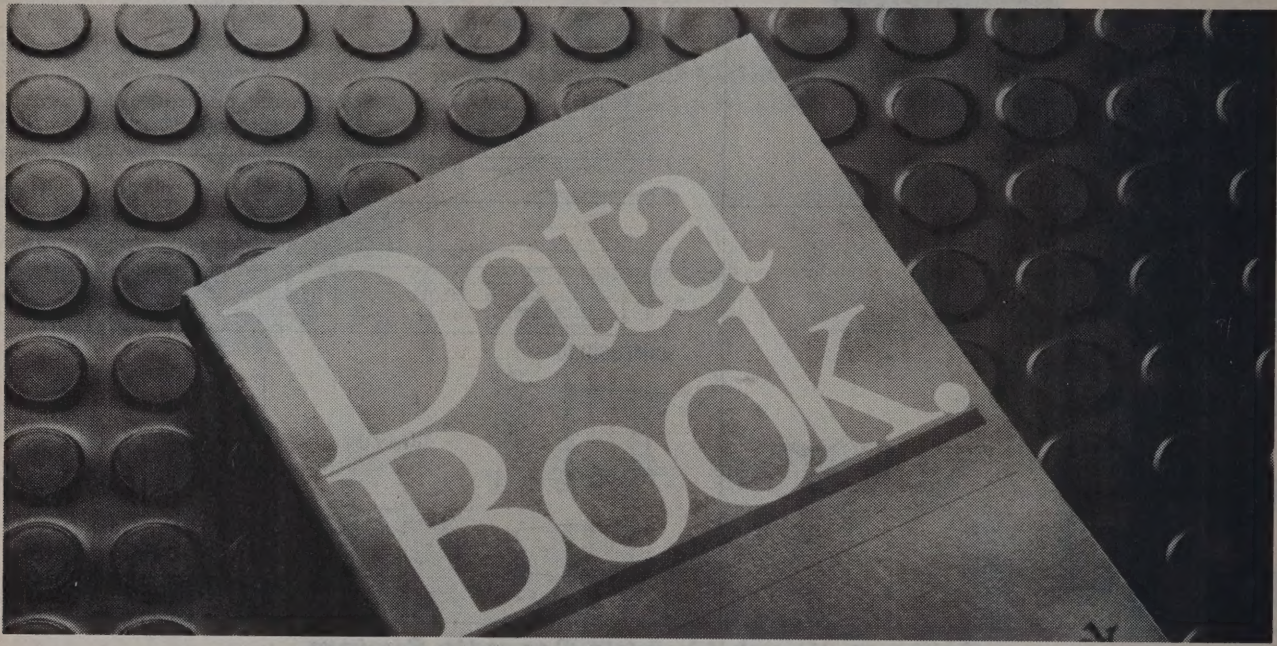
READ THE SECRET BEHIND OUR NEW DUAL PORT RAM.



It's all there in Volume 3 SYN–the details on our new SY2130 Dual Port RAM.

Our SY2130 solves all the timing problems that result when two different 8- or 16-bit CPUs have to communicate with each other–even when they both operate at different speeds.

Of course our Dual Port RAM, with its range of densities and available access times, is only the newest of our memory products. We offer a full line of 16 to 256K ROMs, 16K static RAMs and our SY2150 512x9 fully TI-compatible Cache Address Comparator.

What's more, every Synertek memory product is backed by more than a decade of experience. And by our massive research and development resources.

So read all about it in Volume 3 SYN. Or use the postpaid card in Volume 4 to send for additional copies of our microprocessor and memory Data Book.

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Synertek Inc. 3001 Stender Way, MS-59D Santa Clara, CA 05054 (408) 988-5600

For More Information. Circle No. 47

Zilog Product Guide

Z8 Family
- Z8601/3 MCU
- Z8611/2/3 MCU
- Z8671 MCU
- Z8681/2 MCU

For Zilog's complete product Data Book, contact Zilog, Inc. Components Publications, 1315 Dell Ave., Campbell, CA 95008

Z80 Family
- Z8400 CPU
- Z8410 DMA
- Z8420 PIO
- Z8430 CTC
- Z8440/1/2 SIO
- Z8470 DART

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Z800 Family
- Z800 MPU

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Z8000 Family
- Z8001/2 CPU
- Z8003/4 VMPU
- Z8010 Z-MMU
- Z8015 Z-PMMU
- Z8016 Z-DTC
- Z8030 Z-SCC
- Z8031 Z-ASCC
- Z8036 Z-CIO
- Z8038 Z-FIO
- Z8060 Z-FIFO
- Z8065 Z-BEP
- Z8068 Z-DCP

For Zilog's complete product Data Book, contact Zilog, Inc. Components Publications, 1315 Dell Ave., Campbell, CA 95008

Universal Periphrals
- Z8090/4, Z8590/4 UPCs
- Z8516 DTC
- Z8530 SCC
- Z8531 ASCC
- Z8536 CIO
- Z8581 CTGC
- Z765A FDC

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Z80,000 Family
- Z80,000 CPU
- Z8070 APU

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Military Microcircuits

For Zilog's complete product Data Book, contact Zilog, Inc. Components Publications, 1315 Dell Ave., Campbell, CA 95008

Development Systems and Software
- Software Information
- Z-SCAN UPC Emulator
- Z8 Development Module
- Z-SCAN 8 Emulator
- Z-SCAN 80 Emulator
- Z8000 Development Module
- Z-SCAN 8000 Emulator
- EMS 8000 Emulator
- System 8000

For Zilog's complete product Data Book, contact Zilog, Inc. Components Publications, 1315 Dell Ave., Campbell, CA 95008

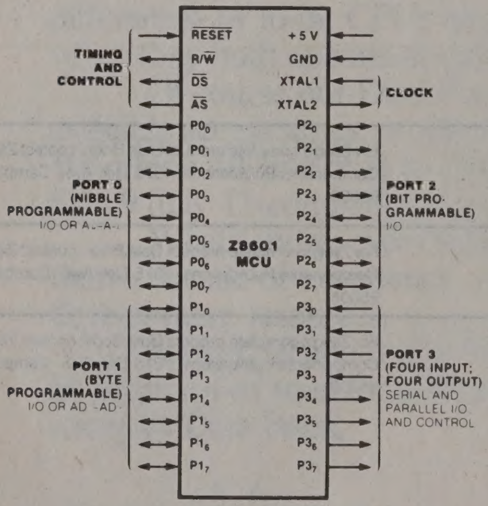
Z8® Family of Microcomputers Z8601 • Z8603 • Z8601L

FEATURES

- Z8601 Single-Chip Microcomputer with 2K ROM; Z8603 Prototyping Device with EPROM interface.
- Complete microcomputer, 2K bytes of ROM, 128 bytes of RAM, 32 I/O lines, and up to 62K bytes addressable external space each for program and data memory.
- 144-byte register file, including 124 general-purpose registers, four I/O port registers, and 16 status and control registers.
- Average instruction execution time of 1.5 μs, maximum of 3 μs.
- Vectored, priority interrupts for I/O, counter/timers, and UART.
- Full-duplex UART and two programmable 8-bit counter/timers, each with a 6-bit programmable prescaler.
- Register Pointer so that short, fast instructions can access any of nine working register groups in 1 μs.
- On-chip oscillator that accepts crystal or external clock drive.
- Low-power standby option that retains contents of general-purpose registers.
- Single +5 V power supply—all pins TTL-compatible.

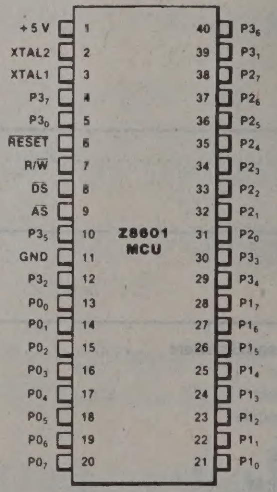
The Z8601 microcomputer introduces a new level of sophistication to single-chip architecture. Compared to earlier single-chip microcomputers, the Z8601 offers faster execution, more efficient use of memory, more sophisticated interrupt, input/output and bit-manipulation capabilities, and easier system expansion.

Under program control, the Z8601 can be tailored to the needs of its user. It can be configured as a stand-alone microcomputer with 2K bytes of internal ROM, a traditional microprocessor that manages up to 124K bytes of external memory, or a parallel-processing element in a system with other processors and peripheral controllers linked by the Z-BUS. In all configurations, a large number of pins remain available for I/O.



TIMING AND CONTROL
PORT 0 (NIBBLE PROGRAMMABLE) I/O OR A -A
PORT 1 (BYTE PROGRAMMABLE) I/O OR AD -AD
RESET
R/W
DS
AS
$P0_0$ $P0_1$ $P0_2$ $P0_3$ $P0_4$ $P0_5$ $P0_6$ $P0_7$
$P1_0$ $P1_1$ $P1_2$ $P1_3$ $P1_4$ $P1_5$ $P1_6$ $P1_7$
Z8601 MCU
+5 V
GND
XTAL1
XTAL2
$P2_0$ $P2_1$ $P2_2$ $P2_3$ $P2_4$ $P2_5$ $P2_6$ $P2_7$
$P3_0$ $P3_1$ $P3_2$ $P3_3$ $P3_4$ $P3_5$ $P3_6$ $P3_7$
CLOCK
PORT 2 (BIT PROGRAMMABLE) I/O
PORT 3 (FOUR INPUT; FOUR OUTPUT) SERIAL AND PARALLEL I/O AND CONTROL

Pin Functions



+5 V 1
XTAL2 2
XTAL1 3
$P3_7$ 4
$P3_0$ 5
RESET 6
R/W 7
DS 8
AS 9
$P3_5$ 10
GND 11
$P3_2$ 12
$P0_0$ 13
$P0_1$ 14
$P0_2$ 15
$P0_3$ 16
$P0_4$ 17
$P0_5$ 18
$P0_6$ 19
$P0_7$ 20
Z8601 MCU
40 $P3_6$
39 $P3_1$
38 $P2_7$
37 $P2_6$
36 $P2_5$
35 $P2_4$
34 $P2_3$
33 $P2_2$
32 $P2_1$
31 $P2_0$
30 $P3_3$
29 $P3_4$
28 $P1_7$
27 $P1_6$
26 $P1_5$
25 $P1_4$
24 $P1_3$
23 $P1_2$
22 $P1_1$
21 $P1_0$

Pin Assignments

For More Information. Circle No. 48

Z8® Family of Microcomputers Z8611•Z8612•Z8613

FEATURES

- Complete microcomputer, 4K bytes of ROM, 128 bytes of RAM, 32 I/O lines, and up to 60K bytes addressable external space each for program and data memory.
- 144-byte register file, including 124 general-purpose registers, four I/O port registers, and 16 status and control registers.
- Average instruction execution time of 1.5 μs, maximum of 3 μs.
- Vectored, priority interrupts for I/O, counter/timers, and UART.
- Full-duplex UART and two programmable 8-bit counter/timers, each with a 6-bit programmable prescaler.
- Register Pointer so that short, fast instructions can access any of nine working-register groups in 1 μs.
- On-chip oscillator which accepts crystal or external clock drive.
- Low-power standby option that retains contents of general-purpose registers.
- Single +5 V power supply—all pins TTL-compatible.
- Z8611 available in military version (see Military Microcircuit section).

The Z8611 microcomputer introduces a new level of sophistication to single-chip architecture. Compared to earlier single-chip microcomputers, the Z8611 offers faster execution, more efficient use of memory, more sophisticated interrupt, input/output and bit-manipulation capabilities, and easier system expansion.

Under program control, the Z8611 can be tailored to the needs of its user. It can be configured as a stand-alone microcomputer with 4K bytes of internal ROM, a traditional microprocessor that manages up to 120K bytes of external memory, or a parallel-processing element in a system with other processors and peripheral controllers linked by the Z-BUS. In all configurations, a large number of pins remain available for I/O.

Z8® Family Z8671 Microcomputer BASIC/Debug Interpreter

FEATURES

- The Z8671 MCU is a complete microcomputer preprogrammed with a BASIC/Debug interpreter. Interaction between the interpreter and its user is provided through an on-board UART.
- BASIC/Debug can directly address the Z8671's internal registers and all external memory. It provides quick examination and modification of any external memory location or I/O port.
- The BASIC/Debug interpreter can call machine language subroutines to increase execution speed.
- The Z8671's auto start-up capability allows a program to be executed on power-up or Reset without operator intervention.
- Single +5 V power supply—all I/O pins TTL-compatible.
- 8 MHz/12 MHz
- Available in military version (see Military Microcircuit section).

The Z8671 Single-Chip Microcomputer (MCU) is one of a line of preprogrammed chips—in this case with a BASIC/Debug interpreter in ROM—offered by Zilog. As a member of the Z8 Family of microcomputers, it offers the same abundance of resources as the other Z8 microcomputers.

Because the BASIC/Debug interpreter is already part of the chip circuit, programming is made much easier. The Z8671 MCU thus offers a combination of software and hardware that is ideal for most industrial control applications. The Z8671 MCU allows fast hardware tests, and bit-by-bit examination and modification of memory location, I/O ports, or registers. It also allows bit manipulation and logical operations. A self-contained line editor supports interactive debugging, further speeding up program development.

Z8® Z8681/82 ROMless Microcomputer

FEATURES

- Complete microcomputer, 24 I/O lines, and up to 64K bytes of addressable external space each for program and data memory.
- 143-bye register file, including 124 general-purpose registers, three I/O port registers, and 16 status and control registers.
- Vectored, priority interrupts for I/O, counter/timers, and UART.
- On-chip oscillator that accepts crystal or external clock drive.
- Full-duplex UART and two programmable 8-bit counter/timers, each with a 6-bit programmable prescaler.
- Register Pointer so that short, fast instructions can access any one of the nine working-register groups.
- Low-power standby option that retains contents of general-purpose registers.
- Available in 8 and 12 MHz versions.

The Z8681 and Z8682 are ROMless versions of the Z8 single-chip microcomputer. The Z8682 is usually more cost effective. These products differ only slightly and can be used interchangeably with proper system design to provide maximum flexibility in meeting price and delivery needs. The Z8681/82 offers all the outstanding features of the Z8 family architecture except an on-chip program ROM. Use of external memory rather than a preprogrammed ROM enables this Z8 microcomputer to be used in low volume applications or where code flexibility is required.

The Z8681/82 can provide up to 16 output address lines, thus permitting an address space of up to 64K bytes of data or program memory. Eight address outputs (AD_0-AD_7) are provided by a multiplexed, 8-bit, Address/Data bus. The remaining 8 bits can be provided by the software configuration of Port 0 to output address bits A_8-A_{15}.

Z80 FAMILY

Z8400 Z80® CPU Central Processing Unit

FEATURES

- The instruction set contains 158 instructions. The 78 instructions of the 8080A are included as a subset; 8080A software compatibility is maintained.
- Eight MHz, 6 MHz, 4 MHz and 2.5 MHz clocks for the Z80H, Z80B, Z80A, and Z80 CPU result in rapid instruction execution with consequent high data throughput.
- The extensive instruction set includes string, bit, byte, and word operations. Block searches and block transfers together with indexed and relative addressing result in the most powerful data handling capabilities in the microcomputer industry.
- The Z80 microprocessors and associated family of peripheral controllers are linked by a vectored interrupt system. This system can be daisy-chained to allow implementation of a priority interrupt scheme. Little, if any, additional logic is required for daisychaining.
- Duplicate sets of both general-purpose and flag registers are provided, easing the design and opera tion of system software through single-context switching, background-foreground programming, and single-level interrupt processing. In addition, two 16-bit index registers facilitate program processing of tables and arrays.
- There are three modes of high speed interrupt processing: 8080 compatible, non-Z80 peripheral device, and Z80 Family peripheral with or without daisy chain.
- On-chip dynamic memory refresh counter.
- Available in a Low Power version and a CMOS version (see Military Microcircuit section for military version).

The Z80, Z80A, Z80B, and Z80H CPUs are third-generation single-chip microprocessors with exceptional computational power. They offer higher system throughput and more efficient memory utilization than comparable second- and third-generation microprocessors. The internal registers contain 208 bits of read/write memory that are accessible to the programmer. These registers include two sets of six generalpurpose registers which may be used individually as either 8-bit registers or as 16-bit register pairs. In addition, there are two sets of accumulator and flag registers. A group of "Exchange" instructions makes either set of main or alternate registers accessible to the programmer. The alternate set allows operation in foreground-background mode or it may be reserved for very fast interrupt response.

Z8410
Z80® DMA Direct Memory Access Controller

FEATURES

- Transfers, searches and search/transfers in Byte-at-aTime, Burst or Continuous modes. Cycle length and edge timing can be programmed to match the speed of any port.
- Dual port addresses (source and destination) generated for memory-to-I/O, memory-to-memory, or I/O-to-I/O operations. Addresses may be fixed or automatically incremented/decremented.
- Next-operation loading without disturbing current operations via buffered starting-address registers. An entire previous sequence can be repeated automatically.
- Extensive programmability of functions. CPU can read complete channel status.
- Standard Z80 Family bus-request and prioritized interrupt-request daisy chains implemented without external logic. Sophisticated, internally modifiable interrupt vectoring.
- Direct interfacing to system buses without external logic.

The Z80 DMA (Direct Memory Access) is a powerful and versatile device for controlling and processing transfers of data. Its basic function of managing CPU-independent transfers between two ports is augmented by an array of features that optimize transfer speed and control with little or no external logic in systems using an 8- or 16-bit data bus and a 16-bit address bus.

Z8420
Z80® PIO Parallel Input/Output Controller

FEATURES

- Provides a direct interface between Z80 microcomputer systems and peripheral devices.
- Both ports have interrupt-driven handshake for fast response.
- Four programmable operating modes: byte input, byte output, byte input/output (Port A only), and bit input/output.
- Programmable interrupts on peripheral status conditions.
- Standard Z80 Family bus-request and prioritized interrupt-request daisy chains implemented without external logic.
- The eight Port B outputs can drive Darlington transistors (1.5 mA at 1.5 V).
- Available in a Low Power version and a CMOS version (see Military Microcircuit section for military version).

The Z80 PIO Parallel I/O Circuit is a programmable, dualport device that provides a TTL-compatible interface between peripheral devices and the Z80 CPU. The CPU configures the Z80 PIO to interface with a wide range of peripheral devices with no other external logic. Typical peripheral devices that are compatible with the Z80 PIO include most keyboards, paper tape readers and punches, printers, PROM programmers, etc.

Z8430
Z80® CTC Counter/Timer Circuit

FEATURES

- Four independently programmable counter/timer channels, each with a readable downcounter and a selectable 16 or 256 prescaler. Downcounters are reloaded automatically at zero count.
- Selectable positive or negative trigger initiates timer operation.
- Three channels have Zero Count/Timeout outputs capable of driving Darlington transistors.
- Interfaces directly to the Z80 CPU or—for baud rate generation—to the Z80 SIO.

CTC (Continued)

- Standard Z80 Family daisy-chain interrupt structure provides fully vectored, prioritized interrupts without external logic. The CTC may also be used as an interrupt controller.
- Available in a Low Power version and a CMOS version (see Military Microcircuit section for military version).

The Z80 CTC four-channel counter/timer can be programmed by system software for a broad range of counting and timing applications. The four independently programmable channels of the Z80 CTC satisfy common microcomputer system requirements for event counting, interrupt and interval timing, and general clock rate generation.

Z8440
Z80® SIO Serial Input/Output Controller

FEATURES

- Two independent full-duplex channels, with separate control and status lines for modems or other devices.
- Data rates of 0 to 500K bits/second in the x1 clock mode with a 2.5 MHz clock (Z80 SIO), or 0 to 800K bits/second with a 4.0 MHz clock (Z80A SIO).
- Receiver data registers quadruply buffered, transmitter registers doubly buffered.
- Asynchronous protocols: everything necessary for complete messages in 5, 6, 7 or 8 bits/character. Includes variable stop bits and several clock-rate multipliers; break generation and detection; parity; overrun and framing error detection.
- Synchronous protocols: everything necessary for complete bit- or byte-oriented messages in 5, 6, 7 or 8 bits/character, including IBM Bisync, SDLC, HDLC, CCITT-X.25 and others. Automatic CRC generation/checking, sync character and zero insertion/deletion, abort generation/detection and flag insertion.
- Highly sophisticated and flexible daisy-chain interrupt vectoring for interrupts without external logic.
- Available in a Low Power version and a CMOS version (see Military Microcircuit section for military version).

The Z80 SIO Serial Input/Output Controller is a dualchannel data communication interface with extraordinary versatility and capability. Its basic functions as a serial-to-parallel, parallel-to-serial converter/controller can be programmed by a CPU for a broad range of serial communication applications.

Z8470 Z80® DART
Dual Asynchronous Receiver/Transmitter

FEATURES

- Two independent full-duplex channels with separate modem controls. Modem status can be monitored.
- In x1 clock mode, data rates are 0 to 500K bits/second with a 2.5 MHz clock, or 0 to 800K bits/second with a 4.0 MHz clock.
- Receiver data registers are quadruply buffered; the transmitter is doubly buffered.
- Programmable options include 1, 1½ or 2 stop bits; even, odd or no parity; and x1, x16, x32 and x64 clock modes.
- Break generation and detection as well as parity-, overrun- and framing-error detection are available.
- Interrupt features include a programmable interrupt vector, a "status affects vector" mode for fast interrupt processing, and the standard Z80 peripheral daisy-chain interrupt structure that provides automatic interrupt vectoring with no external logic.
- On-chip logic for ring indication and carrier-detect status.

The Z80 DART (Dual-Channel Asynchronous Receiver/Transmitter) is a dual-channel multi-function peripheral component that satisfies a wide variety of asynchronous serial data communications requirements in microcomputer systems. The Z80 DART is used as a serial-to-parallel, parallel-to-serial converter/controller in asynchronous applications. In addition, the device also provides modem controls for both channels. In applications where modem controls are not needed, these lines can be used for general-purpose I/O.

Z800™ MPU Microprocessing Unit

FEATURES

- Enhanced Z80® instruction set that maintains object-code compatibility with Z80 microprocessor.
- On-chip paged Memory Management Unit (MMU).
- Large memory address space: up to 16M bytes.
- On-chip, high-speed local or cache memory.
- High performance 16-bit Z-BUS interface or 8-bit Z80-compatible bus interface.
- Four on-chip 16-bit counter/timers.
- Four on-chip DMA channels.
- On-chip full duplex UART.
- On-chip clock oscillator.
- 10-25 MHz CPU processor clock.

Zilog's new Z800 family of 8- and 16-bit microprocessors features high-performance microprocessors designed to give the end-user a powerful and cost-effective solution to application requirements. The Z800 family incorporates advanced architectural features that allow fast and efficient throughput and increased memory addressing while maintaining Z80 object code compatibility. Z800 microprocessors offer both a continuing growth path for present Z80-based designs and a high-performance microprocessor for future designs.

Central to the Z800 microprocessors pipelined architecture is an enhanced version of the Z80 Central Processing Unit (CPU). To assure system integrity, the Z800 microprocessors can operate in either user or system mode, allowing protection of system resources from user tasks and programs.

The Z80 CPU instruction set has been retained, meaning that the Z800 microprocessors are completely binarycode compatible with present Z80 code. The basic addressing modes of the Z80 microprocessor have been augmented with the addition of Indexed mode with full 16-bit displacement, Program Counter Relative with 16-bit displacement, Stack Pointer Relative with 16-bit displacement, and Base Index mode. The new addressing modes are incorporated into many of the old Z80 CPU instructions, resulting in greater flexibility and power.

The Z800 microprocessors have an on-chip Memory Management Unit (MMU) that enables the microprocessors to address up to 16M bytes. In addition to enabling the address space to be expanded, the MMU performs other memory management functions previously handled by dedicated off-chip memory management devices.

I/O address space has been expanded by the addition of an I/O Page register used to select pages of I/O addresses. The 8-bit I/O Page register can select one of 256 possible pages of I/O addresses to be active at one time, allowing a total of 64K I/O addresses to be accessed.

There are 256 bytes of on-chip memory present on all members of the Z800 family. This memory can be configured as a high-speed cache or as a fixed address local memory. When configured as a cache, the memory can be programmed to be instruction only, data only, or both data and instruction.

Many features that have traditionally been handled by external peripheral devices have been incorporated in the design of the Z800 microprocessors. The "on-chip peripherals" reduce system chip count and reduce interconnection on the external bus. All members of the Z800 family contain an on-chip clock oscillator. Also present is a refresh controller that provides 10-bit refresh ad dresses for dynamic memories.

Z8000 FAMILY

Z8001/2
Z8000™ CPU Central Processing Unit

FEATURES

- Regular, easy-to-use architecture
- Instruction set more powerful than many minicomputers
- Directly addresses 8M bytes
- Eight user-selectable addressing modes
- Seven data types that range from bits to 32-bit long words and byte and word strings
- System and normal operating modes
- Separate code, data and stack spaces
- Sophisticated interrupt structure
- Resource-sharing capabilities for multi-processing systems
- Multi-programming support
- Compiler support
- Memory management and protection provided by Z8010 Memory Management Unit
- 32-bit operations, including signed multiply and divide
- Z-BUS compatible
- 4, 6 and 10 MHz clock rate
- Available in military version (see Military Microcircuit section).

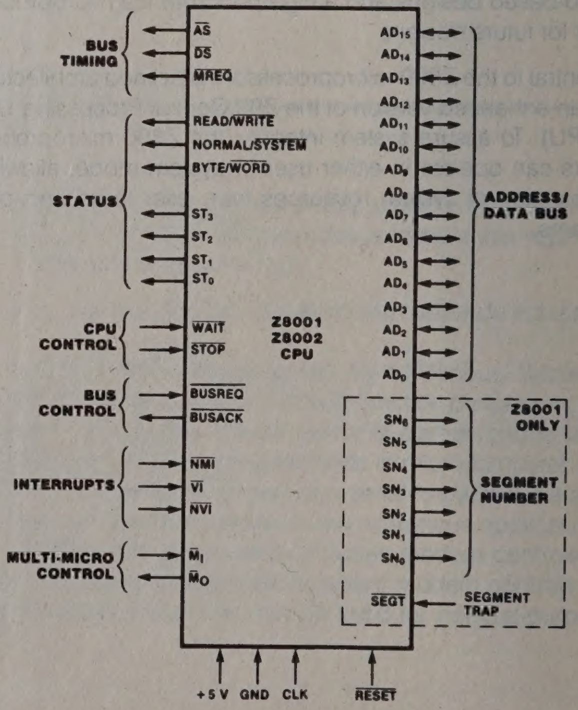
The Z8000 is an advanced high-end 16-bit microprocessor that spans a wide variety of applications ranging from simple stand-alone computers to complex parallel-processing systems. Essentially a monolithic minicomputer central processing unit, the Z8000 CPU is characterized by an instruction set more powerful than many minicomputers; abundant resources in registers, data types, addressing modes and addressing range; and a regular architecture that enhances throughput by avoiding critical bottlenecks such as implied or dedicated registers.

CPU resources include sixteen 16-bit general-purpose registers, seven data types that range from bits to 32-bit long words and byte and word strings, and eight userselectable addressing modes. The 110 distinct instruction types can be combined with the various data types and addressing modes to form a powerful set of 414 instructions. Moreover, the instruction set exhibits a high degree of regularity: most instructions can use any of the five main addressing modes and can operate on byte, word, and long-word data types.

The CPU can operate in either the system or normal modes. The distinction between these two modes permits privileged operations, thereby improving operating system organization and implementation. Multiprogramming is supported by the "atomic" Test and Set instruction; multiprocessing by a combination of instruction and hardware features; and compilers by multiple stacks, special instructions and addressing modes.

The Z8000 CPU is offered in two versions: the Z8001 48-pin segmented CPU and the Z8002 40-pin nonsegmented CPU. The main difference between the two is in addressing range. The Z8001 can directly address 8 megabytes of memory; the Z8002 directly addresses 64 kilobytes. The two operating modes—system and normal—and the distinction between code, data and stack spaces within each mode allows memory extension up to 48 megabytes for the Z8001 and 384 kilobytes for the Z8002.

To meet the requirements of complex, memory-intensive applications, a companion memory-management device is offered for the Z8001. The Z8010 Memory Management Unit manages the large address space by providing features such as segment relocation and memory protection. The Z8001 can be used with or without the Z8010. If used by itself, the Z8001 still provides an 8 megabyte direct addressing range, extendable to 48 megabytes.



Z8000 CPU Pin Functions

Z8003/4 Z8000™ VMPU Virtual Memory Processing Unit

FEATURES

- Regular, easy-to-use architecture.
- Instruction set more powerful than many minicomputers.
- Direct addressing capability of up to 8M bytes in each address space.
- Supports implementation of virtual memory systems.
- Eight user-selected addressing modes.
- Wide range of data types including bits, bytes, words, 32-bit long words, and byte and word strings.
- Binary-compatible with Z8001/2 CPUs.
- Separate System and Normal operating modes.
- Sophisticated interrupt structure.
- Resource-sharing capabilities for multiprocessing systems.
- Multi-programming support.
- 32-bit operations, including signed multiply and divide.
- BUS™ compatible.
- Multiple clock rates: 4, 8, or 10 MHz.

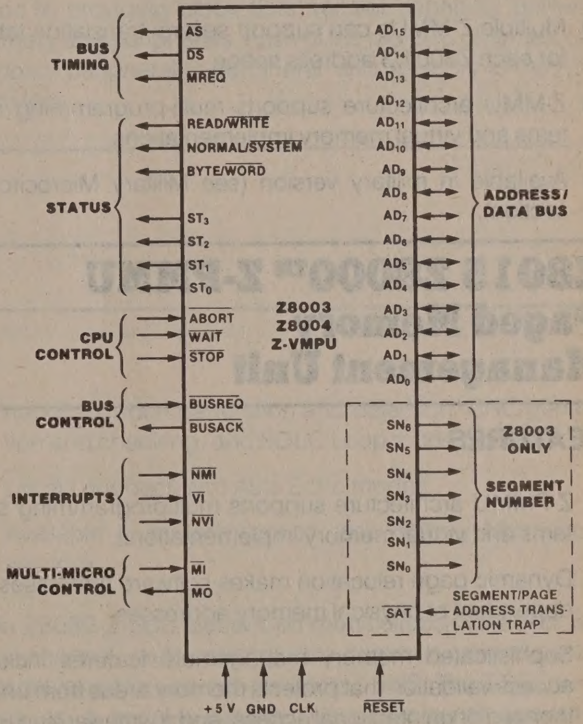
The Virtual Memory Microprocessor Units (Z8003 and Z8004 VMPUs) accommodate applications that range from the simplest to the most complex.

The Z8003 VMPU uses both segmented and nonsegmented address spaces. It also provides facilities for the implementation of demand segment swapping or a demand paged virtual memory system.

The Z8004 VMPU uses only nonsegmented address spaces. It also provides facilities for the implementation of a demand paged virtual memory system.

Both VMPUs interface with the entire Z8000 Family of support components. Used alone or with Z8000 Family components, the advanced architecture of these LSI VMPUs permits the implementation of systems that have the flexibility and the sophisticated features usually associated with minicomputers or mainframe computers.

The Z8003/4 microprocessors are binary compatible with other Z8000 Family microprocessors. The features that distinguish these microprocessors from the Z8001 and Z8002 microprocessors are the abort capability and the Test and Set status.


BUS TIMING
AS
DS
MREQ
STATUS
READ/WRITE
NORMAL/SYSTEM
BYTE/WORD
ST3
ST2
ST1
ST0
CPU CONTROL
ABORT
WAIT
STOP
BUS CONTROL
BUSREQ
BUSACK
INTERRUPTS
NMI
VI
NVI
MULTI-MICRO CONTROL
MI
MO
Z8003
Z8004
Z-VMPU
AD15
AD14
AD13
AD12
AD11
AD10
AD9
AD8
AD7
AD6
AD5
AD4
AD3
AD2
AD1
AD0
ADDRESS/ DATA BUS
SN6
SN5
SN4
SN3
SN2
SN1
SN0
Z8003 ONLY
SEGMENT NUMBER
SAT
SEGMENT/PAGE ADDRESS TRANSLATION TRAP
+5 V
GND
CLK
RESET

Pin Assignments

Z8010
Z8000™ Z-MMU Memory Management Unit

FEATURES

- Dynamic segment relocation makes software addresses independent of physical memory addresses.
- Sophisticated memory-management features include access validation that protects memory areas from unauthorized or unintentional access, and a writewarning indicator that predicts stack overflow.
- 64 variable-sized segments from 256 to 65,536 bytes can be mapped into a total physical address space of 16M bytes; all 64 segments are randomly accessible.
- For use with both Z8001 and Z8003 CPU.
- Multiple Z-MMUs can support several translation tables for each Z8001/3 address space.
- Z-MMU architecture supports multi-programming systems and virtual memory implementations.
- Available in military version (see Military Microcircuits section).

The Z8010 Memory Management Unit (Z-MMU) manages the large 8M byte addressing spaces of the Z8001 CPU. The Z-MMU provides dynamic segment relocation as well as numerous memory protection features.

Dynamic segment relocation makes user software addresses independent of the physical memory addresses, thereby freeing the user from specifying where information is actually located in the physical memory. It also provides a flexible, efficient method for supporting multiprogramming systems. The Z-MMU uses a translation table to transform the 23-bit logical address output from the Z8001 CPU into a 24-bit address for the physical memory. (Only logical memory addresses go to a Z-MMU for translation; I/O addresses and data, in general, must bypass this component.)

Z8015 Z8000™ Z-PMMU Paged Memory Management Unit

FEATURES

- Z-PMMU architecture supports multiprogramming systems and virtual memory implementations.
- Dynamic page relocation makes software addresses independent of physical memory addresses.
- Sophisticated memory management features include access validation that protects memory areas from unauthorized or unintentional access, and a writewarning indicator that predicts stack overflow.
- 64 pages, each 2048 bytes in length, can be mapped into a total physical address space of 16 megabytes; all 64 pages are randomly accessible.
- Pages larger or smaller than 2048 bytes can be easily implemented.
- The number of accessible pages can be increased by using multiple Z-PMMUs.

The Z8015 Paged Memory Management Unit (Z-PMMU), a new member of Zilog's Z8000 Family, is designed to support a paged virtual memory system for the Z8003 Virtual Memory Processor Unit (Z-VMPU). Although designed primarily for the Z8003, the Z-PMMU can also be used to support other CPUs in the Z8000 Family. The sophisticated memory management features of the Z-PMMU include access validation for memory protection, a write-warning that gives advance warning of possible stack overflow, and the generation of instruction aborts for accesses to pages not in main memory. Each Z-PMMU can manage a basic memory area of sixty-four 2048-byte, fixed-size pages. The Z-VMPU's 8M byte logical address space is translated by the Z-PMMU into a 16M byte physical address space. Page size can be easily changed and multiple PMMUs can be combined to support more pages.

For More Information. Circle No. 48

Z8016 Z8000™ Z-DTC Direct Memory Access Transfer Controller

FEATURES

- Memory-to-peripheral transfer up to 2.66M bytes/second at 4 MHz.
- Memory-to-memory transfers up to 1.33M bytes/second at 4 MHz.
- Two fully independent, multi-function channels.
- Masked data pattern matching for search and transfer-and-search operations.
- Funneling option permits mixing of byte and word data during transfer operations.
- Can operate in logical address space with Zilog Memory Management Units, providing an 8M byte logical addressing range and 16M byte physical addressing range.
- Programmable chaining operation provides automatic loading of control parameters from memory into each channel.
- Software- or hardware-controlled wait state insertion.
- Z-BUS daisy-chain interrupt hierarchy and busrequest structure.

The Z8016 DMA Transfer Controller (Z-DTC) is a high-performance data transfer device designed to match the power and addressing capability of the Z8000 CPUs. In addition to providing block data transfer capability between memory and peripherals, each of the two DTC channels can perform peripheral-to-peripheral and memory-to-memory transfers.

Z8030 Z8000™ Z-SCC Serial Communications Controller

FEATURES

- Two independent, 0 to 1M bit/second, full-duplex channels, each with a separate crystal oscillator, baud rate generator, and Digital Phase-Locked Loop for clock recovery.
- Multi-protocol operation under program control; programmable for NRZ, NRZI, or FM data encoding.
- Asynchronous mode with five to eight bits and one, one and one-half, or two stop bits per character; programmable clock factor; break detection and generation; parity, overrun, and framing error detection.
- Synchronous mode with internal or external character synchronization on one or two sync characters and CRC generation and checking with CRC-16 or CRCCCITT preset to either 1s or 0s.
- SDLC/HDLC mode with comprehensive frame-level control, automatic zero insertion and deletion, I-field residue handling, abort generation and detection, CRC generation and checking, and SDLC Loop mode operation.
- Local Loopback and Auto Echo modes.
- Available in military version (see Military Microcircuit section).

The Z8030 Z-SCC Serial Communications Controller is a dual-channel, multi-protocol data communications peripheral designed for use with the Zilog Z-BUS. The Z-SCC functions as a serial-to-parallel, parallel-to-serial converter/controller. The Z-SCC can be software-configured to satisfy a wide variety of serial communications applications. The device contains a variety of new, sophisticated internal functions including on-chip baud rate generators, Digital Phase-Locked Loops, and crystal oscillators that dramatically reduce the need for external logic.

Z8031 Z8000™ Z-ASCC Asynchronous Serial Communications Controller

FEATURES

- Two independent, 0 to 1M bit/second, full-duplex channels, each with a separate crystal oscillator and baud rate generator.
- Programmable for NRZ, NRZI, or FM data encoding.
- Asynchronous communications with five to eight bits per character and one, one and one-half, or two stop bits per character; programmable clock factor; break detection and generation; parity, overrun, and framing error detection.
- Local Loopback and Auto Echo modes.

The Z8031 Z-ASCC Asynchronous Serial Communications Controller is a dual-channel data communications peripheral designed for use with the Zilog Z-BUS. The Z-ASCC functions as a serial-to-parallel, parallel-to-serial converter/controller. The device contains a variety of new, sophisticated internal functions including on-chip baud rate generators and crystal oscillators that dramatically reduce the need for external logic.

Z8036 Z8000™ Z-CIO Counter/Timer and Parallel I/O Unit

FEATURES

- Two independent 8-bit, double-buffered, bidirectional I/O ports plus a 4-bit special-purpose I/O port. I/O ports feature programmable polarity, programmable direction (Bit mode), "pulse catchers," and programmable open-drain outputs.
- Four handshake modes, including 3-Wire (like the IEEE-488).
- REQUEST/WAIT signal for high-speed data transfer.
- Flexible pattern-recognition logic, programmable as a 16-vector priority interrupt controller.
- Three independent 16-bit counter/timers with up to four external access lines per counter/timer (count input, output, gate, and trigger), and three output duty cycles (pulsed, one-shot, and square-wave), programmable as retriggerable or nonretriggerable.
- Easy to use since all registers are read/write and directly addressable.
- Available in military version (see Military Microcircuit section).

The Z8036 Z-CIO Counter/Timer and Parallel I/O element is a general-purpose peripheral circuit, satisfying most counter/timer and parallel I/O needs encountered in system designs. This versatile device contains three I/O ports and three counter/timers. Many programmable options tailor its configuration to specific applications. The use of the device is simplified by making all internal registers (command, status, and data) readable and (except for status bits) writable. In addition, each register is given its own unique address so that it can be accessed directly—no special sequential operations are required. The Z-CIO is directly Z-BUS compatible.

For More Information. Circle No. 48

Z8038 Z8000™ Z-FIO FIFO Input/ Output Interface Unit

FEATURES

- 128-byte FIFO buffer provides asynchronous bidirectional CPU/CPU or CPU/peripheral interface, expandable to any width in byte increments by use of multiple FIOs.
- Interlocked 2-wire or 3-wire handshake logic port mode; Z-BUS or non-Z-BUS interface.
- Pattern-recognition logic stops DMA transfers and/or interrupts CPU; preset byte count can initiate variable-length DMA transfers.
- Seven sources of vectored/nonvectored interrupts which include pattern-match, byte count, empty or full buffer status; a dedicated "mailbox" register with interrupt capability provides CPU/CPU communication.
- REQUEST/WAIT lines control high-speed data transfers.
- All functions are software controlled via directly addressable read/write registers.

The Z8038 FIO provides an asynchronous 128-byte FIFO buffer between two CPUs or between a CPU and a peripheral device. This buffer interface expands to a 16-bit or wider data path and expands in depth to add as many Z8060 FIFOs (and an additional FIO) as are needed.

The FIO manages data transfers by assuming Z-BUS, non-Z-BUS microprocessor (a generalized microprocessor interface), Interlocked 2-Wire Handshake, and 3-Wire Handshake operating modes. These modes interface dissimilar CPUs or CPUs and peripherals running under differing speeds or protocols, allowing asynchronous data transactions and improving I/O overhead by as much as two orders of magnitude.

Z8060 Z8000™ Z-FIFO Buffer Unit and Z-FIO Expander

FEATURES

- Bidirectional, asynchronous data transfer capability
- Large 128-bit-by-8-bit buffer memory
- Two-wire, interlocked handshake protocol
- Wire-ORing of empty and full outputs for sensing of multiple-unit buffers
- Connects any number of FIFOs in series to form buffer of any desired length.
- Connects any number of FIFOs in parallel to form buffer of any desired width

The Z8060 First-In First-Out (Z-FIFO) Buffer Unit consists of a 128-bit-by-8-bit memory, bidirectional data transfer and handshake logic. The structure of the Z-FIFO unit is similar to that of other available buffer units. Z-FIFO is a general-purpose unit; its handshake logic is compatible with that of other members of Zilog's Z8 and Z8000 Families.

For More Information. Circle No. 48

Z8065
Z8000™ Z-BEP
Burst Error Processor

FEATURES

- Detects errors in serial data up to 585,442 bits in length
- Implements correction of a detected error burst of up to 12 bits in length
- Handles effective data rates of up to 20M bits per second
- Provides four industry-standard polynomials for error detection
- Designed for use in both microprocessor and microprogrammed disk-controlled systems
- Provides three correction algorithms:
  - ☐ Full-period clock-around method for conformance to current practices
  - ☐ Chinese remainder theorem, which reduces correction time by orders of magnitude
  - ☐ Reciprocal polynomial, which allows correction with 48-bit code

The Z8065 Burst Error Processor (BEP) provides error detection and correction facilities for high-performance, high-density disk systems and any other system in which high-speed serial data transfers occur.

For error detection, the BEP provides a selection of four standard polynomials, including the more popular 56-bit and 48-bit versions, to satisfy a broad range of applications. During write operations, the BEP generates checkbit words, which are appended to the record being written onto the disk. These check-bit words are then used in subsequent reads and, if necessary, in correction operations.

Z8068
Z8000™ Z-DCP Data Ciphering Processor

FEATURES

- Encrypts and decrypts data using the National Bureau of Standards encryption algorithm.
- Supports three standard ciphering modes: Electronic Code Book, Chain Block and Cipher Feedback.
- Three separate registers for encryption, decryption, and master keys improve system security and throughput by eliminating frequent reloading of keys.
- Three separate programmable ports (master, slave, and key data) provide hardware separation of encrypted data, clear data, and keys.
- Data rates greater than 1M bytes per second can be handled.
- Key parity check.

The Z8068 Data Ciphering Processor (DCP) is an n-channel, silicon-gate LSI device, which contains the circuitry to encrypt and decrypt data using National Bureau of Standards encryption algorithms. It is designed to be used in a variety of environments, including dedicated controllers, communication concentrators, terminals, and peripheral task processors in general pro cessor systems.

The DCP provides a high throughput rate using Cipher Feedback, Electronic Code Book, or Cipher Block Chain operating modes. The provision of separate ports for key input, clear data, and enciphered data enhances security.

The Z8068 DCP is designed to interface directly to Zilog's Z-BUS®.

For More Information. Circle No. 48

Z8® Family of Universal Peripheral Controllers

FEATURES

- Complete slave Z8 microcomputer, for distributed processing use.
- Unmatched power of Z8 architecture and instruction set.
- Three programmable I/O ports, two with optional 2-Wire Handshake.
- Six levels of priority interrupts from eight sources: six from external sources and two from internal sources.
- Two programmable 8-bit counter/timers each with a 6-bit prescaler. Counter/Timer T0 is driven by an internal source, and Counter/Timer T1 can be driven by internal or external sources. Both counter/timers are independent of program execution.
- 256-byte register file, accessible by both the master CPU and UPC, as allocated in the UPC program.
- 2K bytes of on-chip ROM for efficiency and versatility.

The Universal Peripheral Controller (UPC) is an intelligent peripheral controller for distributed processing applications. The UPC unburdens the host processor by assuming tasks traditionally done by the host (or by added hardware), such as performing arithmetic, translating or formatting data, and controlling I/O devices. Based on the Z8 microcomputer architecture and instruction set, the UPC contains 2K bytes of internal program ROM, a 256-byte register file, three 8-bit I/O ports, and two counter/timers.

The UPC is offered in two basic configurations: the Z8090/4, which interfaces to multiplexed address/data CPUs such as the Z8000, and the Z8590/4, which interfaces with non-multiplexed CPUs such as the Z80. Both devices have the same instruction set and I/O port configuration. The difference in the devices is in the UPC-tohost interface pins and the sequence of data transfer between the units.

The UPC offers fast-execution time, an effective use of memory, and sophisticated interrupt, I/O, and bit manipulation. Using a powerful and extensive instruction set combined with an efficient internal addressing scheme, the UPC speeds program execution and efficiently packs program code into the on-chip ROM.

Z8516™ DTC DMA Transfer Controller

FEATURES

- Two independent multi-function channels
- Transfer modes: single, demand dedicated with bus hold, demand dedicated with bus release, demand interleave
- Memory/peripheral transfers up to 2.66 Megabytes/second at 4 MHz and 4 Megabytes/second at 6 MHz
- Memory/memory flowthrough transfer up to 1.33 Megabytes/second at 4 MHz and 2 Megabytes/second at 6 MHz
- 16 Megabyte physical addressing range in each address space
- Data types: byte-to-byte, word-to-word, byte/word funneling
- Automatic loading/reloading of control parameters by each channel
- Optional automatic chaining of operations
- Masked data pattern matching for search operations
- Vectored interrupts on selected transfer conditions
- Software or hardware wait state insertion
- Address increment, decrement, or hold
- Channel interleave operations
- Interleave operations with system bus
- Base registers for efficient repetitive operations
- Reload word table for efficient channel initialization
- Software DMA request

The Z8516 Universal DMA Transfer Controller (DTC) is a high performance, peripheral interface circuit for non-Z-BUS CPUs. In addition to providing data block transfer capability between memory and peripherals, each of the DTC's two channels can perform peripheral-to-peripheral and memory-to-memory transfers. A special Search mode of operation compares data read from a memory or peripheral source with the contents of a pattern register.

For More Information. Circle No. 48

Z8530 SCC Serial Communications Controller

FEATURES

- Two independent, 0 to 1M bit/second, full-duplex channels, each with a separate crystal oscillator, baud rate generator, and Digital Phase-Locked Loop for clock recovery.
- Multi-protocol operation under program control; programmable for NRZ, NRZI, or FM data encoding.
- Asynchronous mode with five to eight bits and one, one and one-half, or two stop bits per character; programmable clock factor; break detection and generation; parity, overrun, and framing error detection.
- Synchronous mode with internal or external character synchronization on one or two synchronous characters and CRC generation and checking with CRC-16 or CRC-CCITT preset to either 1s or 0s.
- SDLC/HDLC mode with comprehensive frame-level control, automatic zero insertion and deletion, I-field residue handling, abort generation and detection, CRC generation and checking, and SDLC Loop mode operation.
- Local Loopback and Auto Echo modes.
- Available in military version (see Military Microcircuit section).

The Z8530 SCC Serial Communications Controller is a dual-channel, multi-protocol data communications peripheral designed for use with conventional nonmultiplexed buses. The SCC functions as a serial-toparallel, parallel-to-serial converter/controller. The SCC can be software-configured to satisfy a wide variety of serial communications applications. The device contains a variety of new, sophisticated internal functions including on-chip baud rate generators, Digital PhaseLocked Loops, and crystal oscillators that dramatically reduce the need for external logic.

Z8531 ASCC Asynchronous Serial Communications Controller

FEATURES

- Two independent, 0 to 1M bit/second, full-duplex channels, each with a separate crystal oscillator and baud rate generator.
- Programmable for NRZ, NRZI, or FM data encoding.
- Asynchronous communications with five to eight bits per character and one, one and one-half, or two stop bits per character; programmable clock factor; break detection and generation; parity, overrun, and framing error detection.
- Local Loopback and Auto Echo modes.

The Z8531 ASCC Asynchronous Serial Communications Controller is a dual-channel, multi-protocol data communications peripheral designed for use with conventional nonmultiplexed buses. The ASCC functions as a serial-to-parallel, parallel-to-serial converter/controller. The device contains a variety of new, sophisticated internal functions including on-chip baud rate generators and crystal oscillators that dramatically reduce the need for external logic.

The ASCC also has facilities for modem controls in both channels. In applications where these controls are not needed, the modem controls can be used for general-purpose I/O.

For More Information. Circle No. 48

Z8536 CIO Counter/Timer and Parallel I/O Unit

FEATURES

- Two independent 8-bit, double-buffered, bidirectional I/O ports plus a 4-bit special-purpose I/O port. I/O ports feature programmable polarity, programmable direction (Bit mode), "pulse catchers," and programmable open-drain outputs.
- Four handshake modes, including 3-Wire (like the IEEE-488).
- REQUEST/WAIT signal for high-speed data transfer.
- Flexible pattern-recognition logic, programmable as a 16-vector interrupt controller.
- Three independent 16-bit counter/timers with up to four external access lines per counter/timer (count input, output, gate, and trigger), and three output duty cycles (pulsed, one-shot, and square-wave), programmable as retriggerable or nonretriggerable.
- Easy to use since all registers are read/write.
- Available in military version (see Military Microcircuit section).

The Z8536 CIO Counter/Timer and Parallel I/O element is a general-purpose peripheral circuit, satisfying most counter/timer and parallel I/O needs encountered in system designs. This versatile device contains three I/O ports and three counter/timers. Many programmable options tailor its' configuration to specific applications. The use of the device is simplified by making all internal registers (command, status, and data) readable and (except for status bits) writable. In addition, each register is given its own unique internal address, so that any register can be accessed in two operations. All data registers can be directly accessed in a single operation. The CIO is easily interfaced to all popular microprocessors.

Z8581 CGC Clock Generator and Controller

FEATURES

- Two independent 20 MHz oscillators generate two 10 MHz clock outputs and one 20 MHz clock output.
- Oscillator input frequency sources can be either crystals or external oscillators.
- Outputs directly drive the Z80 and Z8000 microprocessor clock inputs.
- Can be used as a general-purpose clock generator.
- 18-pin slimline package used; single +5 V dc power required.
- Provides ability to stretch High and/or Low phase of clock signal under external control.
- On-chip 2-bit counter can be used to selectively stretch clock cycles.
- On-chip reset logic
  - ☐ Reset output is synchronized with System Clock output.
  - ☐ Power-up reset period is maintained for a minimum of 30 ms.
  - ☐ External input initiates system reset.
- Available in military version (see Military Microcircuit section).

The Z8581 Clock Generator and Controller is a versatile addition to Zilog's family of Universal microprocessor components. The selective clock-stretching capabilities and variety of timing outputs produced by this device allow it to easily meet the timing design requirements of systems with microprocessors and LSI peripherals. The clock output drivers of the Z8581 also meet the non-TTL voltage requirements for driving NMOS clock inputs with no additional external components.

Z765A FDC Floppy Disk Controller

FEATURES

- IBM compatible format (single and double density)
- Multisector and multi-track transfer capability
- Drives up to four floppy disk drives
- Data scan capability—scans a single sector or an entire cylinder comparing byte-for-byte host memory and disk data.
- Data transfers in DMA or non-DMA Modes
- Parallel seek operations on up to four drives
- Compatible with Z80, 8080/8085, and 8086/8088 microprocessors
- Single phase clock (8 MHz)
- 40-pin package
- Single +5V power supply

Zilog's Z765A Floppy Disk Controller provides the circuitry and control functions for interfacing a processor to up to four floppy-disk drives. It is capable of supporting either IBM 3740 Single Density format (FM) or IBM System 34 Double Density format (MFM) including double-sided recording.

The Z765A FDC provides control signals which simplify the design of an external phase-locked loop and write precompensation circuitry. The FDC simplifies and handles most of the burdens associated with implementing a floppy-disk interface.

Handshaking signals are provided in the FDC which make DMA operation with an external DMA Controller easy to implement. The FDC operates in either the DMA or non-DMA mode. In non-DMA mode the FDC generates interrupts to the CPU every time a data byte needs to be transferred. In DMA mode, the CPU needs only to load the command into the FDC and all transfers are controlled by the FDC and DMA controller.

Z80,000 FAMILY

Z80,000™ CPU Central Processing Unit

FEATURES

- Full 32-bit architecture and implementation
- 4 gigabytes (billion bytes) of directly addressable memory
- Linear or segmented address space
- Virtual memory management integrated with CPU
- On-chip cache memory
- General-purpose register file with 16 32-bit registers
- Nine general addressing modes
- Numerous data types include bit, bit field, logical value, signed integer, and string
- Mainframe performance
- Extended Processing Architecture supports floating point operations
- Regular use of operations, addressing modes, and data types in instruction set
- System and Normal modes of operation with separate stacks
- Sophisticated interrupt and trap handling
- Software is a binary-compatible extension of Z8000™ software
- Hardware is compatible with other Z-BUS™ components

The Z80,000 CPU is an advanced, high-end 32-bit microprocessor that integrates the architecture of a mainframe computer into a single chip. While maintaining full compatibility with Z8000 family software and hardware, the Z80,000 CPU offers greater power and flexibility in both its architecture and interface capability. Operating systems and compilers are easily developed in the Z80,000 CPU's high-quality environment, and the hardware interface provides for connection to a wide variety of system configurations.

Addresses in the Z80,000 CPU are 32 bits. This allows direct addressing of 4G bytes in each of four address spaces: System-mode data, System-mode instruction, Normal-mode data, and Normal-mode instruction. The CPU supports three modes of address representation. The 16-bit compact addresses are compatible with Z8000 non-segmented mode. The 32-bit segmented addresses include both 16-bit offset, which is compatible with Z8000 segmented mode, and 24-bit offset. In addition a full 32-bit linear address space is provided.

Z8070 Z-APU Arithmetic Processing Unit

FEATURES

- Fast and complete implementation of proposed IEEE Standard P754 Draft 10.0 for Binary Floating-Point Arithmetic. Performs a single-precision multiplication in under three microseconds (with a 10 MHz clock).
- Data types supported are: Single, Double, and Double Extended floating-point; 16- and 32-bit integer; BCD strings.
- Operations supported include add, subtract, multiply, divide, square root, remainder, and compare.
- Interfaces as coprocessor to Z800™, Z8000™, and Z80,000™ CPUs.
- Speed versions offered from 10 MHz to 25 MHz.
- Provides for conversion of binary integer and Binary Coded Decimal formats to and from floating-point format.
- Can be interfaced through Zilog's Extended Processing Architecture or a general-purpose interface.
- Frees CPU for performance of other tasks.

The Z8070 Arithmetic Processing Unit (APU) is an Extended Processing Unit (EPU) designed to perform floating-point arithmetic functions while operating in parallel with a CPU. By monitoring the same instruction stream as the CPU, it is able to identify and execute those instructions intended for it, thereby freeing the CPU to perform other activities.

The APU can use Zilog's Extended Processing Architecture (EPA) for the Z800, Z8000, and Z80,000, or it can be integrated into systems based on other popular microprocessors, using a general-purpose interface.

The APU supports several data formats, enabling it to handle a wide range of business and scientific applications. These include three binary floating-point formats and four integer formats, including one for variable length Binary Coded Decimal (BCD) strings. All of the APU's internal numeric manipulations use an 80-bit floating-point format; however, transfers of data between the APU's data registers and CPU registers or memory can use any of the formats desired, as specified in the floating-point instruction.

Floating-point arithmetic operations are performed according to the requirements of the proposed IEEE Standard for floating-point arithmetic. The Z8070 supports:

- Single (32-bit), Double (64-bit), and Extended (80-bit) Precision floating-point number formats.
- Addition, subtraction, multiplication, division, square-root, remainder, and compare operations.
- Conversions between different floating-point formats.
- Conversions between binary integers and floating-point numbers.
- Conversions between decimal integers and floating-point numbers.
- Non-numbers (NaNs) and infinity arithmetic.
- Floating-point exceptions and their handling.

MILITARY MICROCIRCUITS

Zilog's military microcircuits are processed and assembled in accordance with the latest requirements of MIL-STD-883 or MIL-M-38510, as specified by the customer purchase order. Zilog offers military versions of many of our Z8000, Z80, and Z8 logic circuits. The Z80 and Z8000 CPUs are currently qualified for Part 1 listing per JAN MIL-M-38510.

Zilog military microcircuits are designed to meet full military temperature range of −55°C to +125°C, and are packaged in ceramic dual-in-line (C) and leadless chip carriers (L). Our military products are processed to Test Method 5004 Screening Procedures and Method 5005 Qualification and Quality Conformance Procedures in accordance with the requirements of MIL-STD-883.

ZILOG MILITARY PRODUCT CROSS-REFERENCE

Please consult Zilog Components Data Book for details on available Military products

	Speed (MHz)					Package		
Device	**2.5**	**4.0**	**6.0**	**8.0**	**10.0**	**C(DIP) Pin No.**	**L(LCC) Pin No.**	**Description**
*Z8001		X				48	(P)68	Z8000 SEG CPU
*Z8001A			X			48	(P)68	Z8000 SEG CPU
*Z8001B					X	48	(P)68	Z8000 SEG CPU
*Z8002		X				40	(F)44	Z8000 NON-SEG CPU
†*Z8002A			X			40	(F)44	Z8000 NON-SEG CPU
*Z8002B					X	40	(F)44	Z8000 NON-SEG CPU
†Z8400	X					40	(F)44	Z80 CPU
†Z8400A		X				40	(F)44	Z80 CPU
Z8010 (F)		X				48	(P)68	MMU
Z8030		X				40		Z-BUS SCC
Z8030A			X			40		Z-BUS SCC
Z8930 (F)		X					44	Z-BUS or UNIVERSAL
Z8930A (F)			X				44	Z-BUS or UNIVERSAL
Z8530		X				40		UNIVERSAL SCC
Z8530A			X			40		UNIVERSAL SCC
Z8036		X				40		Z-BUS CIO
Z8036A			X			40		Z-BUS CIO
Z8936 (F)		X					44	Z-BUS or UNIVERSAL
Z8936A (F)			X				44	Z-BUS or UNIVERSAL
Z8536		X				40		UNIVERSAL CIO
Z8536A			X			40		UNIVERSAL CIO
Z8440	X					40		Z80 SIO/0
Z8440A		X				40		Z80 SIO/0
Z8441	X					40		Z80 SIO/1
Z8441A		X				40		Z80 SIO/1
Z8442	X					40		Z80 SIO/2
Z8442A		X				40		Z80 SIO/2
Z8444 (F)	X						44	Z80 SIO/0,1,2
Z8444A (F)		X					44	Z80 SIO/0,1,2
Z8420	X					40	(F)44	Z80 PIO
Z8420A		X				40	(F)44	Z80 PIO
Z8430	X					28	(F)44	Z80 CTC
Z8430A		X				28	(F)44	Z80 CTC
Z8581 (F)			X			18	TBD	CGC
Z8581-10 (F)					X	18	TBD	CGC
Z8611 (F)				X		40	TBD	Z8 MCU
Z8671 (F)				X		40	TBD	Z8 MCU
Z8681 (F)				X		40	TBD	Z8 ROMless
Z8038		X				(P)40	(P)44	Z-FIO
Z8038A			X			(P)40	(P)44	Z-FIO

(F) Future, currently available in military temperature range only.
(P) Future package
†JAN MIL-M-38510 Qualified Part I
*Available in −55°C to +110°C temperature range.

For More Information. Circle No. 48

DEVELOPMENT SYSTEMS AND SOFTWARE

Software Information

Zilog's Cross-Software Packages, running on UNIX*, enable multi-user access for enhanced software development. The packages consist of a complete set of software tools for developing Z8, Z80, Z800, Z8000, and Z80,000 programs. These packages include cross-assemblers for each CPU, and a set of high-level language compilers offering further support in program development.

The ZRTS Kernel, a small executive program, saves software development time by providing the core of a realtime multitasking operating system in PROMable form. Using ZCL, a high-level configuration language, the designer can define the target system and produce a memory-efficient, cost-effective end product.

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*UNIX is a trademark of Bell Laboratories.

Z-SCAN UPC Emulator

The Z-SCAN UPC is a portable stand-alone in-circuit emulator (ICE) that emulates the Z8090 and Z8094 Z-BUS Z-UPCs, and the Z8590 and Z8594 non-Z-BUS UPCs. By supporting eight possible terminal types and a wide variety of hosts, the emulator is easily integrated into most operating environments.

The Z-SCAN UPC is physically located between the host system and the user's terminal via RS-232C interfacing. It can operate in stand-alone mode for simple debugging operations, or it can be placed in transparent mode to allow software development with the host.

The Z-SCAN UPC contains both a Z8 MCU and a UPC. The Z8 MCU controls monitor functioning, and the UPC features a 256-byte register file including three I/O port registers, 234 general-purpose registers, and 19 control, status, and special I/O registers. Twenty-four pins can be dedicated to I/O functions in various combinations of input and output, with or without handshake, and with push-pull or open drain outputs.

In addition to supporting eight popular terminal types and a wide variety of host systems, Z-SCAN UPC software includes a monitor/debug program residing in 4096 bytes of PROM. This program is divided into four functional groups: monitor commands, debug commands, manipulation commands, and file commands.

Z8® Development Module

FEATURES

- Two 4K Z8s are used on the board: one as board manager and one for emulation (without real-time trace) or other user-defined configuration.
- 4096 bytes of static RAM allow convenient creation and debugging of user code.
- On-board socket tests user code in a 2716 or 2732 EPROM.
- Up to 4096 hardware breakpoints on address compare cover the entire internal ROM space.
- Versatile monitor software allows debugging, with register/memory examination and manipulation, and file upload and download.
- "Transparent" operation allows terminal-to-host communication without disconnecting the Development Module.
- Wire-wrap area for prototyping.
- Z8 board management is operated at 7.3728 MHz for baud rate purposes. The User Z8 has switchselectable 8 or 12 MHz crystals.

The Z8 Development Module is a single-board microcomputer system specifically designed to assist in the development and evaluation of hardware and software designs based on the Z8 microcomputer family. It allows the user to build a prototype using the Z8 prototyping device, thereby developing code that will eventually be mask-programmed into the Z8 on-chip ROM.

Z-SCAN 8
Z8® Emulator

FEATURES

- Provides real-time emulation capability for the family of Z8 microcomputers.
- Operates with Zilog systems and other hosts; Z-SCAN 8 uses standard RS-232 links and is compatible with many standard CRTs and software hosts. This includes Zilog's S8000 systems and others with usersupplied load/save routines and cross-software support.
- Hardware/software debugging is fast and convenient. Two screens display the status of the Z-SCAN 8 monitor and Z8 target resources. Target memory can be displayed and modified in a scrollable window.
- Fulfills the user's essential real-time trace, two complex breakpoints, single-step capability, and four blocks of mappable memory.
- Interactive and easy to use. Commands are selected from menus; command arguments are self-prompting.

The Z-SCAN 8 Emulator is a combination of hardware and software that allows efficient, interactive emulation of the Z8 microcomputer. By the simple exchange of target devices, the selected Z8 MCU can be emulated in a realistic mode that allows user inspection and control over the environment being tested. Real-time trace, two breakpoints, single-step capability, and extensive mappable memory ensure the user a tool that accurately simulates the anticipated Z8 operating environment.

Z-SCAN 8 is an in-circuit emulator designed specifically for Zilog's Z8601 (2K), Z8611 (4K), and Z8681/82 (ROMless) microcomputers. Z-SCAN 8 works with Zilog's family of development hosts, interfacing via two RS-232 serial ports to the host and a CRT terminal.

Z-SCAN 80
Emulator

FEATURES

- Real-time emulation for the Z80 microprocessor
- Two complex breakpoints
- 4K × 32 bits of real-time trace
- 32 1K-byte blocks of mappable memory
- Disassembly from trace and user memory
- Screen-oriented, user-friendly software
- Line assembler
- Standard RS-232 links; compatible with standard CRTs and software development systems (hosts)
- Can be used stand-alone or in combination with virtually any host computer
- Transparent operation for direct communication between CRT and host computer.

The Z-SCAN 80 Emulator combines hardware and software to provide efficient, interactive emulation of the Z80 CPU. Running at up to 8 MHz, the emulator closely matches the Z80H chip in high-speed operations and efficiency.

Based on the Z8001 CPU, the emulator interfaces via two RS-232C serial ports to the host computer and CRT terminal. This standard interface allows the Z-SCAN 80 Emulator to be used with virtually any software development host system that runs a cross-assembler or cross-compiler capable of generating Z80 code. Such hosts include the VAX and Zilog's System 8000 (running the UNIX* operating system). Only a simple upload and download utility is needed for operation, since communication between the Z-SCAN 80 Emulator and the host is through a standard serial port using Tektronix (Tek) hex or Intel hex format.

For More Information. Circle No. 48

Z8000™ Development Module

FEATURES

- Z8001/Z8002 CPU evaluation and debug support
- 16K Words dynamic RAM (expandable to 32K for user code execution and debug
- 32 programmable I/O lines
- EPROM monitor and debugger
- Transparent operation allows software development without disconnection from CRT and host system
- RS-232C standard serial interfaces compatible with most CRT terminals and development hosts
- Wire-wrap area for prototyping

The Z8000 Development Module is a complete, single-board microcomputer that is used as a tool for the evaluation and debug of Z8000-based microprocessor systems. The Development Module is used in the first stages of the design and development process, not only as a tool for evaluating Z8000 microprocessor capabilities, but also as an environment in which code can be executed and debugged.

Z8000™ Emulator Z-SCAN 8000

FEATURES

- Provides real time emulation up to 4 MHz of the Z8001 and Z8002 CPUs.
- Two RS-232C serial ports make it a peripheral usable with most standard CRTs and software hosts.
- Transparent operation permits direct communication between CRT and host without physical disconnect.
- Highly interactive, screen-oriented user interface makes Z-SCAN easy to use.
- Shadow monitor removes all restrictions on target system memory space, making it fully available to the user.
- High-speed mappable memory (no wait states) is available to simulate target system RAM/ROM.

The Z-SCAN 8000 Emulator is an in-circuit emulator that has been designed as a peripheral unit for Zilog's Z8001 and Z8002 16-bit microprocessors. Interfacing via two RS-232C serial ports to host and CRT terminal, Z-SCAN 8000 can work with Zilog's family of development hosts.

Because it employs a standard serial interface, Z-SCAN 8000 can also be used with virtually any software host system that runs a cross assembler or cross compiler capable of generating Z8000 code. Communication between the host system and Z-SCAN 8000 is with a standard serial format requiring only a simple upload and download utility to operate. For PROM-based target systems, Z-SCAN can operate stand-alone with a CRT terminal because the monitor and debug software is EPROM-resident.

EMS 8000 Emulator System

FEATURES

- Snapshot feature permits partitioning of a large realtime trace module into many small trace memories.
- Up to 126K bytes of high-speed, static mappable memory can be accessed by the target system.
- A pulse output feature permits use of a high-end logic analyzer.
- Network debugging is supported.
- Full access is permitted to the target microprocessor's registers, memory and I/O space.
- A "transparent" mode allows the same terminal to be used for host and EMS user interface.
- Emulates Z8001/3 or Z8002 CPUs at 6MHz clock rates.
- Complex triggering.

EMS (Continued)

- Large real-time trace buffer.
- Large mappable memory space.
- Real-time partitionable trace module for multiple recordings of program execution.
- Three parallel event comparators that can be allocated for trigger, trace, breakpoint recognition, and enable/disable functions.
- General-purpose counter for benchmarking critical software routines.

The Emulator System 8000 (EMS) is a state-of-the-art incircuit subsystem. The EMS supports the software/hardware engineer in developing products using the Zilog Z8000 family of microprocessors and peripheral components. Combined with Zilog's enhanced UNIX* System (ZEUS), EMS 8000 provides the designer with a complete and powerful set of tools for speeding up the product development cycle.

The EMS links the application software developed on a host system and the target system, and aids in the integration of the software into the target system by executing in a real-time environment. The EMS uses the full capability of the target microprocessor and can start or stop program execution or perform single-step execution. The user has full access to the target microprocessor's registers, memory, and I/O space.

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*UNIX is a trademark of Bell Laboratories

System 8000™

FEATURES

- UNIX* operating system including the full-screen vi editor, record locking and C-ISAM™.
- Media and software compatibility with System 8000 family.
- Integral cartridge tape drive for disk backup.
- Supports multiple industry languages such as Pascal, Fortran and C.
- Optional Intelligent Communications Processor supports popular protocols.

The System 8000 Family members are high-performance, multi-user, UNIX supermicro computer systems designed for today's demanding business applications. Zilog is committed to the development of the System 8000 family of products over the long term. In so doing we can provide the tools for the user whose commercial and technical applications need to keep pace with technology developments.

Designed for performance, reliability, and growth, the System 8000 family of supermicros offers exceptional performance in cost-effective microcomputers. And, every System 8000 is backed by three levels of support including local field engineers, technical hardware and software specialists, and the Technical Support Center at Zilog's headquarters in Campbell, CA. Additional support in the form of classes for System 8000 customers is also available.

Model 11, Model 11 Plus. Both models are part of Zilog's System 8000 family, which has enjoyed years of trouble-free operation by thousands of satisfied users.

These systems use field-proven, state-of-the-art VLSI components such as Zilog's Z8001®B 16-bit CPU which is supported by three Z8010™B Memory Management Units.

The Model 11 Plus supports up to sixteen users and eight users can be supported on the Model 11. There is an Integral 52MB disk on the Model 11 Plus and a 19MB disk on the Model 11 with one-disk expansion. Both systems hold up to 1MB of memory.

Model 21 Plus and Model 31 Plus. The System 8000 Models 21 Plus and 31 Plus support up to 24 users-from the novice to the sophisticated programmer, with each user performing a different task simultaneously. The Model 21 Plus supports up to four integral 52MB disks and has up to 4MB of memory. The Model 31 Plus supports up to four integral high-performance 168MB disks and has up to 4MB of memory. Both models offer an optional industry-standard 9-track, half inch tape drive and an optional IEEE 754 hardware Floating-Point Processor, with 3.28 msec, double precision, extended-multiply time.

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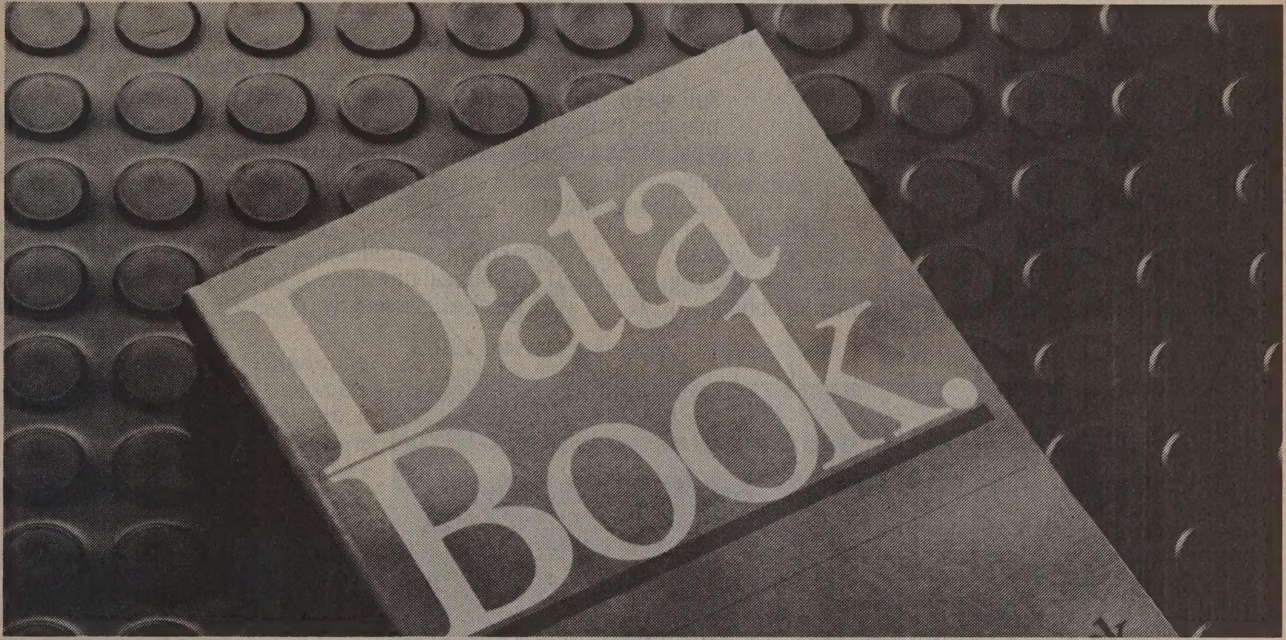
For More Information. Circle No. 48

WHEN IT COMES TO MICROPROCESSORS, WE WROTE THE BOOK.



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There's a lot to see, because whether you're designing airplanes, appliances, games or systems architecture, we have a full family of microprocessors for you to consider.

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Then there's our 6500 family. Not only are we the largest non-captive source for it, we're now sampling a CMOS version of the SY6502 (SY65C02).

And last but not least, our SY8048 8-bit microcontroller. (We're engaged in some rather active family planning for it.)

So why not include Synertek in your design plans. We back every one of our microprocessors with more than a decade of experience. And with our massive research and development resources.

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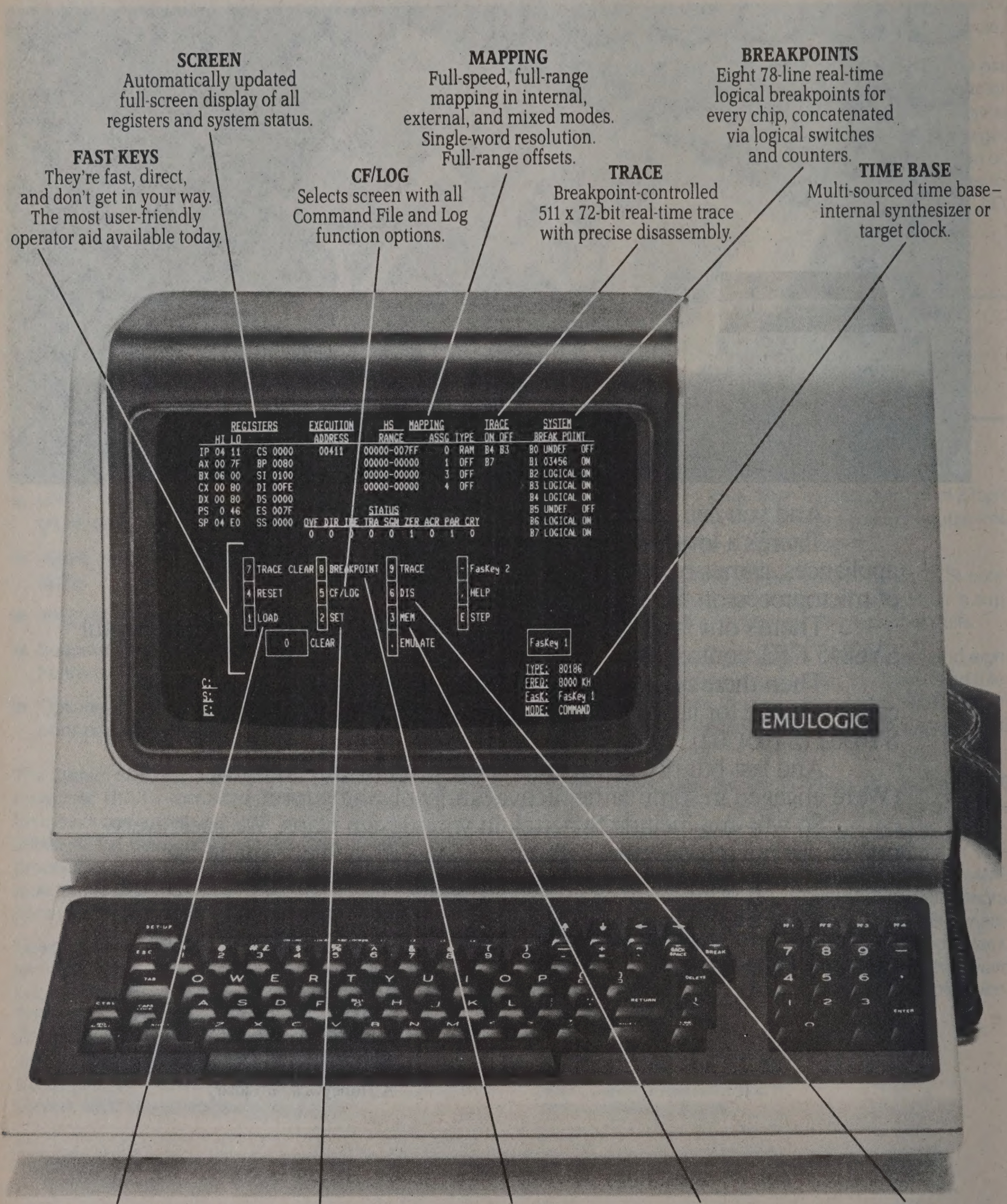
THE EMULOGIC® ECL-3211.



```
     REGISTERS      EXECUTION   HS   MAPPING          TRACE      SYSTEM
   HI LO             ADDRESS   RANGE        ASSG TYPE  ON OFF    BREAK POINT
IP 04 11   CS 0000   00411    00000-007FF     0  RAM  B4 B3    B0 UNDEF   OFF
AX 00 7F   BP 0080            00000-00000     1  OFF  B7       B1 03456   ON
BX 06 00   SI 0100            00000-00000     3  OFF           B2 LOGICAL ON
CX 00 80   DI 00FE            00000-00000     4  OFF           B3 LOGICAL ON
DX 00 80   DS 0000                                             B4 LOGICAL ON
PS  0 46   ES 007F              STATUS                         B5 UNDEF   OFF
SP 04 E0   SS 0000  OVF DIR INE TRA SGN ZER ACR PAR CRY        B6 LOGICAL ON
                     0   0   0   0   0   1   0   1   0         B7 LOGICAL ON

        7 TRACE CLEAR 8 BREAKPOINT  9 TRACE     - FasKey 2
        4 RESET       5 CF/LOG      6 DIS       , HELP
        1 LOAD        2 SET         3 MEM       E STEP
           0    CLEAR               . EMULATE
                                                  FasKey 1
C:                                               TYPE:  80186
S:                                               FREQ:  8000 KH
E:                                               FasK:  FasKey 1
                                                 MODE:  COMMAND
```

SCREEN
Automatically updated full-screen display of all registers and system status.

MAPPING
Full-speed, full-range mapping in internal, external, and mixed modes. Single-word resolution. Full-range offsets.

BREAKPOINTS
Eight 78-line real-time logical breakpoints for every chip, concatenated via logical switches and counters.

FAST KEYS
They're fast, direct, and don't get in your way. The most user-friendly operator aid available today.

CF/LOG
Selects screen with all Command File and Log function options.

TRACE
Breakpoint-controlled 511 x 72-bit real-time trace with precise disassembly.

TIME BASE
Multi-sourced time base–internal synthesizer or target clock.

LOAD
Selects LOAD screen with all options.

SET
Selects screen with all SET options.

BREAKPOINT
Selects screen with all BREAKPOINT options.

MEM
Selects screen with all MEMORY options.

DIS
Selects screen with all DISASSEMBLY options.

For More Information. Circle No. 49

STILL THE BEST MICROPROCESSOR DEVELOPMENT SYSTEM YOU CAN GET. AT ANY PRICE.

WORLD'S BEST EMULATOR.

It's the best you can buy. Pure and simple.

Built around DEC's LSI-11 CPU's, RT-11, and a full range of DEC options like RL02 hard disks, the Emulogic general purpose emulator supports more chips from more manufacturers better than any other system.

With the ECL-3211 you can find your bugs in the lab, before your customers find them in the field. It lets you probe into things that other systems can't even see. In fact, you probably can't define a condition that the 3211 can't trap. And yet it's easy to use.

"NO-WAIT-STATE" EMULATION.

Up to the full rated speed of every chip with all features implemented. Doesn't steal any interrupts, stack pointers, stack space, or memory space. Handles all types of interrupts in any mapping configuration. Logical switches, counters, and trigger outputs manipulated in real time at no cost to user program.

COMPLETE HELP FACILITIES.

Our new "FAST KEYS" and Advanced Command Syntax make it a snap to learn to use. You don't even have to read the manual to get started.

And once you've used it for one chip, you don't have to learn anything new for the next chip. The screen format is uniform for all chips, and all system functions are the same. All you have to learn is the chip itself.

WORLD'S BEST DEVELOPMENT SOFTWARE.

More powerful and easier to use than any in the field, the software tools available with every ECL-3211 let you develop and debug software as readily as hardware. So system integration gets done effectively and on schedule.

DEC Operating System. RT-11 Version 5 is standard for stand-alone ECL-3211's. (RSX-11M and VMS for multi-user systems.) It's the latest update of the field-proven PDP-11 operating system.

Keypad Editor. Full-screen-oriented KED Keypad editor that makes full use of DEC terminal functions.

Assemblers/Linkers. MACRO-11-based cross-assemblers and linkers for every chip. Mnemonics identical to original chip manufacturers. Pseudo-ops and directives of MACRO-11. No relearning from chip to chip.

Pascal/C Compilers. Available for most chips, they are true cross-compilers that produce executable code that can be run on the ECL-3211 or the target chip. Permit linking of assembly-level and compiler-level symbols and include utilities for standard load module format conversions.

High-Level Debuggers. Permit user to modify Pascal and "C" variables in the format of the high-level language. User can debug completely within the high-level language without reference to assembly-level parameters.

Advanced Command Syntax. Expanded HELP facility, new memory display and MOVE commands, greatly enhanced command file functions.

Now you can activate command files from breakpoints as well as the keyboard, include pauses for user response, nest multiple files up to five levels deep. With the new LOG command you can store any sequence of operations for later use.

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WORLD'S BEST MULTI-USER SYSTEMS.

If you need to coordinate the work of a team of hardware and software engineers, don't forget to check into Emulogic's multi-user systems:

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EMUNET-2. VMS-based system for the VAX family. Up to 60 users. Easy migration from stand-alone ECL-3211's and from EMUNET-1.

For more information on the ECL-3211 or our multi-user systems, contact EMULOGIC, Inc., Three Technology Way, Norwood, MA 02062, 617-329-1031 or 800-435-5001.

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DEVELOPMENT SYSTEMS

CMA CUSTOM MOS ARRAYS, INC.

211 TOPAZ STREET, MILPITAS, CA 95035
(408) 946-9111 TWX: 910-3388-2304

GENERAL: CMA manufacturers Gate Arrays, Standard Cell (Structured Cell) and Full Custom IC utilizing 2.5 MICRON and 2.0 MICRON SINGLE LAYER METAL and DUAL LAYER METAL HCMOS process respectively.

2.5 MICRON HCMOS PROCESS

DC CHARACTERISTICS (T_A=0~70°C, V_{CC}=5V ±10%)

Symbol	Parameter	Test Conditions	Limits Min.	Typ.	Max.	Unit
V_{IH}	High-level input voltage		2.0		V_{CC}	V
V_{IL}	Low-level input voltage		−0.3		0.8	V
V_{OH}	High-level output voltage	I_{OH}=+1 mA	2.4			V
V_{OL}	Low-level output voltage	I_{OL}=4 mA			0.4	V
I_{IL}	Input current	V_I=0~5.5V			±10	μA

2.5 MICRON HCMOS PROCESS

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Conditions	Limits	Unit
V_{CC}	Supply voltage	With respect to GND	−0.3~7	V
V_I	Input voltage		−0.3~7	V
T_{opg}	Operating ambient temperature (Military)		−55~+125	°C
T_{opg}	Operating ambient temperature (Commercial)		0~70	°C
T_{stg}	Storage temperature (Hermetic)		−65~150	°C
T_{stg}	Storage temperature (Plastic)		−40~125	°C

PRODUCT OUTLINE:

1. 2.5 MICRON HCMOS GATE ARRAYS:

ARRAY #	COMPLEXITY # OF 2 INPUT NAND EQUIV.	MAXIMUM I/O PADS.
CMA 2002	200	42
" 2004	400	40
" 2008	800	60
" 2015	1500	80
" 2018	1800	128
" 2026	2600	146
" 2031	3100	110

2. 2.0 MICRON HCMOS GATE ARRAYS:

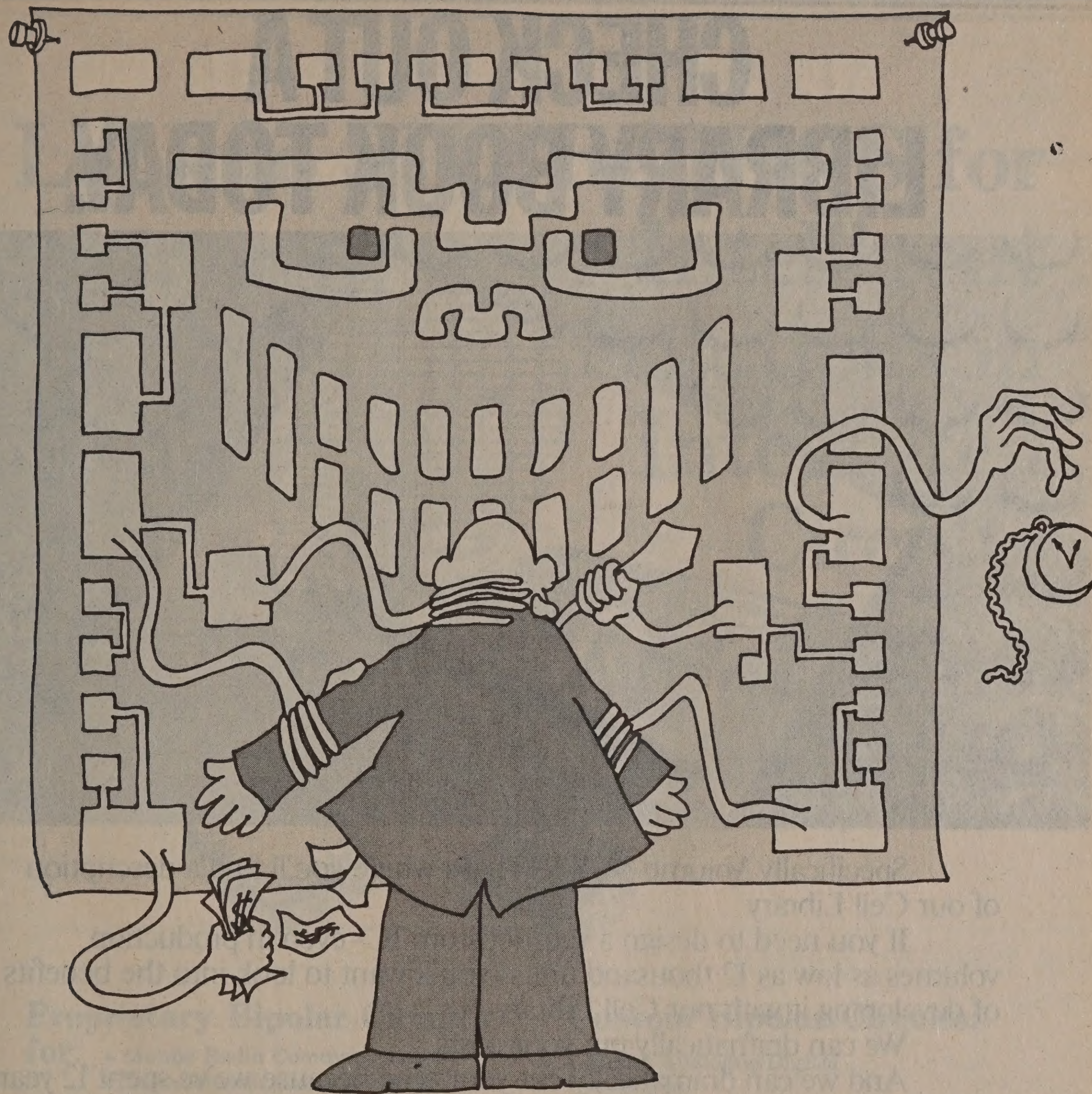
ARRAY #	COMPLEXITY # OF 2 INPUT NAND EQUIV.	MAXIMUM I/O PADS.
CMA 1002	250	40
" 1005	500	60
" 1010	1000	80
" 1015	1500	132
" 1020	2000	100
" 1030	3000	150
" 1045	4500	180
" 1060	6000	240

3. 2.5/2.0 MICRON STANDARD CELL LIBRARY:
   CMA has to date (7-24-84) 150 macro cells and macro functions in the Standard Cell library.

*INFORMATION CONTAINED IN THIS DATA SHEET IS SUBJECT TO CHANGE WITHOUT NOTICE.

TO REQUEST MORE INFORMATION SEE OUR IMMEDIATE ACTION CARD, VOL. 4

For More Information. Circle No. 50



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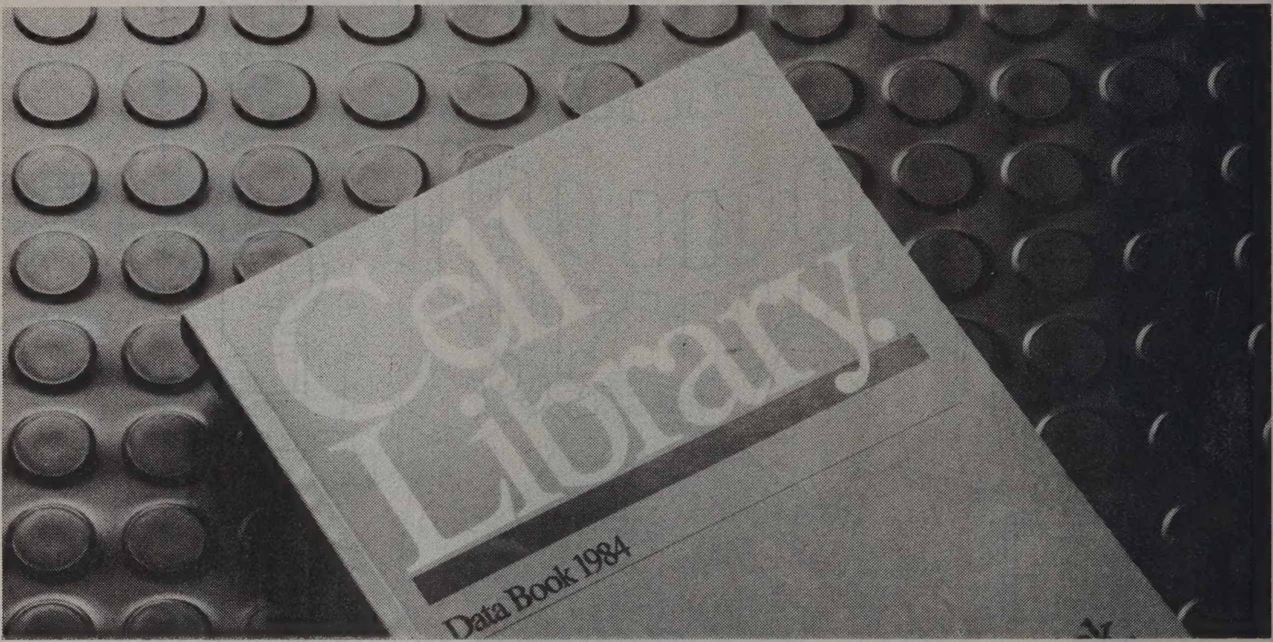

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For More Information. Circle No. 52

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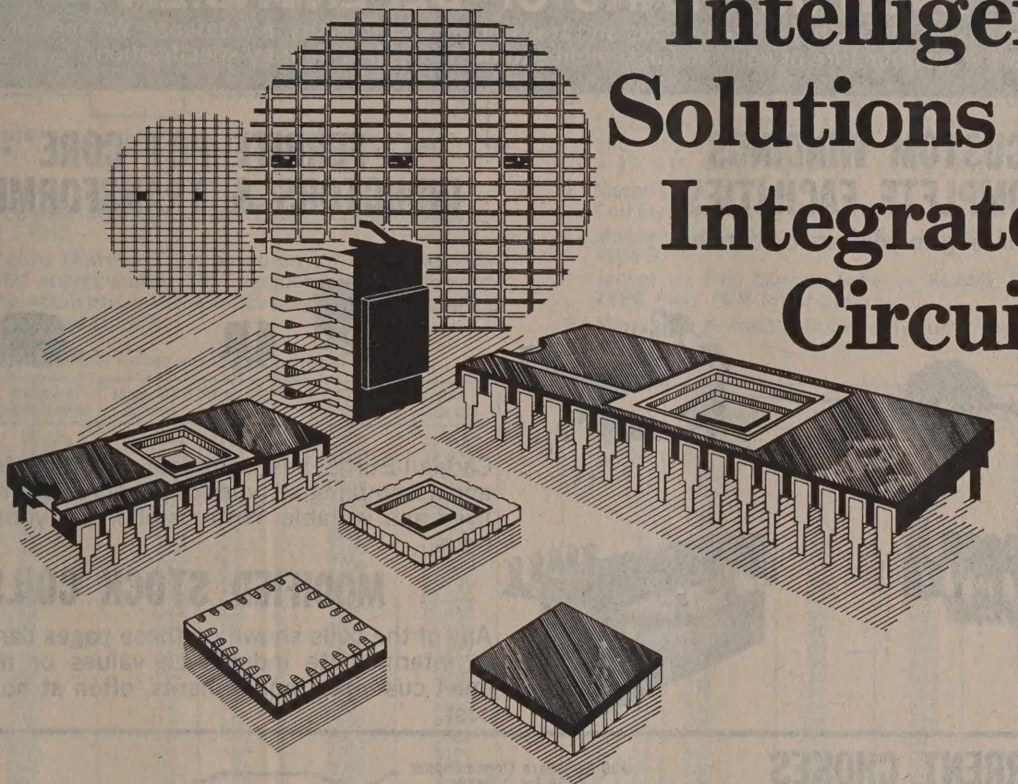

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Mineola, New York 11501-3597
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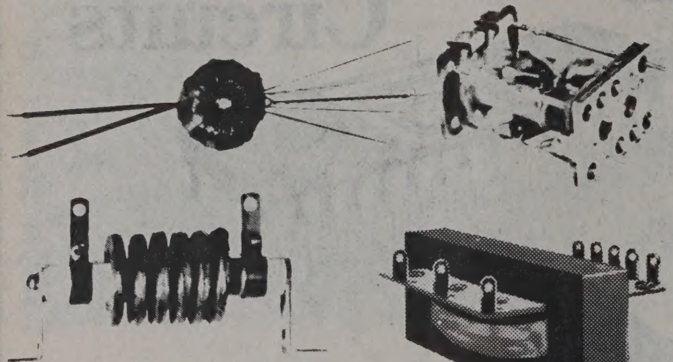

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MODIFIED STOCK COILS

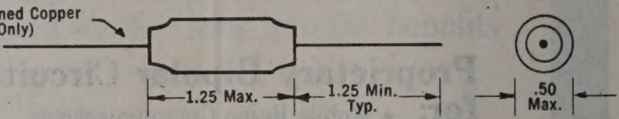
Any of the coils shown on these pages can be wound to intermediate inductance values or modified to meet customer requirements, often at no additional cost.

HIGH CURRENT CHOKES

TYPE 6150 10-100μH
Recommended mounting pitch — 1.50″

NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on .75 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.



STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance*	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	INCR I Amps
6150-1	10μH	30	2.5	.018	10	6.40	21
6150-2	20	18	2.5	.036	7.2	4.50	15
6150-3	30	12	2.5	.063	5.0	3.40	13
6150-4	40	12	2.5	.096	4.3	2.75	12
6150-5	50	10	2.5	.110	3.7	2.60	10
6150-6	75	8	2.5	.200	3.2	1.90	9
6150-7	100	26	.79	.400	2.2	1.30	7.8

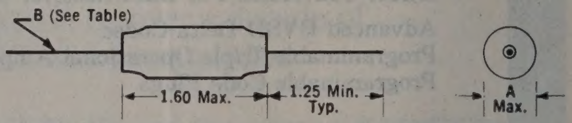
*(−10, +20%)

HIGH CURRENT CHOKES

TYPE 6490 10μH-1.0mH 10% Tolerance
Recommended mounting pitch — 1.75″

NOTES:

1. Inductance measured on General Radio 1650B Impedance Bridge at 1 kHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.
   Lead Wires — Bare tinned copper.



STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	INCR I Amps	A Dia. In.	B Lead Size AWG
6490-1	10μH	.010	12.0	10.0	20	.65	14
6490-2	20	.017	9.0	7.7	16	.62	16
6490-3	30	.031	6.0	5.7	12	.61	18
6490-4	40	.050	5.0	4.5	11	.60	20
6490-5	50	.068	4.5	3.8	10	.59	20
6490-6	75	.13	3.4	2.8	9.0	.58	20
6490-7	100	.056	1.5	4.2	7.0	.79	18
6490-8	250	.14	0.90	2.7	4.5	.75	20
6490-9	500	.30	0.60	1.8	3.3	.72	20
6490-10	750	.56	0.45	1.3	2.6	.68	20
6490-11	1.0mH	.80	0.35	1.1	2.3	.66	20

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QUALITY COILS SINCE 1946
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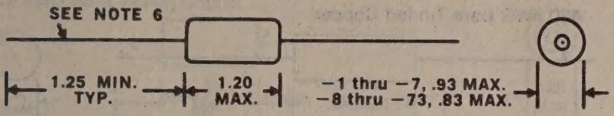
HIGH CURRENT CHOKES

TYPE 6950 10μH - 10H — 10% Tolerance
Recommended mounting pitch — 1.40″



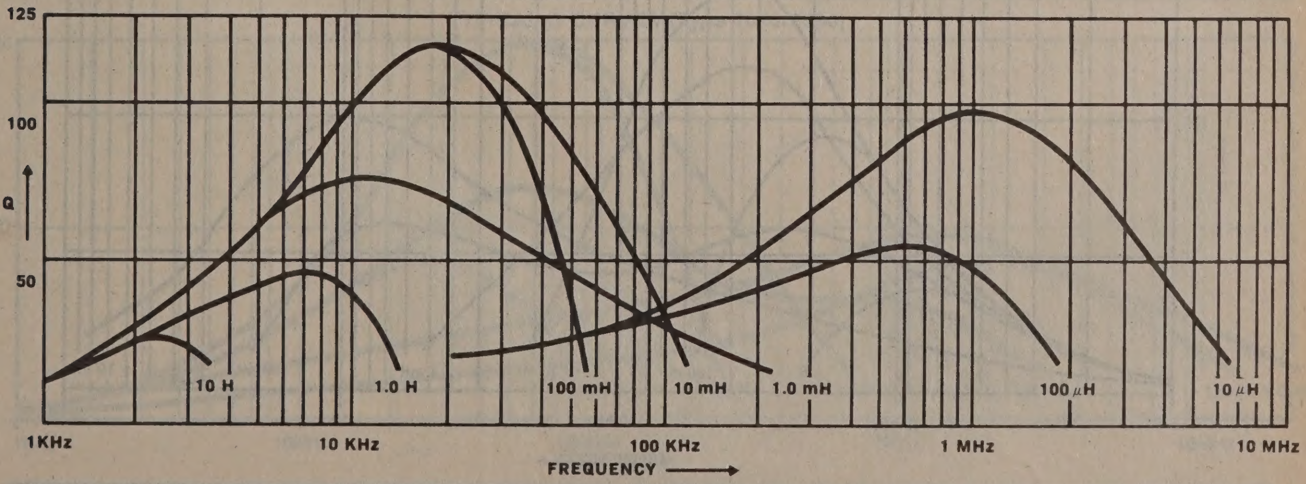
NOTES:

1. Inductance measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage — 1000 VRMS.
5. Operating temperature range: −55° to +105°C.
6. Leads are bare tinned copper: −1 thru −7, #14 AWG; −8 and −9, #16 AWG; −10 thru −14, #18 AWG; −15 thru −17, #19 AWG; −18 thru −73, #20 AWG.
7. Materials:
   Coil Form — Ferrite
   Magnet Wire — Per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B)
   Jacket — PVC Shrink Tube — FLAME RETARDANT UL TYPE FR-1 PER MIL-I-23053
8. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-01	10 μH	.007	12	12,000	35,000
-02	12	.008	8.0	11,200	32,600
-03	15	.009	6.0	10,500	28,400
-04	18	.010	5.7	10,000	25,900
-05	22	.011	5.3	9500	23,800
-06	27	.012	5.0	9100	21,000
-07	33	.013	4.5	8800	18,700
-08	39	.020	3.4	7100	17,600
-09	47	.022	3.2	6700	16,300
-10	56	.034	2.6	5400	14,700
-11	68	.038	2.4	5100	13,300
-12	82	.042	2.2	4900	12,400
-13	100	.048	1.9	4600	11,100
-14	120	.054	1.7	4300	10,100
-15	150	.073	1.5	3700	9100
-16	180	.082	1.3	3500	8300
-17	220	.091	1.2	3300	7500
-18	270	.12	1.1	2900	6800
-19	330	.13	1.0	2800	6100
-20	390	.18	.92	2400	5600
-21	470	.20	.84	2200	5100
-22	560	.26	.78	2000	4700
-23	680	.30	.69	1800	4300
-24	820	.40	.56	1600	3900
-25	1.0 mH	.45	.54	1500	3500
-26	1.2	.50	.50	1400	3200
-27	1.5	.70	.45	1200	2900
-28	1.8	.80	.43	1100	2600
-29	2.2	1.1	.42	950	2400
-30	2.7	1.2	.40	910	2100
-31	3.3	1.6	.28	790	1900
-32	3.9	1.8	.26	750	1800
-33	4.7	2.4	.23	650	1600
-34	5.6	2.6	.21	620	1500
-35	6.8	3.0	.20	580	1300
-36	8.2	4.0	.19	500	1200
-37	10	4.6	.18	470	1100
6950-38	12 mH	6.1	.16	400	1000
-39	15	7.1	.15	380	910
-40	18	9.6	.14	320	830
-41	22	11	.12	300	750
-42	27	13	.095	280	680
-43	33	15	.085	260	610
-44	39	21	.077	220	560
-45	47	24	.067	200	510
-46	56	33	.065	180	470
-47	68	36	.062	170	430
-48	82	41	.057	160	390
-49	100	55	.051	140	350
-50	120	60	.048	130	320
-51	150	84	.040	110	290
-52	180	94	.033	100	260
-53	220	110	.032	95	240
-54	270	127	.030	88	210
-55	330	165	.027	78	190
-56	390	220	.023	67	180
-57	470	240	.021	65	160
-58	560	330	.020	55	150
-59	680	360	.017	53	130
-60	820	400	.016	50	120
-61	1.0 H	570	.014	42	110
-62	1.2	650	.013	40	100
-63	1.5	740	.012	37	90
-64	1.8	1000	.011	32	83
-65	2.2	1100	.010	30	75
-66	2.7	1500	.0090	26	68
-67	3.3	1700	.0085	24	61
-68	3.9	2200	.0080	21	56
-69	4.7	2500	.0073	20	51
-70	5.6	3500	.0062	17	47
-71	6.8	4000	.0058	16	43
-72	8.2	4800	.0050	15	39
-73	10	5400	.0042	14	35

TYPICAL Q CURVES — (TYPE 6950)



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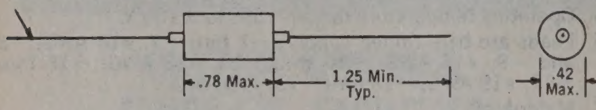
Area Code 516 746-2310

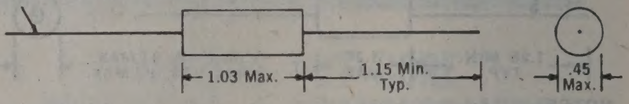
HIGH CURRENT CHOKES

10μH-1.0H. 10% Tolerance. Recommended Mounting Pitch — 1.25"

TYPE 6860



TYPE 6870 (EPOXY ENCAPSULATED VERSION)



NOTES: (FOR BOTH TYPES)

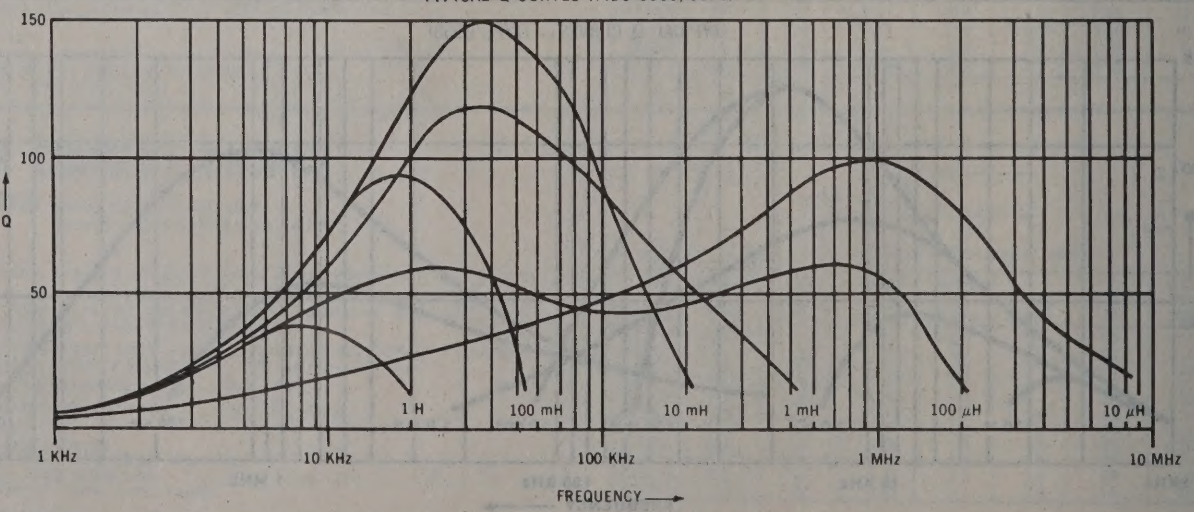
1. Inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inducance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range — 55° to + 105°C.
6. Materials:
   Coil Form: Ferrite.
   Cover: TYPE 6860 - Polyester alpha-cellulose.
   Coating: Polyurethane per MIL-1-46058.
   TYPE 6870- Cover & Coating: Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—01	10 μH	.023	45	4600	3200
—02	12	.025	40	4500	2900
—03	15	.030	32	4100	2600
—04	18	.032	21	3900	2400
—05	22	.035	12	3700	2200
—06	27	.038	8.5	3600	2000
—07	33	.043	5.8	3400	1800
—08	39	.047	3.5	3200	1700
—09	47	.054	3.2	3000	1500
—10	56	.060	2.9	2900	1400
—11	68	.068	2.7	2700	1200
—12	82	.073	2.5	2600	1100
—13	100	.098	2.3	2300	1000
—14	120	.14	2.1	1900	930
—15	150	.18	1.9	1700	830
—16	180	.20	1.5	1600	760
—17	220	.28	1.3	1400	680
—18	270	.31	1.3	1300	620
—19	330	.35	1.2	1200	560
—20	390	.38	1.1	1100	510
—21	470	.44	1.0	1050	460
—22	560	.48	.90	1000	430
—23	680	.63	.80	890	390
—24	820	.87	.72	760	350
—25	1.0 mH	.96	.65	720	320
—26	1.2	1.3	.62	620	290
—27	1.5	1.4	.58	600	260
—28	1.8	1.7	.53	540	240
—29	2.2	2.3	.44	470	220
—30	2.7	2.6	.39	440	190
—31	3.3	3.5	.36	380	180

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
—32	3.9 mH	3.8	.34	360	160
—33	4.7	4.3	.32	340	150
—34	5.6	5.6	.26	300	140
—35	6.8	6.3	.24	280	120
—36	8.2	8.6	.21	240	110
—37	10	9.7	.20	220	100
—38	12	11	.19	210	92
—39	15	15	.17	180	84
—40	18	20	.14	160	75
—41	22	24	.13	140	68
—42	27	26	.12	130	62
—43	33	35	.10	120	56
—44	39	38	.95	110	51
—45	47	50	.80	100	47
—46	56	55	.72	95	43
—47	68	76	.66	81	39
—48	82	86	.62	76	35
—49	100	99	.57	71	32
—50	120	110	.52	67	29
—51	150	200	.47	50	26
—52	180	220	.43	48	24
—53	220	300	.38	41	22
—54	270	320	.35	40	20
—55	330	420	.32	35	18
—56	390	480	.29	32	16
—57	470	670	.26	27	15
—58	560	730	.24	26	14
—59	680	870	.19	24	12
—60	820	950	.18	23	11
—61	1.0 H	1100	.17	21	10

TYPICAL Q CURVES (Tvpe 6860/6870)



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QUALITY COILS SINCE 1946

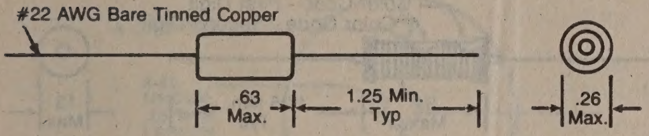
CADDELL-BURNS

40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

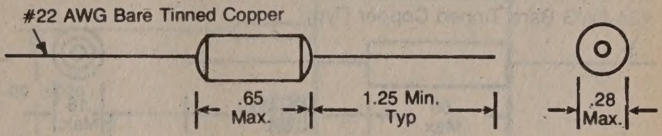
MINIATURE HIGH CURRENT CHOKES

1.0μH - 100mH. 10% Tolerance. Recommended Mounting Pitch — .80"

TYPE 7070



TYPE 7080 (EPOXY ENCAPSULATED VERSION)



NOTES: (FOR BOTH TYPES)

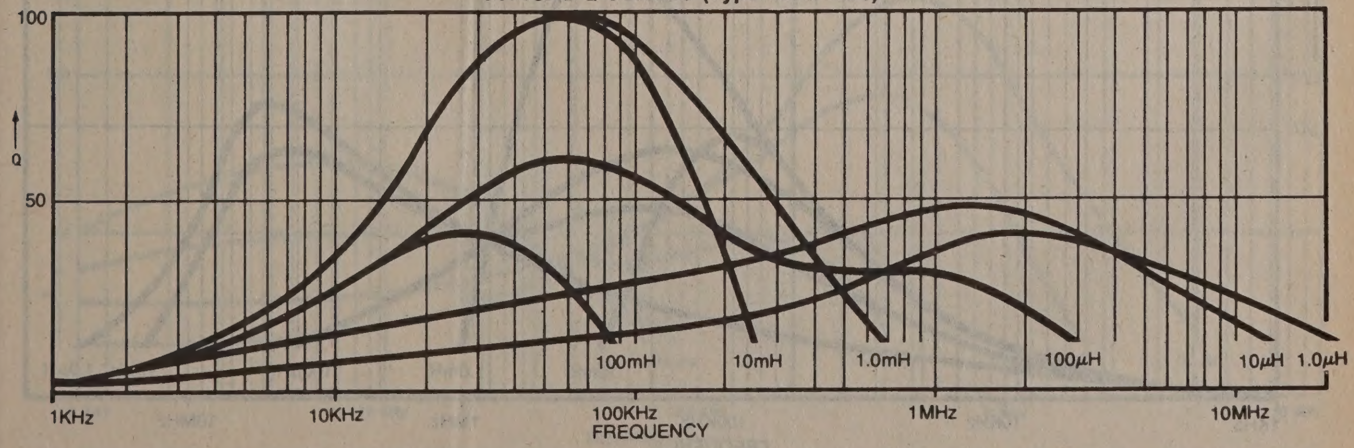
1. INDUCTANCE:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305.
   For 10μH thru 100mH; inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: TYPE 7070 - PVC shrink tube-flame retardant UL type FR-1 per MIL-I-23053
   TYPE 7080 - Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

DASH NO.	NOMINAL INDUCTANCE	MAX.DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-01	1.0μH	.010	155	5,000	6,400
-02	1.2	.011	148	4,800	6,000
-03	1.5	.012	128	4,600	5,000
-04	1.8	.013	120	4,400	4,500
-05	2.2	.014	108	4,200	4,100
-06	2.7	.015	100	4,100	3,600
-07	3.3	.016	96	4,000	3,200
-08	3.9	.017	90	3,800	3,000
-09	4.7	.022	85	3,400	2,700
-10	5.6	.028	76	3,000	2,500
-11	6.8	.031	70	2,800	2,300
-12	8.2	.035	51	2,700	2,000
-13	10	.038	35	2,600	1,900
-14	12	.043	21	2,400	1,700
-15	15	.049	14	2,300	1,500
-16	18	.054	10	2,200	1,400
-17	22	.059	8.0	2,100	1,300
-18	27	.070	6.5	1,900	1,100
-19	33	.077	6.1	1,800	1,000
-20	39	.084	5.7	1,700	940
-21	47	.093	5.1	1,600	870
-22	56	.12	4.3	1,500	790
-23	68	.13	3.6	1,400	710
-24	82	.16	3.2	1,300	650
-25	100	.24	3.0	1,000	590
-26	120	.32	2.7	880	540
-27	150	.43	2.1	760	480
-28	180	.48	1.7	720	440
-29	220	.55	1.6	670	400
-30	270	.62	1.5	640	360

DASH NO.	NOMINAL INDUCTANCE	MAX.DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-31	330μH	.72	1.4	590	320
-32	390	.79	1.3	560	300
-33	470	.88	1.2	530	270
-34	560	1.2	1.1	460	250
-35	680	1.5	1.0	410	230
-36	820	1.7	.96	380	210
-37	1.0mH	1.9	.88	360	190
-38	1.2	2.4	.78	320	170
-39	1.5	2.8	.64	300	150
-40	1.8	3.1	.60	280	140
-41	2.2	4.5	.54	240	120
-42	2.7	5.8	.44	210	110
-43	3.3	8.1	.43	180	100
-44	3.9	8.9	.40	170	95
-45	4.7	10	.38	160	86
-46	5.6	11	.35	150	79
-47	6.8	15	.29	130	72
-48	8.2	17	.26	120	65
-49	10	22	.24	110	59
-50	12	26	.23	100	54
-51	15	34	.19	86	48
-52	18	39	.17	80	44
-53	22	54	.16	68	40
-54	27	62	.15	64	36
-55	33	82	.12	55	32
-56	39	93	.11	52	30
-57	47	120	.096	46	27
-58	56	130	.092	44	25
-59	68	190	.088	36	23
-60	82	210	.080	35	21
-61	100	270	.074	30	19

TYPICAL Q CURVES (Type 7070/7080)



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QUALITY COILS SINCE 1946

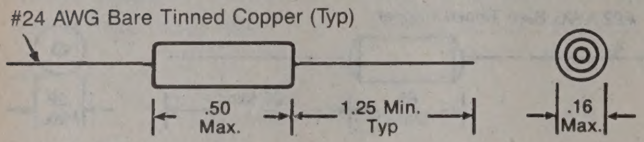
CADDELL-BURNS

40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

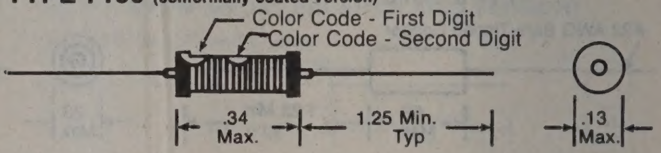
MINIATURE HIGH CURRENT CHOKES

1.0μH - 10mH. 10% Tolerance. Recommended Mounting Pitch — .60″

TYPE 7120



TYPE 7130 (conformally coated version)



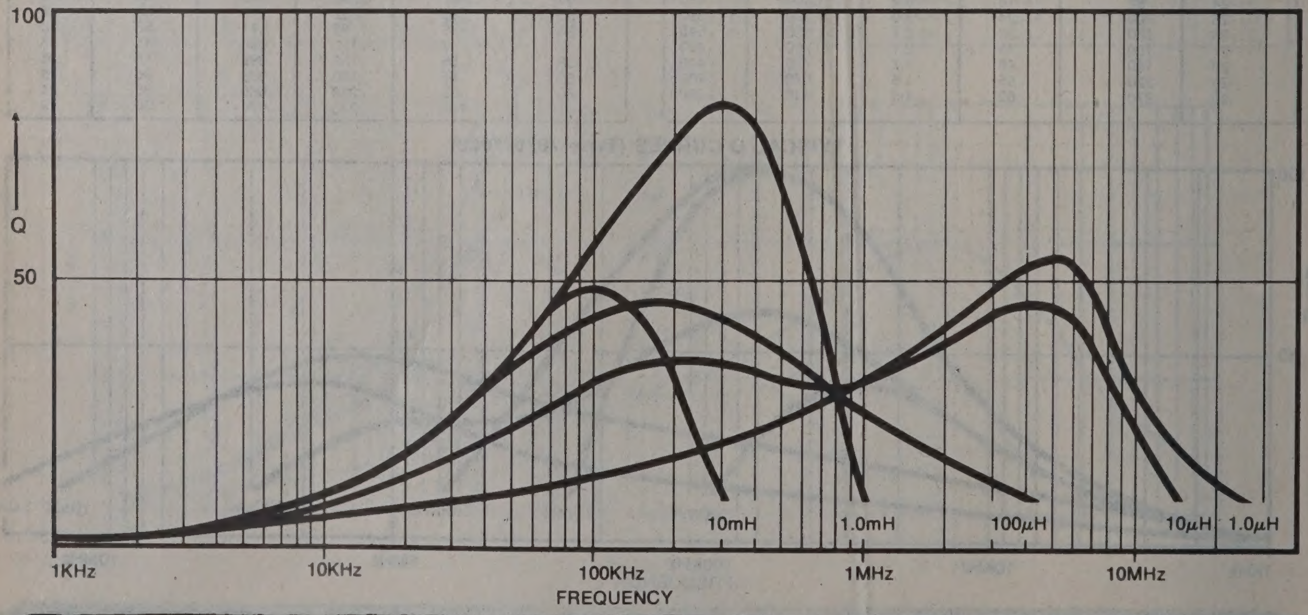
NOTES: (FOR BOTH TYPES)

1. Inductance:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305. For 10μH thru 10mH, inductance (Ls) measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated 1 DC) is based on 0.2 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR 1) is the minimum current at which the inductance will be decreased by 5% from its initial (zero - DC) value because of saturation.
4. Dielectric Withstanding Voltage:
   Type 7120 - 1000 VRMS
   Type 7130 - 100 VRMS
5. Operating temperature range -55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: Type 7120 - PVC shrink tube - flame retardant UL type FR-1 per MIL-I-23053.
   Type 7130 - conformally coated with Polyurethane per MIL-I-46058
   Magnet Wire: Per FED SPEC J-W-001177/9
   (MIL-W-583 Type B)
7. Marking:
   Type 7120 - Printed with part number
   Type 7130 - Color coded per dash number using standard EIA color code.

STANDARD VALUES (Electrical Characteristics are identical for both types. Other values are available on special order.)

DASH NO.	NOMINAL INDUCTANCE	MAX. DCR OHMS	MIN.SRF MHz	RATED IDC ma	INCR I ma
-01	1.0μH	.018	190	3300	3000
-02	1.2	.019	170	3200	2700
-03	1.5	.020	160	3100	2500
-04	1.8	.023	150	2900	2100
-05	2.2	.031	130	2600	2000
-06	2.7	.033	120	2500	1900
-07	3.3	.054	110	1900	1700
-08	3.9	.060	100	1800	1500
-09	4.7	.068	86	1700	1400
-10	5.6	.074	64	1600	1300
-11	6.8	.080	44	1600	1200
-12	8.2	.087	32	1500	1100
-13	10	.095	25	1500	970
-14	12	.11	17	1400	880
-15	15	.15	13	1200	790
-16	18	.16	10	1100	710
-17	22	.19	8.4	1000	640
-18	27	.22	8.0	950	580
-19	33	.24	7.6	910	530
-20	39	.26	7.1	880	480
-21	47	.35	6.0	760	430
-22	56	.47	5.8	650	400
-23	68	.53	4.3	610	370
-24	82	.60	4.1	580	330
-25	100	.67	3.9	550	300
-26	120μH	.90	3.6	470	270
-27	150	1.2	3.2	410	250
-28	180	1.4	2.8	380	220
-29	220	1.9	2.3	320	200
-30	270	2.1	2.1	310	180
-31	330	2.4	1.9	290	170
-32	390	3.0	1.7	260	150
-33	470	3.4	1.4	240	140
-34	560	4.7	1.3	210	130
-35	680	6.4	1.2	180	110
-36	820	7.1	1.1	170	100
-37	1.0mH	7.9	1.0	160	95
-38	1.2	9.0	.94	150	87
-39	1.5	12	.76	130	78
-40	1.8	14	.72	120	71
-41	2.2	19	.64	100	64
-42	2.7	25	56	90	58
-43	3.3	29	53	83	52
-44	3.9	34	48	77	48
-45	4.7	37	.45	74	44
-46	5.6	50	.40	63	40
-47	6.8	58	.36	59	36
-48	8.2	68	.29	54	33
-49	10	75	.27	52	30

TYPICAL Q CURVES (TYPE 7120/7130)



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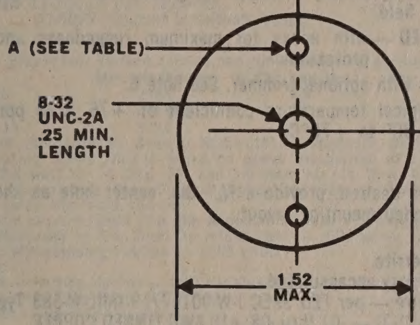
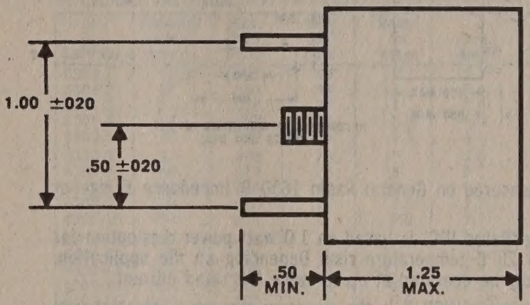
CADDELL-BURNS

40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

HIGH CURRENT CHOKES

TYPE 7000 10 μH — 10 mH — 10% Tolerance





NOTES:

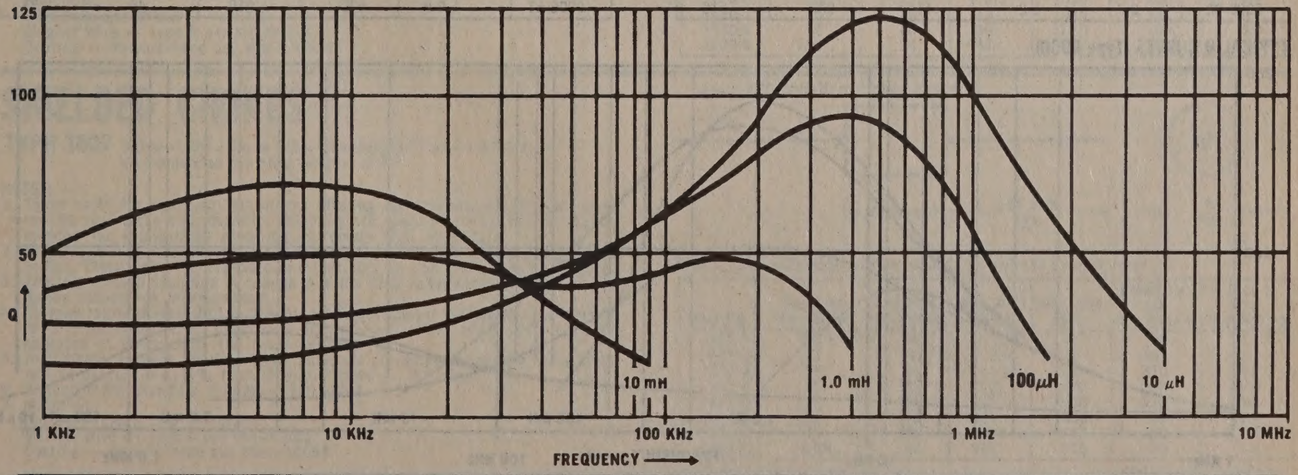
1. Inductance measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated IDC) is based on 3.0 watts power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage (winding to case and mounting stud) — 500 VRMS.
5. Operating temperature range: −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B).
   Leads — Bare tinned copper.
   Mounting Stud — 18-8 stainless steel.
   Case — epoxy encapsulated.
7. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps (2)	INCR I Amps (3)	A Lead Size AWG
7000-01	10 μH	.004	9.0	27	65	10
7000-02	12	.004	7.2	27	58	10
7000-03	15	.005	5.2	24	52	10
7000-04	18	.006	4.4	22	44	11
7000-05	22	.007	3.8	21	41	11
7000-06	27	.008	3.5	19	38	12
7000-07	33	.011	2.8	17	33	13
7000-08	39	.012	2.7	16	31	13
7000-09	47	.013	2.5	15	28	13
7000-10	56	.014	2.4	14	26	13
7000-11	68	.017	2.1	13	23	13
7000-12	82	.019	2.0	13	21	13
7000-13	100	.022	1.8	12	19	13
7000-14	120	.027	1.4	11	17	14
7000-15	150	.030	1.3	10	15	14
7000-16	180	.039	1.1	8.8	14	15
7000-17	220	.054	.90	7.5	13	16
7000-18	270	.060	.85	7.1	12	16
7000-19	330	.070	.75	6.5	11	16

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps (2)	INCR I Amps (3)	A Lead Size AWG
7000-20	390 μH	.090	.65	5.8	10	17
7000-21	470	.10	.62	5.5	8.8	17
7000-22	560	.11	.56	5.2	8.0	17
7000-23	680	.14	.51	4.6	7.5	18
7000-24	820	.17	.49	4.2	6.7	18
7000-25	1.0 mH	.22	.43	3.7	6.0	19
7000-26	1.2	.25	.37	3.5	5.4	19
7000-27	1.5	.29	.36	3.2	4.8	19
7000-28	1.8	.32	.33	3.1	4.4	19
7000-29	2.2	.44	.31	2.6	4.0	20
7000-30	2.7	.50	.27	2.4	3.6	20
7000-31	3.3	.69	.23	2.1	3.2	21
7000-32	3.9	.75	.21	2.0	3.0	21
7000-33	4.7	1.0	.20	1.7	2.8	22
7000-34	5.6	1.1	.18	1.6	2.6	22
7000-35	6.8	1.3	.17	1.5	2.3	22
7000-36	8.2	1.6	.14	1.4	2.1	23
7000-37	10	1.8	.13	1.3	1.9	23

TYPICAL Q CURVES (Type 7000)



SEND YOUR REQUIREMENTS. PROMPT QUOTES.

QUALITY COILS SINCE 1946

CADDELL-BURNS

40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

SHIELDED HIGH CURRENT CHOKES

TYPE 6900

10 μH — 82 μH — 10% Tolerance
100 μH — 1.0 μH — 5% Tolerance

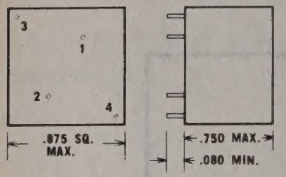
SPECIAL FEATURES

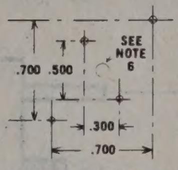
SHIELDED — Magnetically shielded with ground lugs to minimize external field.

ENCAPSULATED — with epoxy for maximum ruggedness and moisture protection.

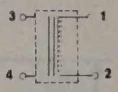
VARIABLE — with optional trimmer. See note 6.

STABLE — typical temperature coefficient of +76 ±28 ppm/°C from −30° to +70°C.





RECOMMENDED MOUNTING LAYOUT
4 HOLES .051 DIA.



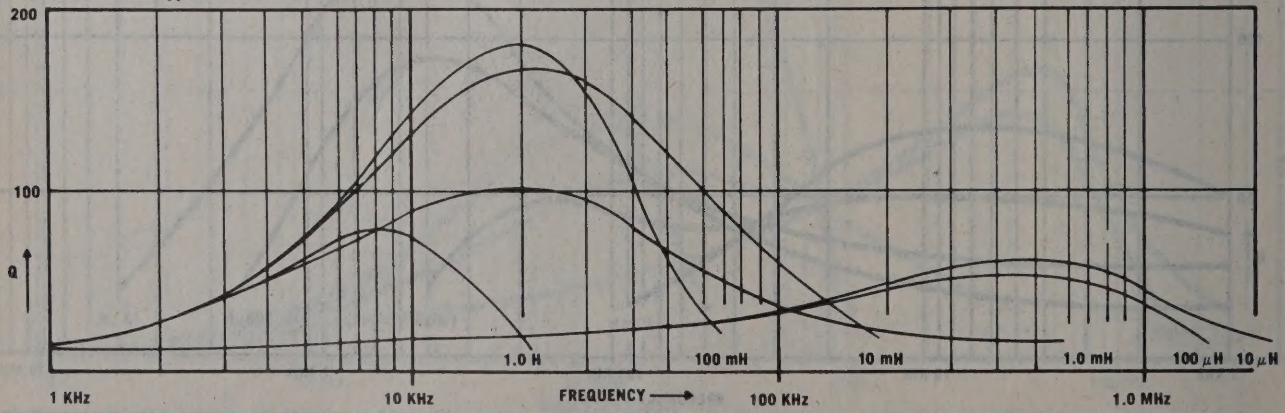
NOTES:

1. Inductance measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from the initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. These units are available with an optional trimmer which, when fully inserted, will increase the inductance by at least 20%. Order by adding suffix "V" to dash numbers, e.g.: 6900 -25V is continuously variable from 1.0 mH ±5% to 1.2 mH +10% −5%. If bottom access to trimmer is desired, provide a 3/16" dia. center hole as shown in the recommended mounting layout.
7. Materials:
   Core — Ferrite.
   Case — Epoxy encapsulated.
   Magnet Wire — per FED SPEC J-W-001177/9 (MIL-W-583 Type B)
   Terminals (1-2) — -01 thru -08 #18 AWG TINNED COPPER
   -09 thru -14 #20 AWG TINNED COPPER
   -15 and -16 #21 AWG TINNED COPPER
   -17 #22 AWG TINNED COPPER
   -18 thru -61 .024 dia. TINNED PH. BRONZE
   Ground Lugs (3-4) — .016 x .028 STEEL, NICKEL PLATE WITH GOLD FLASH.
8. Marking — Rubber stamped with Caddell-Burns part number.

STANDARD VALUES: (other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
6900-01	10 μH	.010	19	10,000	10,500
6900-02	12	.011	13	9,500	9,500
6900-03	15	.012	8.0	9,100	8,000
6900-04	18	.013	6.6	8,700	7,400
6900-05	22	.014	5.3	8,400	6,900
6900-06	27	.016	4.9	7,900	6,000
6900-07	33	.018	4.5	7,400	5,400
6900-08	39	.020	4.0	7,000	5,100
6900-09	47	.031	3.6	5,700	4,600
6900-10	56	.034	3.4	5,400	4,200
6900-11	68	.040	3.2	5,000	3,800
6900-12	82	.042	2.9	4,900	3,500
6900-13	100	.047	2.7	4,600	3,200
6900-14	120	.053	2.4	4,300	2,900
6900-15	150	.071	2.1	3,800	2,600
6900-16	180	.080	1.9	3,500	2,300
6900-17	220	.11	1.7	3,000	2,100
6900-18	270	.15	1.5	2,600	1,900
6900-19	330	.17	1.4	2,400	1,700
6900-20	390	.19	1.2	2,300	1,600
6900-21	470	.24	1.1	2,000	1,500
6900-22	560	.28	.90	1,900	1,300
6900-23	680	.31	.80	1,800	1,200
6900-24	820	.34	.70	1,700	1,100
6900-25	1.0 mH	.46	.61	1,500	1,000
6900-26	1.2	.52	.57	1,400	910
6900-27	1.5	.72	.54	1,200	820
6900-28	1.8	.79	.52	1,100	740
6900-29	2.2	.89	.50	1,000	670
6900-30	2.7	1.2	.44	900	610
6900-31	3.3 mH	1.3	.38	880	550
6900-32	3.9	1.9	.35	730	510
6900-33	4.7	2.1	.32	690	460
6900-34	5.6	2.6	.29	620	420
6900-35	6.8	3.1	.26	570	380
6900-36	8.2	3.4	23	540	350
6900-37	10	4.6	.20	470	310
6900-38	12	5.1	.18	440	290
6900-39	15	5.8	.17	420	260
6900-40	18	7.8	.16	360	240
6900-41	22	9.0	.15	330	210
6900-42	27	12	.13	290	190
6900-43	33	13	.12	280	170
6900-44	39	18	.11	240	160
6900-45	47	20	.10	220	150
6900-46	56	27	.085	190	130
6900-47	68	31	.070	180	120
6900-48	82	34	.065	170	110
6900-49	100	45	.060	150	100
6900-50	120	51	.055	140	91
6900-51	150	58	.050	130	82
6900-52	180	77	.045	110	75
6900-53	220	88	.040	105	67
6900-54	270	120	.036	91	61
6900-55	330	130	.032	88	55
6900-56	390	150	.030	82	51
6900-57	470	200	.028	71	46
6900-58	560	280	.026	60	42
6900-59	680	310	.024	57	38
6900-60	820	350	.020	53	35
6900-61	1.0 H	470	.016	46	31

TYPICAL Q CURVES (Type 6900)



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QUALITY COILS SINCE 1946
CADDELL-BURNS
40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

HIGH CURRENT/HIGH VOLTAGE CHOKES

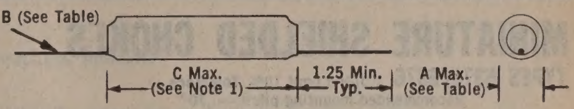
suitable for any high-current application — especially those requiring high-voltage transient suppression.

TYPE 6309 11-360μH 10% Tolerance
20-50KV minimum breakdown voltage

NOTES:
1. Minimum Breakdown Voltage ratings and dimensions are as follows:

	Min. Breakdown	C Max. Length In.	Rec. Mtg. Pitch In.
-1 thru -5	20KV	2.8	3.0
-6 thru -10	35KV	4.2	4.4
-11 thru -15	50KV	5.8	6.0

2. Inductance measured on General Radio 1650 Impedance Bridge at 1 KHz.
3. Current rating (Rated IDC) is based on power dissipation of 1.5 watt for -1 thru -5, 2.5 watt for -6 thru -10, and 3.5 watt for -11 thru -15; for approx. 20°C temperature rise. Depending on application, these units may be operated at up to twice the rated current.
4. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
5. Dielectric Withstanding Voltage — 1000 VRMS.
6. Materials:
   Coil Form — Ferrite. Jacket — PVC shrink tube.
   Magnet Wire — Type B per MIL-W-583.
   Lead Wires — Bare tinned copper.



STANDARD VALUES: (Other values available on special order.)

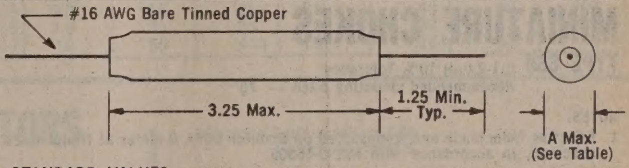
Part No.	Nominal Induc-tance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	INCR I Amps	A Dia. In.	B Lead Size AWG
6309-1	11μH	.005	40	18	11	.62	10
6309-2	18	.007	33	15	9.0	.59	12
6309-3	31	.013	27	11	7.0	.56	14
6309-4	46	.023	22	8.0	6.0	.52	16
6309-5	79	.042	15	6.0	4.5	.49	18
6309-6	32	.008	25	18	4.0	.62	10
6309-7	48	.012	20	15	3.2	.59	12
6309-8	80	.019	15	12	2.7	.56	14
6309-9	120	.036	13	8.3	2.2	.52	16
6309-10	190	.068	11	6.0	1.7	.49	18
6309-11	60	.010	15	19	2.2	.62	10
6309-12	90	.014	13	16	1.8	.59	12
6309-13	146	.025	10	12	1.4	.56	14
6309-14	225	.050	8	8.4	1.2	.52	16
6309-15	360	.100	7	6.0	.95	.49	18

HIGH CURRENT/HIGH VOLTAGE CHOKES

suitable for any high-current application — especially those requiring high-voltage transient suppression.

TYPE 6400 80μH-2.0mH 10% Tolerance
Recommended mounting pitch — 3.50″
25kV minimum breakdown voltage

NOTES:
1. Inductance measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 2.0 watt power dissipation for approx. 20°C temperature rise. Depending on application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.



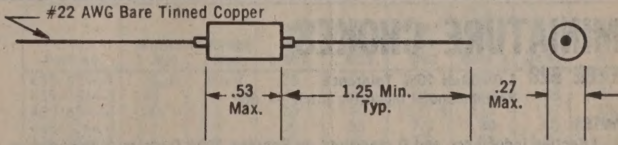
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	INCR I Amps	A Dia.
6400-1	80μH	.034	12	7.7	7.5	.70
6400-2	130	.065	11	5.5	5.6	.68
6400-3	220	.13	9.0	3.9	4.3	.67
6400-4	350	.25	7.0	2.8	3.6	.66
6400-5	560	.49	5.0	2.0	2.9	.65
6400-6	780	.87	4.5	1.5	2.5	.64
6400-7	1.4mH	1.9	3.2	1.0	1.8	.63
6400-8	2.0	3.6	2.6	.75	1.4	.62

SHIELDED CHOKES

TYPE 1670 250μH-100mH 10% or 25% Tolerance (GMV also available).
Recommended mounting pitch — .80″

NOTES:
1. These units are especially suited for filtering applications where small size, low DC resistance and magnetic shielding are required. They are not recommended for applications requiring extremely high stability.
2. Inductance (LP) is measured at 1.0 KHz on a General Radio 1650-B impedance bridge. These units are available in either 10% or 25% inductance tolerance.
3. The test voltage specified in column 3 is the RMS voltage across the test unit during inductance measurement.
4. Current rating (Rated IDC) is based on 0.3 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
6. Dielectric Withstanding Voltage — 100 VRMS.
7. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.



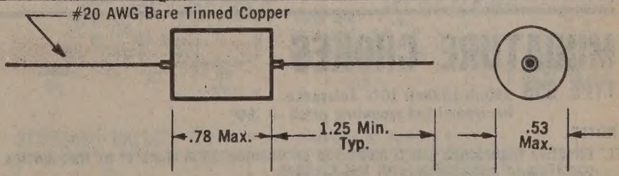
STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Test Volts See Note 3	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 4	INCR I ma See Note 5
1670-1	250μH	.007	0.17	1.5	1330	60
1670-2	500	.014	0.39	1.1	880	44
1670-3	1.0mH	.028	0.80	0.90	610	30
1670-4	2.5	.07	1.8	0.40	400	20
1670-5	5.0	.14	3.1	0.30	310	13
1670-6	10	.15	6.3	0.20	220	9.4
1670-7	25	.30	13	0.14	150	6.0
1670-8	50	.40	28	0.10	100	4.3
1670-9	100	.24	54	0.70	75	3.0

SHIELDED CHOKES

TYPE 1662 5.0mH-1.0H 10% or 25% Tolerance (GMV also available).
Recommended mounting pitch — 1.20″

NOTES:
1. These units are especially suited for filtering applications where small size, low DC resistance and magnetic shielding are required. They are not recommended for applications requiring extremely high stability.
2. Inductance (Lp) is measured at 1.0 KHz on a General Radio 1650-B impedance bridge. These units are available in either 10% or 25% inductance tolerance.
3. The test voltage specified in column 3 is the RMS voltage across the test unit during inductance measurement.
4. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
6. Dielectric Withstanding Voltage — 100 VRMS.
7. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.



STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Test Volts See Note 3	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 4	INCR I ma See Note 5
1662-1	5.0mH	.14	.83	.28	770	20
1662-2	10	.16	2.4	.20	450	13
1662-3	25	.32	5.2	.11	310	8.0
1662-4	50	.42	12	.080	200	5.0
1662-5	100	.24	30	.050	130	4.0
1662-6	250	.40	65	.035	88	2.3
1662-7	500	.46	130	.024	62	1.6
1662-8	1.0H	.25	200	.015	50	1.2

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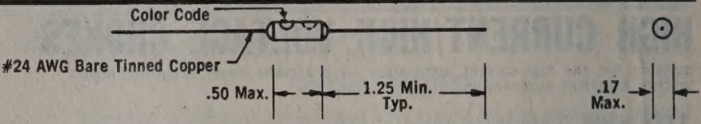
QUALITY COILS SINCE 1946

CADDELL-BURNS

40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

MINIATURE SHIELDED CHOKES

TYPES 6375/6376 1.0μH-5.0mH 10% Tolerance
Recommended mounting pitch — .70″



NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form and Shield — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Construction — Epoxy encapsulated.
   Coating — Polyurethane per MIL-I-46058.

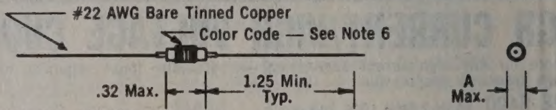
Marking — Color coded per dash number using standard EIA color as follows: 6375 — one color dot; 6376 — two color dots. e.g.: 6375-1 — one brown dot; 6376-1 — two brown dots, etc.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
6375-1	1.0μH	55	7.9	.05	200	2200	2700
6375-2	2.5	45	7.9	.08	115	1700	1600
6375-3	5.0	35	7.9	.12	90	1400	1000
6375-4	10	65	2.5	.42	55	770	750
6375-5	25	55	2.5	.80	35	560	450
6375-6	50	60	2.5	1.5	27	400	300
6375-7	100	70	2.5	3.1	20	280	200
6376-1	100	50	.79	.60	6.0	640	50
6376-2	250	55	.79	.92	2.6	520	32
6376-3	500	50	.79	2.0	1.9	350	22
6376-4	1.0mH	45	.25	4.7	0.8	230	15
6376-5	2.5	45	.25	7.5	0.5	180	10
6377-6	5.0	45	.25	17	0.4	120	7.0

MINIATURE CHOKES

TYPE 660 0.1-2.0μH 10% Tolerance
Recommended mounting pitch — .70″



NOTES:

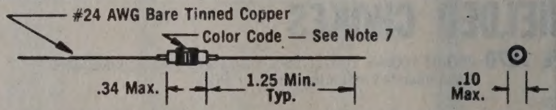
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Dielectric Withstanding Voltage — 100 VRMS.
4. Operating Temperature Range — −55°C to +105°C.
5. Materials:
   Coil Form — Mineral filled phenolic.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
6. Marking — Color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps See Note 2	A Dia.
660-1	0.1μH	60	25	.014	420	3.8	.15
660-2	0.2	60	25	.034	380	2.4	.14
660-3	0.3	55	25	.060	340	1.8	.13
660-4	0.4	55	25	.074	310	1.6	.13
660-5	0.5	55	25	.12	280	1.3	.13
660-6	0.75	45	25	.23	240	0.9	.13
660-7	1.0	50	25	.39	200	0.7	.13
660-8	1.5	30	7.9	.76	160	0.5	.12
660-9	2.0	30	7.9	.96	140	0.4	.12

MINIATURE CHOKES

TYPE 620 1.0-100μH 10% Tolerance
Recommended mounting pitch — .60″



NOTES:

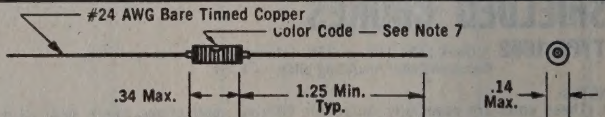
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — Color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
620-1	1.0μH	50	7.9	.11	190	1300	4400
620-2	2.5	50	7.9	.18	120	1000	2600
620-3	5.0	45	7.9	.24	90	900	1800
620-4	7.5	40	7.9	.33	70	800	1350
620-5	10	40	2.5	.39	64	700	1100
620-6	15	60	2.5	.74	54	500	950
620-7	20	55	2.5	.96	46	450	780
620-8	25	60	2.5	1.2	40	400	680
620-9	50	85	2.5	3.6	28	270	490
620-10	75	90	2.5	6.3	22	170	410
620-11	100	80	2.5	8.6	20	150	320

MINIATURE CHOKES

TYPE 659 250μH-10.0mH 10% Tolerance
Recommended mounting pitch — .60″



NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — Color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
659-1	250μH	40	.79	2.0	3.2	315	165
659-2	500	35	.79	3.9	1.5	225	120
659-3	1.0mH	60	.25	9.5	1.1	145	78
659-4	2.5	55	.25	24	0.6	90	50
659-5	5.0	50	.25	50	0.5	63	37
659-6	10	40	.079	75	0.3	51	30

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For More Information. Circle No. 54

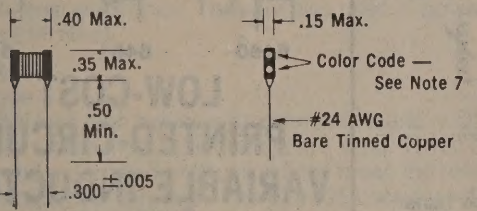
QUALITY COILS SINCE 1946

CADDELL-BURNS

40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

PRINTED CIRCUIT CHOKES

TYPE 6550 1.0μH-10mH 10% Tolerance



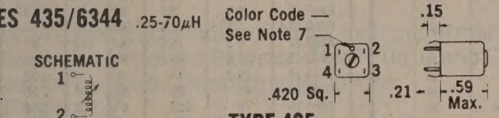
NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — color coded per dash number using standard EIA color code.

STANDARD VALUES: (Other values available on special order.)

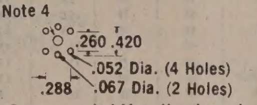
Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} ma See Note 2	INCR I ma See Note 3
6550-1	1.0μH	90	7.9	.015	180	3600	7000
6550-2	2.5	85	7.9	.03	110	2500	4100
6550-3	5.0	90	7.9	.06	75	1800	2900
6550-4	7.5	95	7.9	.11	70	1300	2500
6550-5	10	90	7.9	.19	55	1020	2100
6550-6	25	80	2.5	.50	18	630	1300
6550-7	50	70	2.5	1.1	11	420	1000
6550-8	75	45	2.5	1.2	5.5	400	860
6550-9	100	85	.79	1.5	2.8	365	700
6550-10	250	55	.79	2.7	1.6	270	450
6550-11	500	35	.79	3.3	1.3	240	340
6550-12	750	30	.79	4.2	1.2	215	280
6550-13	1.0mH	80	.25	8.6	1.0	150	210
6550-14	2.5	75	.25	16	.53	110	140
6550-15	5.0	45	.25	31	.45	80	100
6550-16	7.5	25	.25	50	.32	63	80
6550-17	10	50	.079	70	.26	53	70

MINIATURE SHIELDED VARIABLE INDUCTORS

TYPES 435/6344 .25-70μH

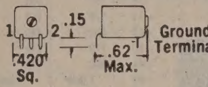


TYPE 435
vertical mount

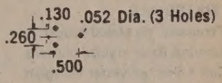


Recommended Mounting Layout

Tolerance 2 place dec. ±.020
3 place dec. ±.005



TYPE 6344
horizontal mount



Recommended Mounting Layout

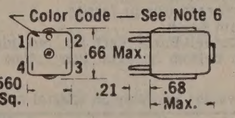
NOTES:
1. For vertical mount, order as 435-1 . . . etc. For horizontal mount, order as 6344-1 . . . etc.
2. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
3. Self-resonant frequencies are measured at maximum inductance.
4. Unit can be tuned from top or bottom with ⅛″ insulated screwdriver (part no. C-B 2102). For type 435 only, provide .156 dia. hole if bottom access to tuning core is desired.
5. Current rating is based on .15 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
6. Materials:
   Terminals — Tin-plated brass. Core — Ferrite.
   Coil Form and Base — Molded nylon. Shield Can — Cadmium-plated brass.
7. Marking — Marked with Caddell-Burns Part No. on side of can, and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

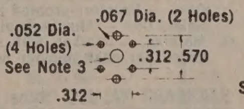
Part No.	Minimum Range L Min.	L Max.	Minimum Q @ L Min.	@ L Max.	Test Freq. MHz	Min. SRF MHz Note 3	Max. DCR Ohms	Current Rating ma
435/6344-1	.25μH	.50μH	75	50	25	200	.03	2200
435/6344-2	.48	1.0	70	45	25	150	.08	1300
435/6344-3	.90	2.1	70	45	25/7.9	110	.17	930
435/6344-4	1.7	3.9	50	55	7.9	80	.60	500
435/6344-5	3.5	8.5	50	45	7.9	55	1.2	350
435/6344-6	7.5	17	60	40	7.9/2.5	40	2.3	250
435/6344-7	16.5	35	50	50	2.5	11	1.9	280
435/6344-8	33	70	45	45	2.5	8	2.9	220

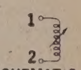
MINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 434 .55-64μH
Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005



Recommended Mounting Layout





SCHEMATIC

NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture proofed powdered iron.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	L Max.	Minimum Q @ L Min.	@ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
434-1	.55μH	.90μH	90	85	25	160	.06	1800
434-2	.90	1.4	90	70	25/7.9	130	.12	1200
434-3	1.4	2.4	60	70	7.9	100	.25	890
434-4	2.2	4.1	60	80	7.9	80	.60	570
434-5	3.9	7.7	55	55	7.9	52	1.0	440
434-6	7.5	11	35	70	7.9/2.5	21	1.2	400
434-7	11	17	55	75	2.5	16	1.4	370
434-8	18	27	55	75	2.5	14	1.8	330
434-9	27	42	55	70	2.5	13	2.4	280
434-10	42	64	55	65	2.5	11	3.1	250

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For More Information. Circle No. 54

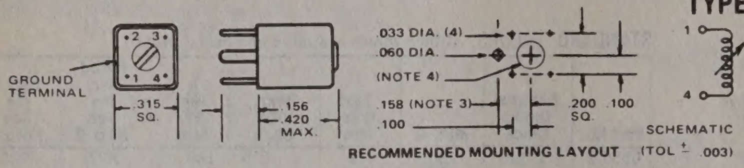
QUALITY COILS SINCE 1946

CADDELL-BURNS

40 East Second Street
Mineola, New York 11501-3597
Area Code 516 746-2310

SUBMINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 6740



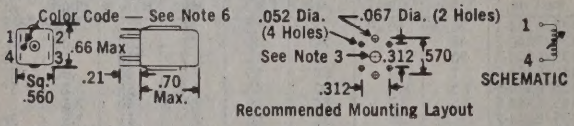
NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at nominal inductance.
3. Ground terminal may be bent as required to fit existing layouts.
4. Provide .156 DIA. hole if bottom access to tuning core is desired. Tuning range on −38 thru −61 may be extended by allowing core to extend 1/16" below mounting surface (when Lmin ≈ ½Lnom).
5. Current rating is based on ¼ watt power dissipation.
6. MATERIALS—
   Terminals: tin plated copper.
   Terminal Base: molded phenolic.
   Coil Form: polyester fiberglass.
   Core: moisture-proofed powdered iron or ferrite.
   Shield Can: tin plated copper.
   Impregnation: varnish per MIL-V-173.

STANDARD VALUES (INTERMEDIATE AND SPÉCIAL VALUES AVAILABLE ON SPECIAL ORDER)

Dash No.	Nominal Inductance	Minimum Range LMIN	LMAX	Min Q @ LNOM	Test Freq. M HZ	Max DCR OHMS	Min SRF M HZ Note 2	Max IDC mA Note 5
−01	.10uH	.08uH	.12uH	80	25	.02	250	3500
−03	.15	.12	.18	85	25	.03	250	2800
−05	.22	.18	.27	85	25	.04	250	2500
−07	.33	.27	.39	90	25	.05	250	2200
−09	.47	.39	.56	90	25	.13	230	1350
−11	.68	.56	.82	90	25	.17	200	1200
−13	1.0	.82	1.2	90	25	.31	160	850
−15	1.5	1.0	1.8	60	7.9	.33	125	850
−17	2.2	1.5	2.7	65	7.9	.72	110	550
−19	3.3	2.2	3.9	65	7.9	1.3	95	425
−21	4.7	3.3	5.6	60	7.9	1.5	80	400
−23	6.8	4.7	8.2	60	7.9	1.8	62	350
−25	10	6.8	12.	60	7.9	2.2	45	325
−27	15	10	18	72	2.5	1.5	12	400
−29	22	15	27	67	2.5	1.8	9.5	350
−31	33	22	39	65	2.5	2.1	7.8	325
−33	47	33	56	57	2.5	2.6	6.6	300
−35	68	47	82	47	2.5	3.0	5.3	275
−37	100	68	120	45	2.5	3.5	5.0	250
−39	150	100	180	70	.79	3.6	3.4	250
−41	220	150	270	65	.78	6.0	2.8	200
−43	330	220	390	60	.79	7.9	2.3	150
−45	470	330	560	40	.79	11	1.9	125
−47	680	470	820	35	.79	13	1.7	125
−49	1.0mH	.68mH	1.2mH	32	.79	17	1.5	100
−51	1.5	1.0	1.8	37	.25	32	.86	85
−53	2.2	1.5	2.7	37	.25	41	.72	75
−55	3.3	2.2	3.9	40	.25	51	.69	65
−57	4.7	3.3	5.6	27	.25	80	.47	55
−59	6.8	4.7	8.2	25	.25	90	.39	50
−61	10	6.8	12	25	.25	110	.37	45

MINIATURE SHIELDED VARIABLE INDUCTORS



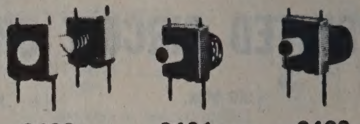
TYPE 6380

.08-370µH
Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005

NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture-proofed powered iron or ferrite.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns Part No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	L Max.	Minimum Q @ L Min.	@ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
6380-1	.08µH	.11µH	65	75	25	300	.012	4000
6380-2	.10	.17	75	85	25	280	.014	3700
6380-3	.13	.23	75	90	25	260	.015	3600
6380-4	.17	.28	80	90	25	230	.016	3500
6380-5	.25	.44	90	95	25	180	.024	2800
6380-6	.29	.53	90	95	25	170	.026	2700
6380-7	.48	.84	90	90	25	140	.058	1800
6380-8	.71	2.5	90	85	25/7.9	80	.10	1400
6380-9	1.8	5.7	70	110	7.9	50	.50	630
6380-10	4.5	14	55	120	7.9/2.5	18	.85	480
6380-11	12	40	60	115	2.5	10	1.6	350
6380-12	30	99	55	80	2.5	5.6	2.4	280
6380-13	73	190	55	115	2.5/.79	4.8	3.8	220
6380-14	148	370	75	120	.79	3.5	5.6	180



LOW-COST PRINTED-CIRCUIT VARIABLE INDUCTORS

TYPE 6460

Variable R.F. Inductors
Four Printed Circuit Terminals, Mounting—.5" x .8" Centers
Size 5/8" x 5/8" x 985 Long
Polyester Cellulose Coil Form

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6460·1	06	09	80	105	008	22
6460·2	09	16	100	130	010	22
6460·3	15	29	120	140	011	22
6460·4	19	40	130	145	012	22
6460·5	32	68	80	105	08	20/44
6460·6	60	1 35	80	125	11	20/44
6460·7	1 14	2 5	90	135	15	20/44
6460·8	2 0	4 0	100	140	21	20/44
6460·9	3 1	5 6	110	120	26	20/44
6460·10	4 5	8 1	48	85	29	20/44
6460·11	7 0	11 4	43	150	37	20/44
6460·12	9 7	16 4	80	140	47	20/44
6460·13	15 6	26 2	90	155	61	20/44
6460·14	19 2	44	80	110	1 80	7/44
6460·15	41	95	80	90	2 56	7/44
6460·16	70	183	65	100	3 24	7/44
6460·17	180	525	90	98	5 76	7/44
6460·18	445	1040	94	105	9 32	7/44

Note Inductance & Q at various frequencies can be altered by changing type of core used (see parts section for cores available) Dash No. 1 thru 15 uses Powdered Iron Core 302—250—6R Dash No 16 thru 18 uses Ferrite Core 303—250—6R

TYPE 6461

Variable R.F. Coil Series
Size 5/8" x 5/8" x 625 Long
0.5" P.C. Mounting

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6461·1	09	12	58	66	007	22
6461·2	1	14	102	128	009	22
6461·3	14	22	128	150	01	22
6461·4	18	33	134	155	011	22
6461·5	23	44	140	154	013	22
6461·6	37	68	87	105	102	7/41
6461·7	58	1 1	87	100	136	7/41
6461·8	1 1	2 2	72	115	2	7/41
6461·9	2	4 4	80	112	29	7/41
6461·10	3 3	8	96	140	77	7/44
6461·11	7	13 6	70	130	1 02	7/44
6461·12	12 4	25 5	85	134	1 42	7/44
6461·13	22 5	49	90	127	1 93	7/44
6461·14	47	100	86	97	2 8	7/44
6461·15	99	174	75	142	4 2	7/44
6461·16	170	332	95	146	6 0	7/44
6461·17	322	570	102	140	8 5	7/44
6461·18	525	910	97	125	10 4	7/44

TYPE 6462

Variable R.F. Coil with Powdered Iron Shield
Size 5/8" x 5/8" x 730 Long
0 5" P C Mounting

Stock No.	Inductance Range Microhenries Min.	Max.	Q'	Q''	Nom. D.C. Res. Ohms	Wire Size AWG
6462·1	08	10	84	89	007	22
6462·2	4	8	82	100	11	7/41
6462·3	6	1 3	85	105	14	7/41
6462·4	1 1	2 6	71	115	20	7/41
6462·5	2 1	5 1	85	145	55	7/44
6462·6	3 4	8.6	96	145	75	7/44
6462·7	8 0	16 9	70	150	1 14	7/44
6462·8	16 2	39 5	94	142	1 52	7/44
6462·9	34	84	86	110	2 21	7/44
6462·10	57	124	80	145	2 74	7/44
6462·11	67	141	80	148	3 16	7/44

CADDELL-BURNS DOES NOT SELL THRU DISTRIBUTORS. ALL SALES ARE DIRECT.

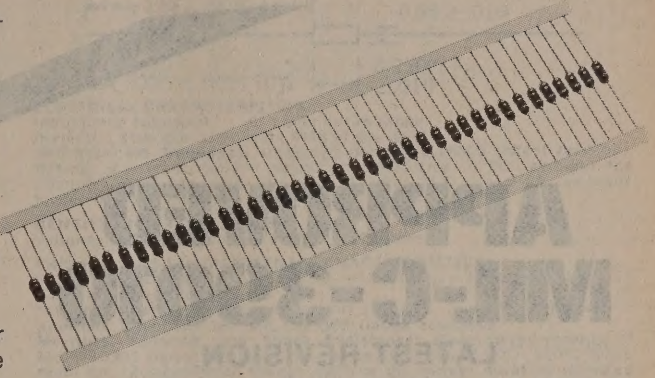
For More Information. Circle No. 54

FIXED INDUCTORS

TDK

TDK CORPORATION OF AMERICA 4711 West Golf Road, Suite 300, Skokie, Illinois 60076, U.S.A. Phone: (312) 679-8200 **LOS ANGELES BRANCH** (213) 539-6631 **NEW YORK BRANCH** (516) 625-0100 **INDIANAPOLIS BRANCH** (317) 872-0370 **DETROIT OFFICE** (313) 353-9393 **TDK CORPORATION** 13-1, Nihonbashi 1-chome, Chuo-ku, Tokyo 103, Japan

Fixed inductors are used in a wide range of applications including VCRs, color TVs, stereo car radios and radio transceivers, and industrial electronics. They are also used in power-driven tools as EMI filters.



Features

1) EL type
The radial lead type inductor is commonly found in consumer products, where most EL inductors are used. TDK's original design and automated production lines mean the reliability of these inductors is very high. The EL0405 uses a very compact design and is supplied on reels.

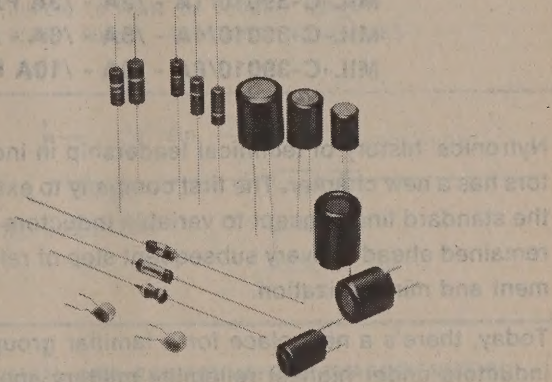
2) SP type
The axial lead type inductor is also used frequently in consumer products. The structure of the AP0408, 0410 and 0412 provide the smallest distribution capacity. Different types are available to meet the needs of automatic insertion equipment.

3) TP type
This type features high reliability and unusually stable characteristics because it is made using the transfer molding technique. The extremely small size of the TP0206 type makes it suitable for high density assembly PCBs in measuring instruments and control devices.

4) FS type
This small ferrite shield inductor has a high performance ferrite cap shape with a molded inductor. The FS0810 and FS1012 are ideal for magnetic shielding applications.

5) TPF0410 type
This highly reliable inductor complies with Defense Agency standards (MIL standards) for industrial applications requiring a magnetic shield.

6) NL, NLF type
Has metal tab type electrodes connected to coils encapsulated in heat-proof resins to ensure excellent reliability.



		Type	Taping	Lead space (mm)	No. of L-values available	Inductance range (μH)	Q range (min.)	Dimension[*1] (mm)
Non-shielded type	Radial lead	EL0405	EL0405RA-	2.5	45	0.22 to 1,000	25 to 50	4×5
		EL0606	EL0606RA-	5.0	49	0.22 to 2,200	30 to 50	6×6
		EL0607	EL0607RA-	5.0	37	10 to 10,000	15 to 45	6×7
		EL0909	FL0909R-	5.0	34	100 to 56,000	35 to 65	9×9
	Axial lead	SP0305	SPT0305-	—	45	0.22 to 1,000	40 to 60	2.8×7
		SP0406	SPT0406-	—	45	0.22 to 1,000	25 to 85	4×9.5
		SP0408	SPT0408-	—	25	0.15 to 27	50 to 70	4.5×8[*2]
		SP0410	—	—	4	33 to 56	60 to 65	4.5×10[*2]
		SP0412	—	—	2	68 to 82	60 to 70	4.5×12[*2]
		SP0412	—	—	8	1 to 15 (1.0 to 4.5A)	20	4×12[*2]
		SP0615	—	—	10	1 to 33 (up to 6A)	20	6×15[*2]
		SP0720	—	—	12	1 to 68 (up to 7A)	20	7×20[*2]
		SP0830	—	—	15	1 to 220 (up to 10A)	20	8×30[*2]
	Axial lead	TP0206	TPT0206-	—	37	0.1 to 100	25 to 55	2×6
		TP0410	TPT0410-	—	62	0.15 to 1,000	33 to 90	4×10
		TP0511	—	—	15	270 to 1,000	100	5×11
		TP0514	—	—	13	1,100 to 3,600	90	5×14
		TP0619	—	—	11	3,900 to 10,000	110	6×19
	Leadless	NL453232T	NL453232T	—	37	1.0 to 1,000 mH	30 to 50	4.5×3.2×3.2
Magnetic shielded type	Radial lead	ELF0505SKI	ELF0505R-	2.5	46	0.22 to 1,200	30 to 50	5.5×5.5
		ELF0607SKI	ELF0607R-	5.0	50	0.22 to 2,700	30 to 60	6.6×7
		ELF0708SKI	ELF0708R-	5.0	39	10 to 15,000	25 to 40	7.7×8
		ELF1010SKI	ELF1010R-	5.0	37	100 to 100,000	30 to 60	10.5 × 10.5
		FS0712	—	5.0	61	1.0 to 100mH	10 to 40	7×12
		FS0810	—	2.5	24	12 to 1,000	55 to 95	8×10
		FS1012	—	2.5	24	1.2 to 100mH	60 to 110	10×12
	Axial lead	TPF0410	TPFT0410	—	57	0.1 to 4,700	40 to 67	4×10
	Leadless	NLF453532	—	—	19	1.0 to 1,000	40 to 50	4.5×3.5×3.2

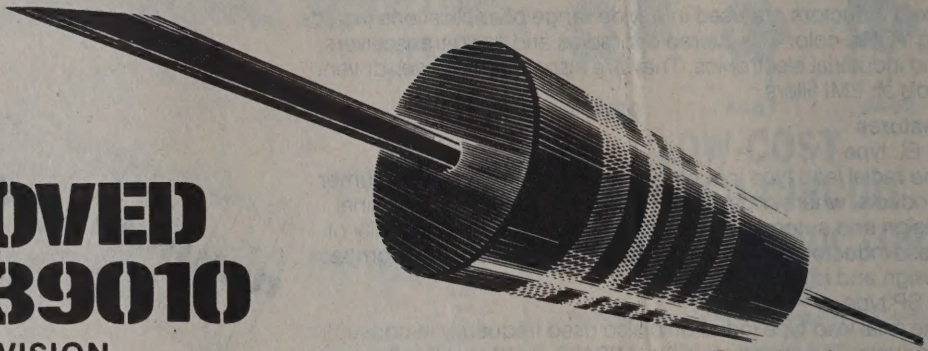
[*1] *Please refer TDK catalogue.*
[*2] *Indicated core length.*

For More Information. Circle No. 55

Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 – TWX 810-665-2182

Inductors



APPROVED MIL-C-39010

LATEST REVISION

MIL-C-39010/1A - /2A - /3A FAILURE RATE "R" .01% / 1000 HRS.
MIL-C-39010/4A - /5A - /6A - /7A FAILURE RATE "R" .01% / 1000 HRS.
MIL-C-39010/8A - /9A - /10A FAILURE RATE "R" .01% / 1000 HRS.

Nytronics' history of technical leadership in inductors has a new chapter. The first company to extend the standard line concept to variable inductors has remained ahead in every subsequent step of refinement and miniaturization.

Today, there's a new place for a familiar group of inductors under highest reliability military specifications—MIL-C-39010 (latest revision). The unique "T" lead construction eliminates fine wire consideration that has previously concerned design engineers on critical circuitry.

With sizes ranging from the world's smallest shielded inductor to the most complex variable inductor . . . shielded, unshielded and variable, in hundreds of off-the-shelf values . . . it makes good sense to check first with Nytronics or your local distributor.

Now tested and approved to highest reliability military specifications.

Nytronics Standard Inductor Part Number	Standard Military Series	New High Reliability Qualification
SWD	MS75087	MIL-C-39010-1
SWD	MS75088	MIL-C-39010-2
SWD	MS75089	MIL-C-39010-3
RFC-S	MS75008	MIL-C-39010-4
RFC-S	MS75101	MIL-C-39010-5
RFC-SS	MS18130	MIL-C-39010-6
RFC-SS	MS14046	MIL-C-39010-7
MD	MS75083	MIL-C-39010-8
MD	MS75084	MIL-C-39010-9
MD	MS75085	MIL-C-39010-10

1984/85 Product Catalog with complete details upon request – Dept. G

For More Information. Circle No. 56

Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

Inductors

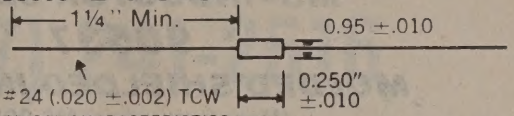
—MS INDUCTOR SERIES 75083, 75084, 75085 MOLDED INDUCTOR/0.100 uh to 1000 uh

MARKING:

COLOR CODED PER MIL-C-15305 (LATEST REV.)

The MS Inductor Series are RF Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). This MS Series is Epoxy Molded enveloped features reliability and uniformity in a Subminiature Inductor.

Mili-Ductor



ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 1000 volts RMS at sea level
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum current based on: 35 C rise in 90 ambient for phenolic, 15 C rise in 90 ambient for iron, 35 C rise in 70 ambient for ferrite core inductors.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches; **Weight** .030 grams.

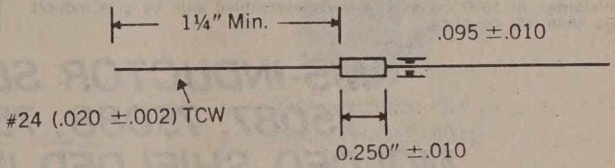
PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55 C to +125 C phenolic core, —55°C to +105 C iron and ferrite core.
Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).
Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 20G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS (body mounted).

DECI-DUCTOR

New Subminiature Inductor 0.10uH to 1000uH Range
0.100" diameter by 0.250" length 49 STANDARD VALUES

The **DECI-DUCTOR** offers the design engineer epoxy-molded reliability and uniformity in a subminiature R.F. Inductor. This smallest of Nytronics growing R.F. Inductor line is designed to meet all the environmental specifications of MIL-C-15305 (latest revision).



GRADE 2, CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over entire range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Rating: Maximum Current based on 35°C rise in 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.002 cubic inches **Weight:** 0.35 grams

PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C

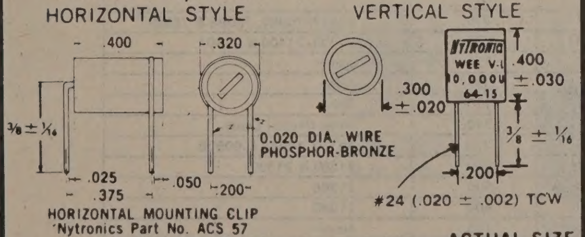
Terminal Strength: Meets three pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), 10 cps to 2000 cps @ 15 G ±10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 50G, 11 MS (body mounted).

Marking: Color coded per MIL-C-15305 (latest revision).

WEE V-L

NOW MIL APPROVED MIL-C-15305 (latest revision) — MS21381 & MS21402
Subminiature Shielded Adjustable Inductor
High Q Values
Vertical or Horizontal* Mounting
Unitized Epoxy-Molded Construction
0.400" by 0.300"
0.10 to 100,000uH

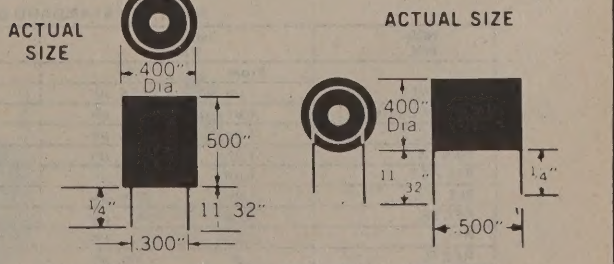


HORIZONTAL MOUNTING CLIP
*Nytronics Part No. ACS 57
(one required per unit)

ACTUAL SIZE

VIV-VIH

Miniature with inductance range of 0.10 to 4700 μh



Terminal Leads #22 (.025 ± .002) VCW

VERTICAL STYLE HORIZONTAL STYLE

1984/85 Product Catalog with complete details upon request – Dept. G

Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 – TWX 810-665-2182

Inductors

MS - INDUCTOR SERIES
90537
MOLDED SHIELDED INDUCTOR
(Manufactured per MS-90537)

Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.
Unique "T" design eliminates Fine Wire considerations.

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.

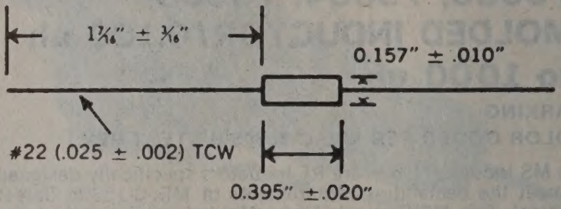
GRADE 1, CLASS B

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 700 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on Q-Meter.
Maximum Current: Based on temperature rise not to exceed 35°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At 1000 cycles two units assembled side by side exhibit less than 3% coupling.



PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: —55°C to +125°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305D, Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ± 10% maximum for 12 logarithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

MS-INDUCTOR SERIES
75087, 75088, 75089
MOLDED SHIELDED INDUCTOR

Ultra-Reliable Molded Shielded Miniature Inductor.
Inductance Range: 0.1uH to 100,000uH.

The **MS-INDUCTOR SERIES** are R.F. Inductors specifically designed to meet the demanding requirements of MIL-C-15305 (latest revision). The MS-INDUCTOR Series epoxy molded envelope and shielding offers the design engineer reliability, electrical performance, and minimum coupling in high density packaging.

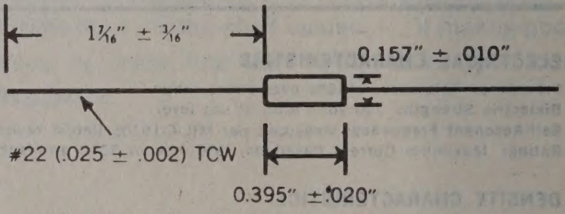
GRADE 1, CLASS A

ELECTRICAL CHARACTERISTICS

Inductance Tolerance: ±10% over the entire inductance range.
Dielectric Strength: 1000 volts RMS at sea level.
Self-Resonant Frequency: Measured per MIL-C-15305 (latest revision).
Q: Measured on a Q-Meter.
Maximum Current: Based on temperature rise not to exceed 15°C at 90°C ambient.

DENSITY CHARACTERISTICS

Volume: 0.0076 cubic inches **Weight:** 0.75 grams maximum
Shielding: At 1000 cycles two units assembled side by side exhibit less than 3% coupling.



PHYSICAL AND ENVIRONMENTAL CHARACTERISTICS

Operating Temperature: −55°C to +105°C.

Terminal Strength: Meets five pound pull test; five 360° rotations in alternate directions per MIL-C-15305 (latest revision).

Moisture, Vibration, and Shock Resistance: Meets requirements of MIL-C-15305 (latest revision), Grade 1, Class B. High frequency 10 cps to 2000 cps @ 20G ± 10% maximum for 12 lograithmic swings each of 20 minute duration repeated for each of three mutually perpendicular planes. Shock: 100G, 6 MS.

Marking: Color coded per MIL-C-15305 (latest revision).

MILITARY STANDARD & COMMERCIAL INDUCTORS

NCG P/N	Inductance Range		Dim. Nom.		MS No.
	From	To	D	L	
Super WEE	.1 µh	100K µh	.157	.395	90537, 75087, 75088 & 75089
Super WEE WEE	.1 µh	10K µh	.133	.335	21399, 21400 & 21401
WEE	.1 µh	100K µh	.164	.375	None
WEE WEE	.1 µh	1K µh	.135	.335	None
PEE WEE	.1 µh	1K µh	.085	.120	None
PEE CEE	.1 µh	100K µh	.265	.270	None (Radial Lead)
RFC SS	.15 µh	240 µh	.155	.375	18130, 14046 & 90538
RFC S	.1 µh	1K µh	.188	.440	21389 & 21390
RFC M	.1 µh	2200 µh	.250	.600	21388
RFC L	1.0 µh	10K µh	.310	.900	21380
PEE DEE	.1 µh	100K µh	.075	.125	None
WEE VL	.1 µh	100K µh	.400	.300	21381, 21402 (Variable)
VIV-VIH	.1 µh	4700 µh	.400	.500	None (Variable)

1984/85 Product Catalog with complete details upon request – Dept. G

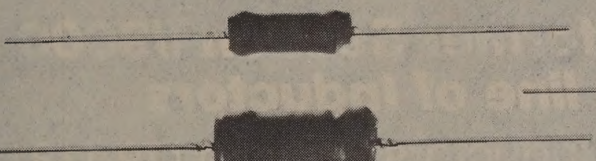
For More Information. Circle No. 56

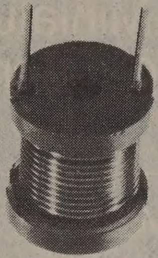
WILCO

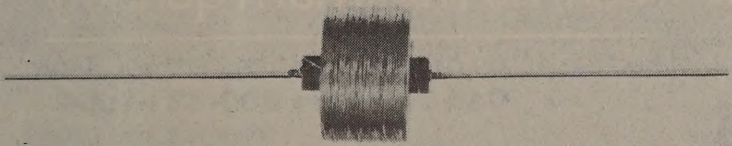
10 DAY DELIVERY
(317) 241-2516

Miniature R.F. Chokes
Conformal Coated

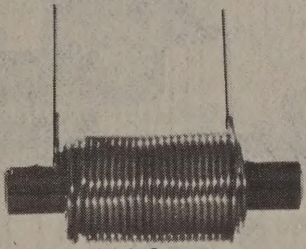
Miniature R.F. Chokes
Open Wound

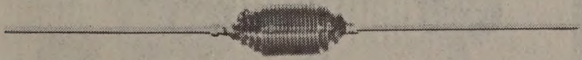

Power Line Inductors
wound on ferrite cores
available shielded


High Saturation Flux
Density Ferrite Bobbins

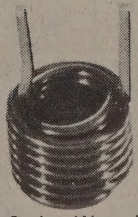

Universal Wound Coils

3 Section Windings
available on phenolic,
iron, and ferrite cores


High Current
Filter Chokes


Wound to Your
Specifications

Adjustable
R.F. Coils


Spring Wound
Air Core Inductors

Custom Coils
of All Types

* For larger orders – partial shipments in 10 days and balance pending availability of materials.

For More Information. Circle No. 57

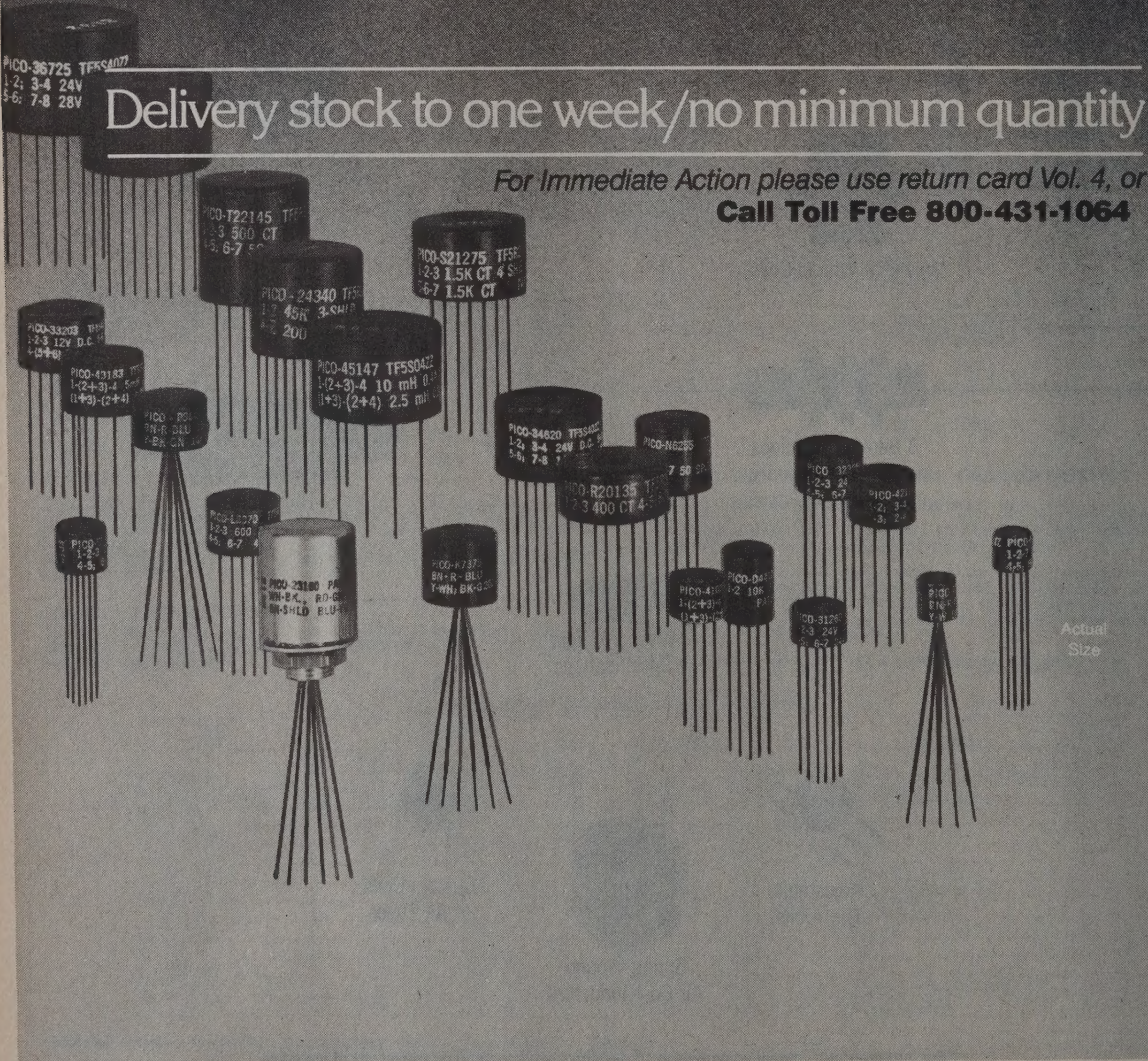
PICO

See Gold Book Transformer Section #9000 for PICO's latest line of Inductors

- Miniature High "Q" Inductors: Pages 1179-1181
- Miniaturized Power Inductors: Page 1176
- EMI Common Mode Suppression Inductors: Page 1177

Delivery stock to one week/no minimum quantity

For Immediate Action please use return card Vol. 4, or
Call Toll Free 800-431-1064


PICO-36725 TF5S4077
1-2; 3-4 24V
5-6; 7-8 28V
PICO-T22145
1-2-3 500 CT
PICO-S21275
1-2-3 1.5K CT
5-6-7 1.5K CT
PICO-24340
1-2 45K
PICO-33203
1-2-3 12V D.C.
PICO-43183
1-(2+3)-4
(1+3)-(2+4)
PICO-45147 TF5S0422
1-(2+3)-4 10 mH
(1+3)-(2+4) 2.5 mH
PICO-34620
1-2; 3-4 24V D.C.
5-6; 7-8
PICO-N6255
PICO-R20135
1-2-3 400 CT
PICO-23180
PICO-K7373
BN-R-BLU
Y-WH; BK-G
Actual Size

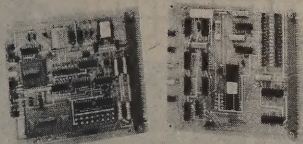
For More Information. Circle No. 58

Voice Communications Subsystems

Intercom

Remote Control

Technical Control



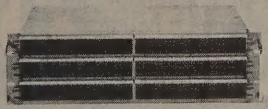
GRIM CORP

AN INDUCTOTHERM COMPANY

Triangle Industrial Center Medford, New Jersey 08055
609-267-7950

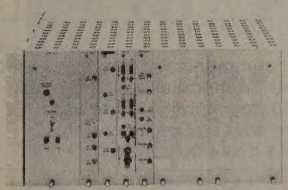
DATA TRANSCEIVER SET (DTS-300)

A pair of circuit cards which sense/generate DC levels and provide buffering and data communications over voice-grade communications facilities (full or half-duplex) at modulation rates to 300 bauds. Ask for brochure 80-0119.



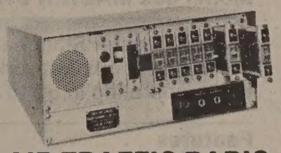
RUGGEDIZED PATCH PANELS

In addition to our standard miniature jack panels, we supply a wide range of custom voice and data patch panels for use in military transportable communications shelters world-wide. Ask for brochure 82-0924.



VO DATA COMM 80

A family of products which provide simultaneous transmission of speech and multiplexed digital control words over voice-grade communications facilities. Ask for VDC-80 brochure.

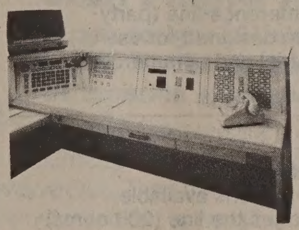


AIR TRAFFIC RADIO CHANNEL CONTROL (ATRCC) SYSTEMS

The highly-modularized and solid state ATRCC-2400A system provides for operator interface and control of radio transmitters/receivers via a distributed matrix. Within the same system, dedicated telephone channels can be accommodated. Ask for ATRCC-2400A brochure and PIB 81-0202.

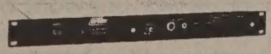
AUDIO SWITCHING SYSTEMS

A variety of audio switches can be configured from a flexible microprocessor controller (GPS) and associated solid-state audio crosspoint matrix (ACM). GPS permits both local and remote control of the ACM, the latter by a system CPU with an RS-232/422 interface. Switch sizes to 128 x 128 can be provided. Switches may be interconnected for redundancy and flexibility. Applications include audio distribution and intercom systems. Ask for PIB 82-1207.



COMMUNICATIONS CONSOLES AND PANELS

Customized communications consoles and operator control panels for use in air traffic control, air defense and ground traffic control systems. In development is a flexible microprocessor-based console equipment group which can be used with various CPU-switch combinations. We'd like to hear about your application. Ask for PIB 83-0125.



TEST MESSAGE GENERATOR

Model TMG-75/2400 is a self-contained code generator (ASCII/BAUDOT) for testing data transmission lines, etc. Sends a standard test message plus a user programmable 7 character identifier. Ask for PIB 83-0309.

MANUFACTURING AND TEST SERVICES

We offer design-to-specification and build-to-print services for systems integrators and original equipment manufacturers (OEMs). Production services include purchasing, assembly, conformal coating and potting. Test and inspection services include burn-in, computerized automatic testing (ATE) and quality assurance per MIL-I-45208 and MIL-Q-9858A. Ask for an OEM literature package.

INTERCOM UNITS AND SYSTEMS

We are providing a wide range of intercom units and systems for use in industrial and defense-related applications. Ask for brochure 82-0930.

MODULAR ALARM SYSTEM

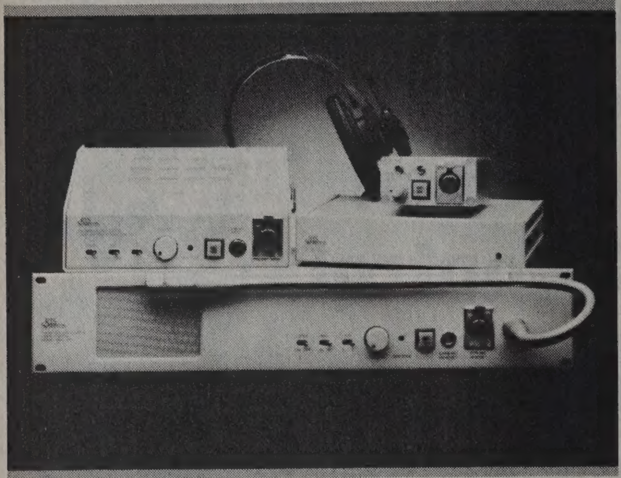
MAS-96 is a rack-mountable modularized, optically-coupled circuit monitor and alarm system for up to 96 circuits, in increments of 8. Ask for MAS-96 brochure.

For More Information. Circle No. 59

PROFESSIONAL AUDIO PRODUCTS

RTS Systems INC

PROFESSIONAL INTERCOMMUNICATIONS SYSTEMS



TW INTERCOM SYSTEM

A high performance two-wire conference-line (party-line) intercommunications system designed for use in teleproduction, broadcast, industrial and commercial applications.

User Stations

☐ Eight different packages available
☐ Headset and headset/speaker stations available
☐ Each station (10,000 ohms) bridges the line (200 ohms)
☐ Up to 75 units on a line without loading
☐ Two channels on three-conductor cable
☐ Full-duplex operation: simultaneous talk and listen to and from each station
☐ Powerful headphone amplification
☐ Dynamic and/or carbon headset capability
☐ Mic-level limiting
☐ 12-volt power operation
☐ Many options available

Power Supplies

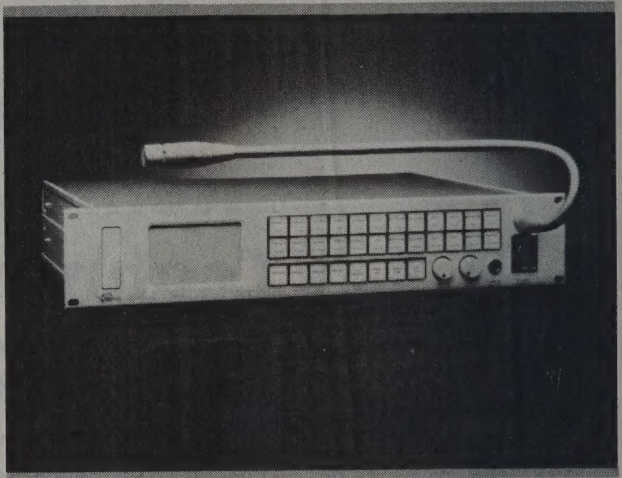
☐ PS8 powers 12 user stations
Two channels – one dry channel at 200 ohms audio impedance – one powered channel at 32 volts at 200 ohms audio impedance
☐ PS30 powers 30 user stations
Six channels – three dry channels at 200 ohms audio impedance – three powered channels at 32 volts at 200 ohms audio impedance

System Interface Units

☐ Interface between two-wire, three-wire, and four-wire lines
☐ Works with virtually any impedance, level, or type of line

Special Designs

☐ A number of standard products are available for special applications including station-isolate, source assignment, retrofit user stations, etc.
☐ Modified standard product and custom products available to customer specifications



Model 802 MASTER STATION

The 802 Master Station is a unique microprocessor-assisted communications network providing 22 independent signal paths operating in up to six separate modes.

Features

☐ Up to twelve full-duplex intercom channels
☐ Conference-line or dedicated-line mode
☐ Two-wire, three-wire, or four-wire operation
☐ One-way (simplex) announce/page functions
☐ Program audio monitoring
☐ Multi-source audio assignment to headset or speaker
☐ Front panel programmability
☐ Easy system expandability
☐ Unique momentary/latching front panel switch operation
☐ Individual channel listen levels
☐ Six programmable relays for auxiliary switching
☐ Wide range of options available
☐ Transformer-balanced audio lines
☐ Convenient interface to external equipment
☐ Programming safeguards
☐ Custom software available
☐ Each station self-contained
☐ Full-range high-quality audio
☐ Non-volatile user memory
☐ RS232 access to Z80-type microprocessor

ADDITIONAL PRODUCTS

Series 4000 IFB System

A one-way "program-interrupt" communications system used primarily for cuing "on-air talent." A modular building block format allows a system to be custom configured to user requirements. A combination of user stations, central electronics, and control stations make up a system.

Series 400 Amplifiers

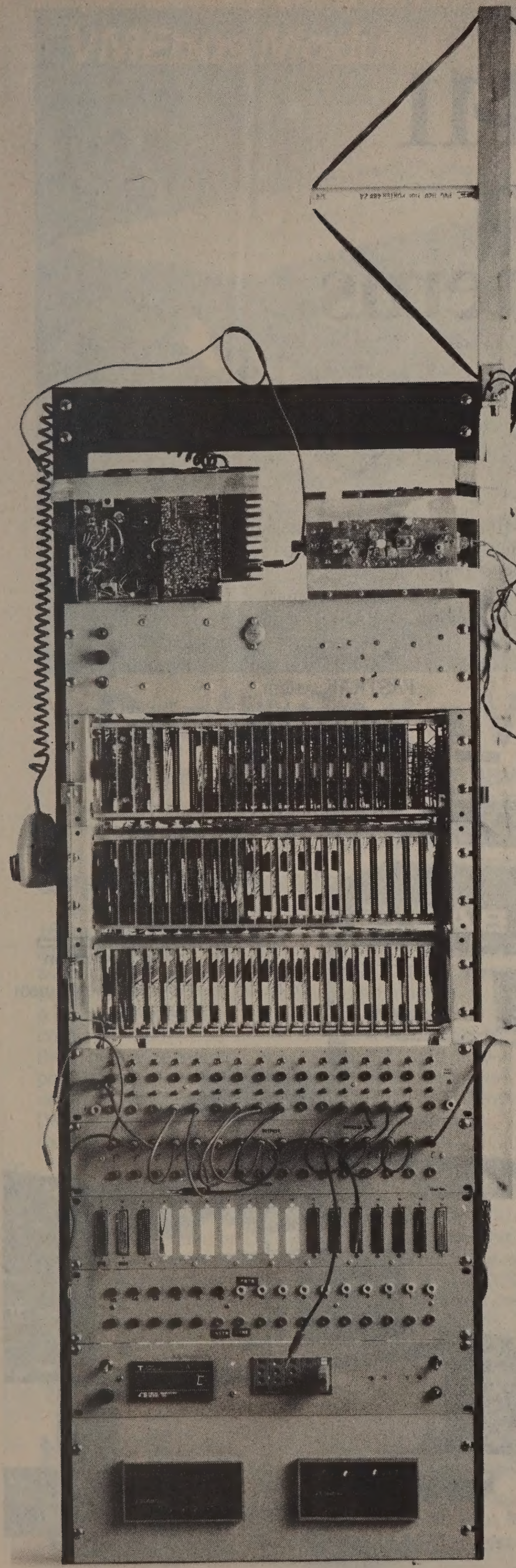
☐ Model 405 Professional Stereo Phono Preamplifier
☐ Model 410 10-Watt Monitor Amplifier
☐ Model 414 1 x 4 Audio Distribution Amplifier
☐ Model 416 1 x 6 Audio Distribution Amplifier
☐ Model 444 Dual Two-Channel Buffer Amplifier
☐ Model 465 Microphone Preamplifier

Model HPM41 Microphone Mixer with 4 inputs and 1 output
Model 1400 Battery Powered Microphone Preamplifier

RTS Systems INC

1100 West Chestnut Street ☐ Burbank, California 91506 USA ☐ TEL 818/843-7022 TWX 910-498-4987 TELEX 194855
A Compact Video Company

For More Information. Circle No. 60



Finally. Telemetry products that aren't hand-me-downs.

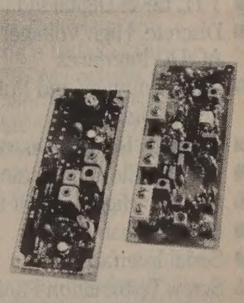
Repco designs RF Links products specifically for monitor and data transmission applications.

Most RF Links products available to the Telemetry market were modifications of two-way radios. Then they were adapted as telemetry products, possibly with some concessions in quality and compromises in function.

Repco thinks you deserve better.

We design products exclusively for your data transmission and monitoring needs. We offer design and engineering services. And, we have a dealer network to support your RF needs in over 700 locations throughout North America.

These days, with the cost of wireline data transmission rapidly escalating, a lot of people are turning to wireless for a wide range of applications.



We'll send you our free Applications Manual. It'll give you the specifics on the kinds of products available and show you how RF Links and low cost modems will work for you.

For further information call or write: Bob Lowell, Repco Incorporated, 2421 North Orange Blossom Trail, Orlando, Florida 32804, (305) 843-8484 TELEX 56-6536

Repco. The one resource you can depend upon for telemetry products that were designed to be telemetry products.

Repco

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The complete selection of LSI-11 data acquisition and control systems.

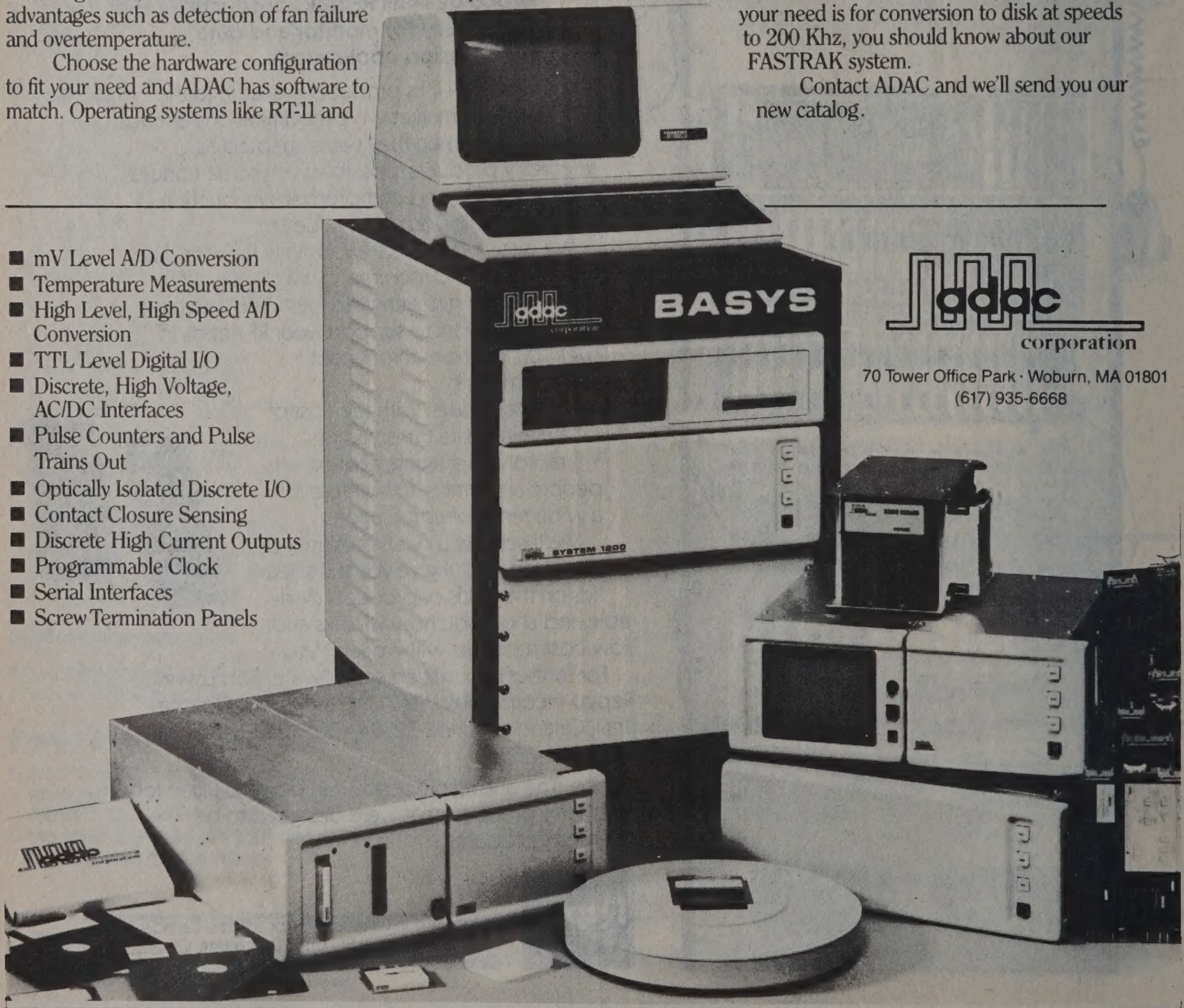
Only from adac.

Nobody else offers this wide choice of LSI-11 based systems. The largest collection of hardware including an unmatched variety of function cards—both analog and digital. Plus the biggest pick of backplanes and enclosures, including 6-slot, 13-slot and 22-slot units. All with unique advantages such as detection of fan failure and overtemperature.

Choose the hardware configuration to fit your need and ADAC has software to match. Operating systems like RT-11 and RSX-11M; higher level languages like FORTRAN, PASCAL, BASIC, "PRO" (Process Oriented software) and ADAC's newest... I/OBASIC!

Ask about BASYS, our family of user-friendly systems that includes MICROBASYS for distributed applications. If your need is for conversion to disk at speeds to 200 Khz, you should know about our FASTRAK system.

Contact ADAC and we'll send you our new catalog.



- mV Level A/D Conversion
- Temperature Measurements
- High Level, High Speed A/D Conversion
- TTL Level Digital I/O
- Discrete, High Voltage, AC/DC Interfaces
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- Programmable Clock
- Serial Interfaces
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VMEbus Modules and Systems

Designing a VMEbus system?

In just 48 hours you can have Mizar's proven VMEbus modules and software development systems for evaluation. In just 5 weeks we will deliver production quantities.

Single Height Modules

Powerful 16-bit single height modules (100mm x 160mm) are easy to package and inexpensive. Performing a single function on each board, these modules can be assembled to "tailor make" your system without incurring the expense of features neither used nor desired.

A complete selection of modules includes a system controller, motherboard, two CPU modules, 128K byte RAM, byte wide memory, quad serial port, quad parallel port, counter-timer module, real time clock, floppy disk controller, SCSI interface, GPIB interface, GPIB TLC with DMA interface, analog input module, analog output module and video controller module.

Double Height Modules

These larger size modules (233mm x 160mm) allow more functions per board, giving you the capability of implementing a high performance computer system configured to the user's needs. Performance is improved because fewer bus accesses are needed. Call Mizar for double height VMEbus modules including a 68010 CPU module with serial and parallel ports. EPROM sockets, dual ported dynamic RAM and system controller functions, a 1 Mbyte dynamic RAM module, a Winchester and floppy disk controller, CMOS battery-backed RAM, Dual Channel GPIB Controller and a graphics module offering 3 planes of display memory with 1024 by 1024 resolution.

Software and Systems

CP/M-68K™ is a single user system for the VME9000 or the VME9100 based on Digital Research's popular 8 bit CP/M. CP/M-68K has been completely rewritten to run on the 68000 and offers built-in commands, including DIR, DIRS, ERA, REN, SUBMIT, TYPE and USER. Standard utilities include DDT-68K, ED, PIP, STAT, archive (AR68), DUMP, relocation (RELOC), SIZE68 and SENDC68. Programming tools include a 68000 assembler (AS68), an object file linker (LO68) and a "C" Compiler.

For those users who need a real-time multi-tasking operating system, Mizar offers OS9/68000™ from Microware Systems Corp. OS9/68000 is a Unix-like operating system that has been optimized for low-cost, high performance applications in personal computers, industrial control systems and general-purpose multi user systems. OS9/68000 offers such features as hierarchial disk directory structure, ROM-able code for use with or without a disk system, UNIX™ software compatibility at C source code level and language support for Basic, C, Pascal and Fortran 77.

CP/M is a trade name of Digital Research
OS9/68000 is a trade name of Microware Systems Corp.
UNIX is a trade name of Bell Labs

MIZAR INC.
302 Chester Street, St. Paul, MN 55107
Phone (612) 224-8941 • Telex 469542

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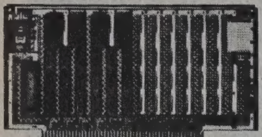
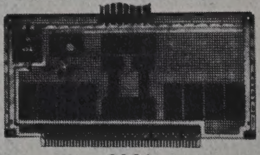
MICROCOMPUTER PRODUCTS

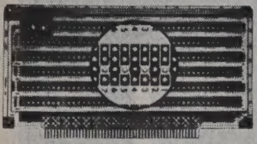
Prototyping Boards • Rack Mount Card Cages • Mother Boards • Connectors • Drop-In Card Racks • Extenders • Enclosures

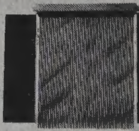
Vector

S100 AND IEEE 696 SYSTEM PACKAGING


8800V


8801


8804


3690-12

Plugbords for interface, memory expansion, breadbording. Nickel/gold plated contacts, 50 each side on 0.125" centers. 0.042" holes on 0.10" grid for DIP sockets, push-in terminals and socket pins. Fire retardant epoxy glass composite material.

8804: "ANY DIP" -- full power and ground planes back-to-back on opposite board sides with offset pads. Two regulator positions provided, one heat sink furnished. Holds 70 16-pin DIPs.

8800V: Power distributed to each DIP location by heavy copper tinned power and ground planes on opposite board sides for low impedance. Prewired regulator circuit and two heat sink provisions. Holds 36 16-pin DIPs.

8801: Individual tinned square pads surround most holes. Heavy tinned power and ground buses are provided and prewired regulator position. Pads for mounting I/O connectors. Holds 82 14-pin DIPs.

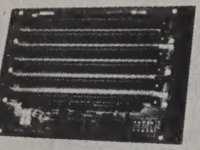
8801-1: No etched circuitry except plug contacts. Holds 121 14-pin DIPs.

3690-12: Provides 7.5" long extension to facilitate testing. Mounted connector.

Connectors with 50/50 gold/nickel plated contacts on .125" centers:

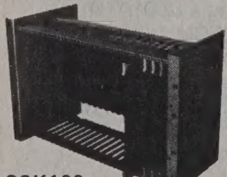
R681 Dip Solder Tail. **R681-1** Wrap Post Tail. **R681-2** for mother board use.

MOTHER BOARDS

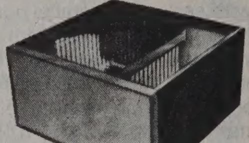

8803-6-1

Hi speed - up to 10MHz, shielded, two-sided, plated thru holes, FR4 epoxy glass, .000050" gold plated connector contacts, liberal decoupling capacitors, "reset" switch wiring pads, fully assembled.

8803-6-1 6-position **8803-18-1** 18-position.


CCK100 Rack Mounting Cage

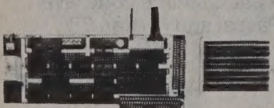
Especially designed to accommodate S100, Exorciser and Micromodule Plugbords. 19" w. x 12.2" h. x 8.9" d. Furnished with 21 pairs of guides. Adjustable rear struts mount mother boards or connectors.


VP2 Assembled Case

Sturdy blue vinyl finished aluminum, fully assembled, with card guides, mounting for mother board or connectors. Power supply chassis plate, and I/O rear connector panel with 10 cutouts for DB25S connectors included.

APPLE II & APPLE IIe

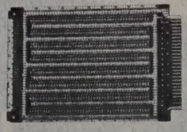
With Expandamem



4609 Plugbords: Hi capacity, mounts 18 16-pin DIPs .1" grid of .042" holes. 7.7" x 3.06". Two gold plated I/O card edge connectors. Wrap wire or solder. Tinned 2 oz. copper power and ground buses.

STD BUS

Plugboards for interface, memory expansion, experimentation. Flame retardant epoxy glass composite 1/16" x 4.5" x 6.5" with 2 oz. tinned copper buses and pads. 28/56 nickel/gold plated on contacts on .125" centers. Power and ground bus terminations per STD Bus .042" dia. holes on 0.1" grid. I/O connector pads.

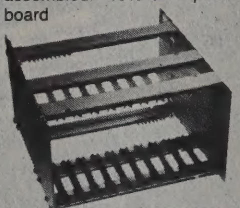

4610

4610 for soldering or wire wrapping
4610-2 for wire wrapping
4610-1 no etched circuitry except for plug contacts
3690-16 extender board has nickel/gold contacts connected to mounted receptacle.

MOTHER BOARDS

4610-8-1

Hi speed – up to 10MHz, shielded, 2-sided, plated thru holes, FR4 epoxy glass, .000050" gold plated connector contacts, liberal decoupling capacitors, "reset" switch wiring pads. Fully assembled. • **4610-8-1** 8-position board • **4610-16-1** 16-position board


CCK19S

CCK19S "drop in" card rack, all aluminum 5¼" h. x 8¼" w. x 8⅛" d. 20 nylon card guides supplied for card mounting on .250" increments, rear cross members for motherboard or connector mounting.
CCK19SMB8: CCK19S rack with 4610-8-1 motherboard.

IBM PERSONAL COMPUTER

8006 Pad-Per-Hole Circbord: Measures 13.25" x 5" x .062" overall, 16-pin DIPs, up to 154, pad size .080" d. on .1" x .1" grid, .043" d. holes drilled & plated thru. Gives unlimited freedom in component mounting without the expense of edge connectors.

8006

4613

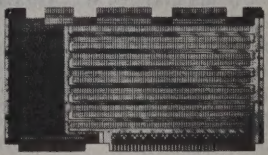
PROTOTYPING PLUGBORDS

4613: 3-hole Pad and Bus Board
4613-1: Bare Board with Peripheral Buses
4613-2: Wire Wrapping Bus Board
4613-3: Pad-Per-Hole
3690-22: Extender Board

COMMON FEATURES:

• Full size boards: 13.23" x 4.2" x .062" overall. • Accept any width DIP ICs.. • 31/62 gold plated contacts on 0.100" centers. • Card guide & universal mounting bracket included for use with or without I/O connector. • Component lead holes on 0.1" grid. • Buses terminate to connector per IBM standard.

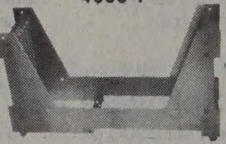
MULTIBUS


4608-1

4608 Plugbord: Series 80 size, shape, and connectors. Solder or wrap wire. .042" dia. holes on 0.1" grid. Prewired for regulator. Dual bus for power and ground.

4608-1: Same size and connectors as 4608 but no other etched circuitry.

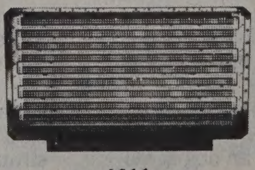
4608-4-1 motherboard, 4-slot with passive termination, gold plated expansion connector, reset switch pads, provision for optional 60-pin connector.



CCK20: 4-slot anodized aluminum card rack for stand alone of chassis mounting.

CCK20MB4: CCK20 rack assembled with 4608-4-1 motherboard.

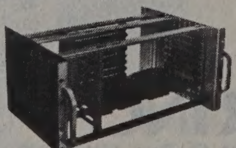
MOTOROLA EXORCISOR - MICROMODULE - ROCKWELL AIM65 EXPANSION


4611

4611 Plugbord: 3-hole pads + 2 buses per Motorola standard, 43/86 nickel/gold contacts on .156" centers. Epoxy glass composite with .042" dia. holes on 0.1" grid for solder or wrap wire.

4611-1: Same as 4611 except no etched circuits except plug contacts.

CCK80 HORIZONTAL CARD CAGE



CCK80 horizontal card cage for S100 Bus - Multibus - Motorola Exorcisor, Micromodule - Rockwell AIM65 Expansion.

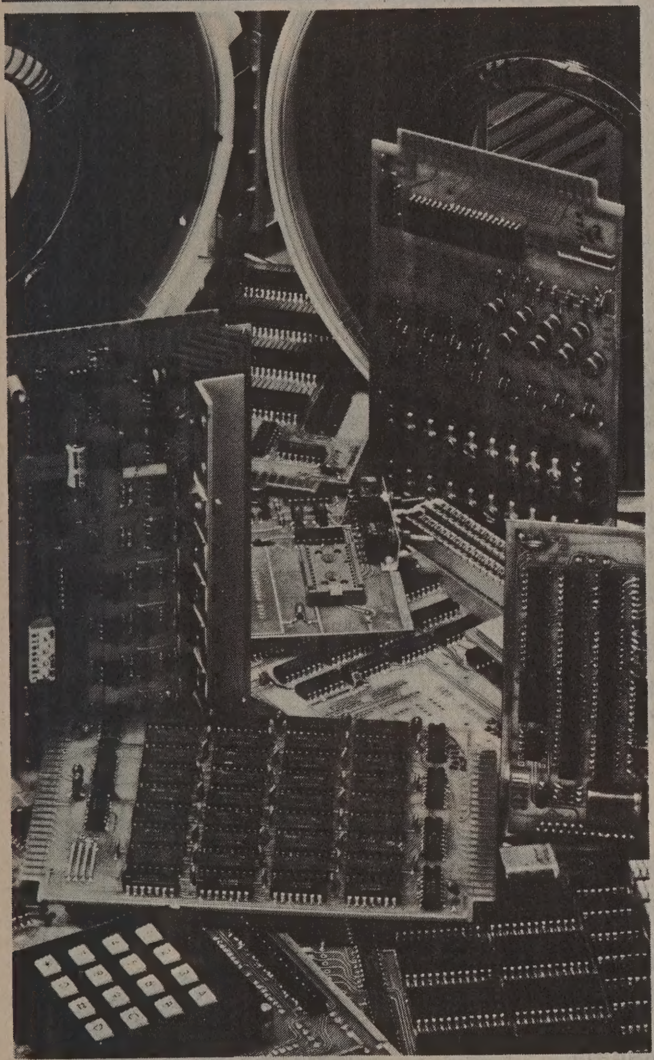
10 card positions. Fully assembled.

Many other models available -- contact your local distributor or factory. For wiring terminals and tools, see Sec. 1700, P. .

VECTOR ELECTRONIC COMPANY, 12460 Gladstone Avenue, P.O. Box 4336, Sylmar, CA 91342-0336 Phone (818) 365-9661

For More Information. Circle No. 64

WINTEK



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All modules are 4.5 by 6.5 inch. Unit prices are listed. Quantity discounts for micro modules are 10-24 10%, 25-49 20%, 50-99 30%, 100-499 40%, 500+ 50%.

MCH18	6809 MPU, 2K RAM, 3 ROM sockets, 2 RS-232 serial ports, 4 parallel ports, watchdog timer, real-time clock	$285
MCH38	6809 MPU, 6K RAM, 1 ROM socket, 2 RS-232 serial ports, 4 parallel ports, watchdog timer, real-time clock	325
MCH68	6809 MPU, 24K RAM, 1 ROM socket, 2 RS-232 serial ports, 4 parallel ports, watchdog timer, real-time clock	885
MCL10	6800 MPU, 128 bytes RAM, 1 ROM socket	101
MCL45	6800 MPU, 0.5K RAM, 1 ROM socket, serial port, 4 parallel ports	182
MAI04	16-channel, 12-bit A/D Converter module	229
MAI20	2-channel, 8-bit D/A Converter module	99
MCI11	16 button keypad with 15 7-seg. displays	199
MCM81	2K bytes CMOS RAM with battery	189
MCS00	Cassette tape & RS-232 interface for 6800 Control Module	109
MCT10	Counter/timer module with battery	129
MDS08	Driver/Sensor module with 8 optically isolated inputs	111
MDS44	Driver/Sensor module with 4 optically isolated inputs and 8 open-collector drivers	107
MDS80	Driver/Sensor module with 16 open-collector drivers	103
MFC04	Floppy disk controller for 4 drives	199
MGP00	IEEE-488 Bus interface	199
MPB00	Breadboard with parallel interface	49
MPI08	64-line parallel I/O	179
MRO16	ROM module for 2708, 16 bytes	89
MRO17	ROM module for 2716, 32K bytes	89
MRO18	ROM module for 2732, 32K bytes	89
MSI08	8-port RS-232 serial interface	249
ABP04	4 slot backplane	66
ABP07	7 slot backplane	114

Development Systems

SDP10	Development Pac 1 — semi-kit with 6800 MPU, 16K RAM, cassette-based editor/assembler	$749
SDP23	Development Pac 2 — semi-kit with 6800 MPU, 48K RAM, cassette-based editor/assembler and BASIC, EPROM programmer	1399
SSP32	Sprint 68 — 6800 MPU with dual 8″ disks, 48K RAM, operating system, editor, assembler, BASIC, and Small-C; optional C-compiler, FORTRAN, Pascal, cross-assemblers, EPROM programmer	3949
SVC00	6801 VICE — Development and test system for 6801/68701 MPU with 6K RAM, debugger, virtual in-circuit emulation, and 68701 programmer	695

Sprint 68 Software

Supplied on diskette for Sprint 68 Development System

RDA00	6800 Macro Assembler	$150
RDA01	6801 Macro Cross-Assembler	150
RDA05	6805 Macro Cross-Assembler	150
RDA09	6809 Macro Cross-Assembler	150
RDC00	6800 C-Compiler	495
RDL00	Linker	75
RDU00	UCSD p-System with FORTRAN & Pascal	675

Cross-Software

Written in ANSI FORTRAN for PDP-11, VAX, IBM, CDC, etc. computers. Request license and media forms before ordering.

CAS00	6800/6801 Macro Cross-Assembler	$1000
CAS50	6805 Macro Cross-Assembler	1000
CAS90	6809 Macro Cross-Assembler	1000
CFP00	6800 Floating-Point Package	500
CLL00	Cross-Linker	400
CPL00	6800 PL/W Compiler	1400
CPL90	6809 PL/W Compiler	1400
CSM00	6800 Simulator	800
CSM10	6801 Simulator	800
CCC00	Pkg: CAS00, CFP00, CLL00, CPL00 & CSM00	3400

TELEX 70-9079 (WINTEK CORP UD)

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COMPUTER A/D-D/A SUBSYSTEMS

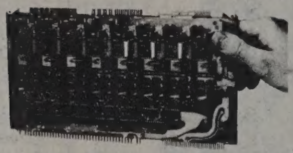
FOR MULTIBUS

INDUSTRY STANDARD 12-BIT A/D-D/A

- Runs directly from Intel RMX-80 software
- 12 binary bits, 20μS A/D conversion
- Differential PGA
- Crystal Pacer interrupt clock
- 4-20 mA loop I/O

ST-711: 32S 16D A/D In
ST-732: 32S 16D A/D In plus 2 D/A Out
ST-724: 4 D/A Out

8 LOOP DAC's INDUSTRIAL



- 4 or 8 D/A channels with selectable 4-20 mA loops
- 8/16-bit data transfer, 16/20-bit addressing (8086-series compatible)
- Runs directly from Intel RMX-80 software
- Floppy disk diagnostic program and listing available
- 12-bit resolution, .05% accuracy
- Optional DC/DC power converter

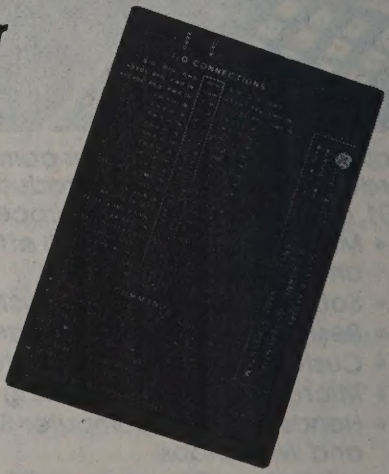
ST-728 SERIES

HIGH RESOLUTION, 14-BIT DAC'S

- 4 or 8 D/A channels
- 8/16-bit data transfer, 16/20-bit addressing (8086-series compatible)
- Accuracy .005% of FSR
- Optional DC/DC power converter
- Floppy disk diagnostic program and listing available

ST-716 SERIES

Without a Passport, your digital computer won't be welcome in an analog world.



- Passport is Datel's SDAS-8 miniature Data Acquisition Microsystem
- 8 Differential A/D Channels
- Measures only 4″ x 6″ x 0.4″
- Simple ASCII RS-232-C connection to personal and microcomputers
- Includes thermocouple software
- Includes PGA, real-time clock, auto-scan start clock
- Multidrop 32D channels thousands of feet between isolated stations.

SDAS-8

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For More Information. Circle No. 66

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Preston's GM Series Systems are used extensively in high quality testing and research applications for a broad spectrum of industries ranging from aerospace to automotive. And, Preston ADC-DAC Systems interface to most computer systems such as DEC, HP, Gould/SEL, Perkin-Elmer, as well as array processors from Floating Point Systems, CSPI and Analogic.

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For More Information. Circle No. 67

What a performance! Seven new data acquisition and control boards for your IBM PC.™

Encore! Encore!

Data Translation has done it again. Our first two analog and digital I/O boards for IBM personal computers received rave reviews.

So we extended our product line to seven ...starting at $295 for quantity purchasers.

While most of the personal computer world focused on home and office applications, we lifted the curtain on two other key areas. Laboratory data acquisition and industrial control.

Now, no matter what you need for your IBM PC, we have it. Each board is a complete data acquisition and control system. With A/D, D/A, digital I/O, and a programmable clock. You simply choose the board offering the speed and resolution you need most. Just plug it into your PC's backplane and it's showtime.

With on-board intelligence, all seven are software compatible and supported by Data Translation's PCLAB software package.

			AD			DA				
Price (U.S.$)	Class	Model	Resolution (bits)	No. of Channels	Speed (KHz)	Resolution (bits)	No. of Channels	Speed (KHz)	Digital I O Channels	Programmable Clock
	Low Cost	DT2808	10	16SE	3.3	8	2	10	16	yes
	General Purpose	DT2801	12	16SE or 8DI	13.7	12		16		
	High Speed	DT2801-A	↓	↓	27.5			33		
	High Resolution	DT2801/5716	16	8DI	2.5			16		
	Low Level	DT2805	12		13.7					
	Low Level, High Resolution	DT2805/5716	16	↓	2.5			↓		
	Simultaneous S/H	DT2818	12	4	27.5	↓	↓	33	↓	↓

NOTES 1 PCLAB software supports all models. 2 Programmable gain is standard for all DT2801 and DT2805 models. 3 Screw terminal and signal conditioning panels available for connection of all I O signals.

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For complete details on our full Analog I/O product line, turn to our Vol. III D.T.I. of Gold Book, or complete and return the post card included in the Gold Book Post Card Pack.

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"Who else could squeeze 512 analog input channels on 2 MULTIBUS boards? Or even 128 channels on one? We've done both."

Try this on for size.

Data Translation's new DT712 has 128 analog input channels. More than any other A/D board on the market. Add the DT713 to get 512 inputs.

Engineers faced with a lot of analog sensor inputs no longer have to add on a ton of extra boards for industrial process control applications.

Now all they need is one. Ours.

The DT712 is also extremely economical. With more channels, the cost per channel is at least a third less than anything the competition can offer.

Besides greater cost efficiency, the DT712 also includes multiple triggering and scanning schemes, and an on-board programmable clock. Plus, a unique screw terminal panel lets you enjoy easy installation of analog signals, and a very clean, noise-free cabling connection.

And the DT712 is compatible with the latest MULTIBUS interface... including 24-bit addressing and 16-bit data transfers.

So before you get into a tight spot, call Data Translation.

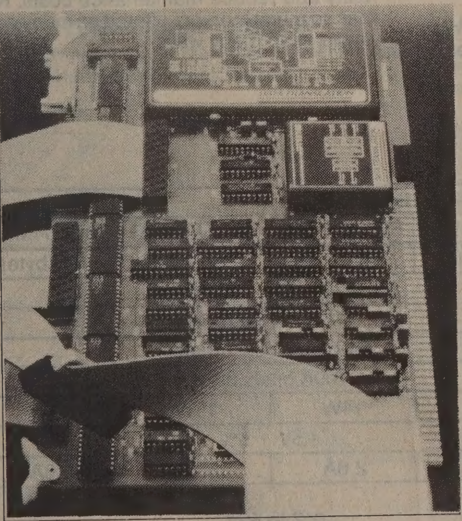
We've loosened up the input problem 512 ways.

Call (617) 481-3700.

Fred Molinari, President

DT712 SERIES A/D BOARD DESCRIPTION

MODEL	TYPE	MAX NUMBER OF CHANNELS
DT712	High Level A/D	128SE/64DI
DT712 + DT713	High Level A/D Expanded	512SE/256DI
DT714	Low Level A/D	64DI
DT714 + DT715	Low Level A/D Expanded	256DI



The DT712 provides for up to 128 A/D channels on a single MULTIBUS board.

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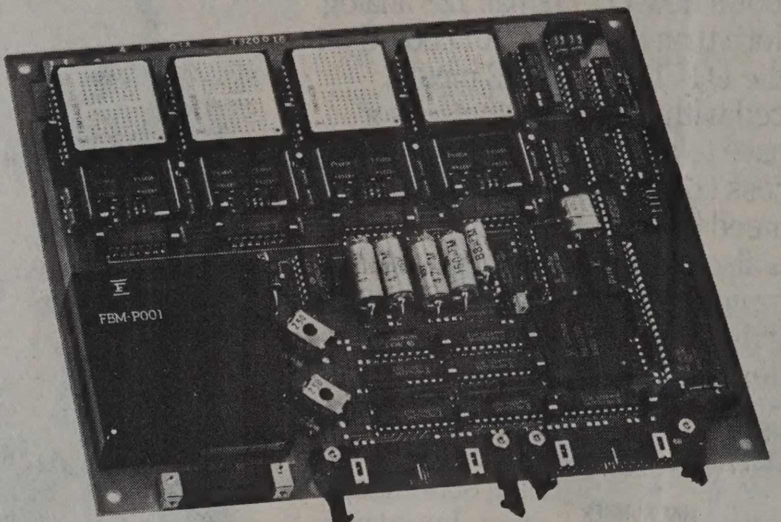
For More Information. Circle No. 68

World–Class Components Update:

FUJITSU

4Mbit Bubble Memory Capacity Now Available On Multibus-Compatible Cards



Cards Connect to Fujitsu's Unique Bubble Memory Cassettes for Easy Off-Loading, Job Changing

Fujitsu's four new bubble memory cards, all compatible with IEEE 796 (Multibus*), offer you capacities of 128K, 256K, 384K and 512K bytes. (Add expansion ports and raise capacity all the way up to 4M bytes.)

Great capacity's not all you get. Check these other user-friendly features:

- **+ 5V Single Power Source.** Makes designing a power supply easy. Also, a power-fail circuit is built in.
- **8-Bit/16-Bit Data Bus.** Gives you your choice of which bus to use.
- **Built-in DMA Controller.** Simplifies the design job. Each board has a controller equivalent to the 8257 standard.
- **Error Correction.** Allows ECC correction of burst errors of up to 3 bits.
- **Cassette-Connectable.** Adds flexibility. Simply hook up a 1Mbit Fujitsu bubble cassette and change jobs or transfer data off-line easily.

In addition, all Fujitsu bubble memories offer you maintenance-free operation, access times 4 times faster than competitive bubbles and 10 times faster than floppy discs, and a non-volatile memory that generates *without a seed bubble.*

What's more, tough Fujitsu cassettes go where discs fear to tread. Portable, removable and magnetically shielded, they shrug off shock, vibration, dirt, oil and chemicals.

Features like these make Fujitsu bubble memories ideal for test and measurement equipment, communications systems and data processing, where they help solidify file memory, improve system functions, upgrade reliability and reduce maintenance costs. Never has so much memory offered so many advantages in so many ways.

*Multibus is a registered trademark of Intel Corporation.

Specifications

Card Number	FBC501M4M	FBC502M4M	FBC503M4M	FBC504M4M
Storage Capacity	128K bytes	256K bytes	384K bytes	512K bytes
Interface	IEEE 796 (TTL-compatible)			
Access time	12.5 ms average			
Transfer system	64-byte block transfer			
Transfer rate	100K bits/s max.			
Average power consumption	13W	14W	15W	17W
Supply voltage	+5V + 5%			
Average supply current	2.5A	2.8A	3.1A	3.3A
Ambient temperature range: Operating Information storage	 0°C to 50°C 40°C to 85°C			
Card dimensions	304.8 mm x 171.5 mm x 15.0 mm			

- *The FBC504M4M-series bubble memory cards operate as memory-mapped I/O and require only a 64-byte memory space. The base address can be set in units of 64 bytes.*
- *The following products can be connected to the extension ports:*

512K-byte extension memory card	*FBC504D4P*
Extension holder unit	*FBM-U502MU*
128K-byte bubble cassette	*FBM-C128GA*
	(Connector: FCN-747J030 AU.O)

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Component Division Fujitsu America, Inc.
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For More Information. Circle No. 69

FUJITSU

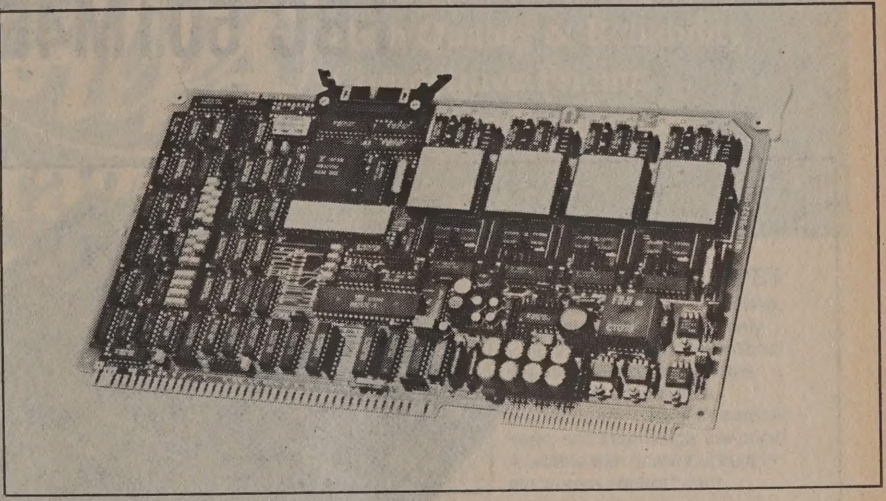
With Built-In 1 Megabit Memory Device and Control LSI

Fujitsu Bubble Memory Card

• FBC504M4P Series... +5V single power source • FBC504M4L Series... +5V, +12V, −12V

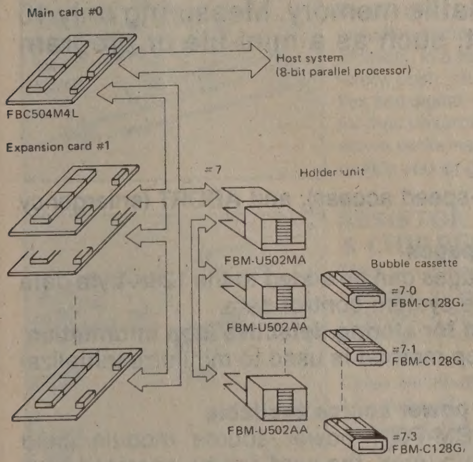
FEATURES

- **Maintenance-free**
  Maintenance is unnecessary because of no moving parts and no battery backup.
- **+5V single or triple power sources**
  Both the popular +5V single power source and the +5V, +12V, and −12V triple power source are available.
- **Wide variety of memory capacities**
  Basic memory capacities of 128KB, 256KB, and 512KB can be expanded by connecting 512KB expansion cards for a total memory capacity of up to 4MB.
- **1-megabit bubble cassette system**
  Data sharing and JOB modification can be easily performed by connecting the 1-megabit bubble cassette system.
- **Error correction function**
  In addition to the ECC error correction function, bus parity is provided for detecting errors due to noise on the bus.
- **A wide variety of commands**
  The card has a total of 24 commands, including R/W, SEEK (high-speed access), ABORT (access interrupt), and READ WRITE CHECK (self diagnosis).
- **Useful sub pages**
  Three sub pages can be added to the 128K-byte data area for storing system control data etc.
- **New defective loop information storage method**
  The boot loop method is used to store defective loop information, thereby minimizing initialization time.



SYSTEM CONFIGURATION (EXAMPLE)

- 4M-byte memory system composed of 7 memory cards and 4 holder units. (Triple power source)



Note:
Restrictions on system configuration
- One main card is necessary to communicate with the host system.
- Expansion cards and holder units (FBM-U502MA) can be combined as desired, but only up to seven cards or units.
- Only up to three FBM-U502AA holder units can be connected to FBM-U502MA.

PRODUCT LINEUP

Type / Memory capacity / Power source	Memory card				Cassette system		
	Main card			Expansion card	Holder unit		Cassette
	128KB	256KB	512KB	512KB	–	–	128KB
+5V	FBC501M4P*	FBC502M4P*	FBC504M4P*	FBC504D4P*	FBM-U502MU*	FBM-U502AA	FBM-C128GA
+5V·+12V·−12V	FBC501M4L	FBC502M4L	FBC504M4L	FBC504D4L	FBM-U502MA		

*under development

LIST OF BUBBLE MEMORY CARDS

Memory capacity	Byte	32K	64K	128K	256K~2M	128K	256K	512K	1M~4M
Model	–	FBC401M3L	FBC402M3L	FBC404M3L	FBC404M3L + Expansion	FBC501M4P /501M4L	FBC502M4P /502M4L	FBC504M4P /504M4L	FBC504M4P /404M3L + Expansion
Mounted chip	–	FBM43DA				FBM54DB			
Number of devices	–	1	2	4	8~64	1	2	4	8~32
Capacity per page	Byte	32				64			
Number of page	Page	1,024	2,048	4,096	8,192 ~65,536	2,048	4,096	8,192	16,384 ~65,536
Mean access time	ms	6.5				12.5			
Transfer method	–	32-byte block transfer				64-byte block transfer			
Transfer rate	K-bits/s	100 (max)							
Interface	–	8-bit parallel and DMA operation available							
Power consumption									
Operation	W	9.8	11.0	13.6	—	P 12.5 L 8.8	15.0 10.5	18.5 3.0	– –
Standby	W	6.2	7.4	9.8	—	P 8.0 L 6.0	9.5 7.0	12.0 8.5	– –
Power voltage	V	+5·+12·−12				P type: +5 single; L type: +5, +12, and −12			
Temperature range									
Operation	°C	0~50							
Non-volatile storage	°C	-40~85							
Withstanding exterior magnetic field									
Operation	Oe	20 (max)							
Non-volatile field	Oe	50 (max)							
Error correction	–	Not possible				Possible			
Exterior dimension	mm	170 x 210 (Mounting height 15 mm max)							
Remarks					Expansion cards 128K bytes: FBC404D3L 256K bytes: FBC408D3L	Available with 1M-bit cassette system			Expansion cards 512K bytes: FBC504D4P /504D4 L

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918 Sherwood Drive, Lake Bluff, IL 60044
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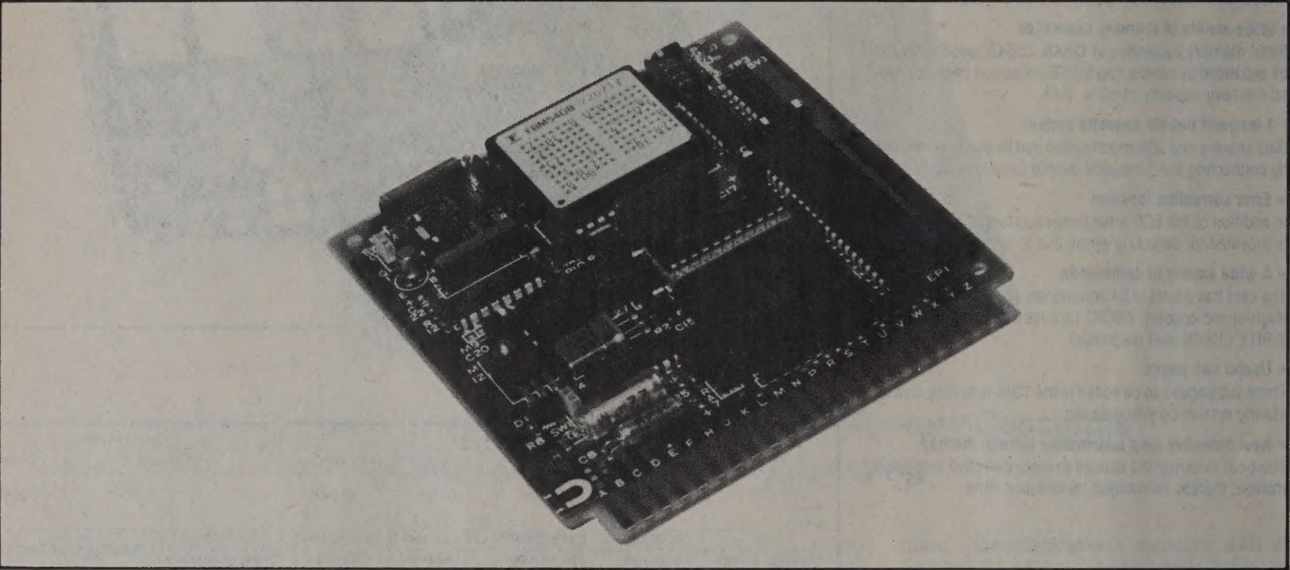
For More Information. Circle No. 69

Fujitsu 128K-Byte Bubble Memory Card FBC 501M4E



The FBC501M4E bubble memory card, with its built-in 1M bits bubble memory chip and unique control circuit, provides 128K bytes of easy-to-change nonvolatile memory. Measuring only 10 cm x 10 cm, this card is ideal for use in compact equipment, such as a mini-file or program memory.

Features

- **Maintenance-free solid file**
  Maintenance is not necessary because the card has no moving parts and does not require battery backup.
- **General-purpose interface and DMA**
  The 8-bit parallel interface enables easy connection to any microprocessor.
- **Error correction function**
  In addition to the ECC error correction function, a bus parity check is also provided to detect errors resulting from noise on the bus.
- **A wide variety of commands**
  The card has a total of 24 commands, including R/W, SEEK (high-speed access), and ABORT (emergency stop).
- **Useful sub-pages**
  Three sub pages can be added to the 128K-byte data area to store system control data.
- **New method for storing defective loop information**
  The boot loop method is used to minimize initialization time.
- **+5V single power source available**
  With the FBM-P001 power source module (sold separately) mounted, the card can be operated on a single +5V supply.

World-Class Components
Part of Tomorrow's
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Component Division Fujitsu America, Inc.
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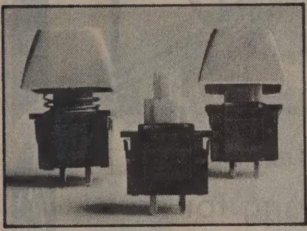
Electro-mechanical products with

The Alps Advantage

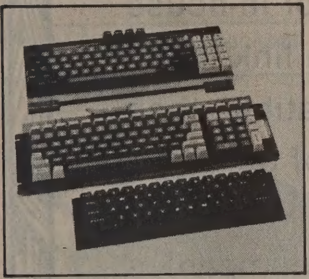
SINCE 1948

- Innovative Technology
- High Quality & Reliability
- Competitive Pricing
- World-Wide Reputation



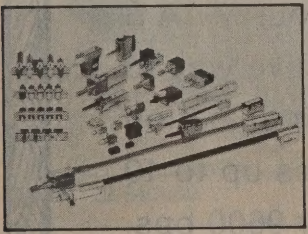
KEY SWITCHES

Choose from several contact types: mechanical, conductive rubber or tactile feedback. Snap-in mounting. Double-shot molded keytops in many colors, shapes, legends. Fully automated assembly assures maximum reliability, with ratings up to 20-million operating cycles.



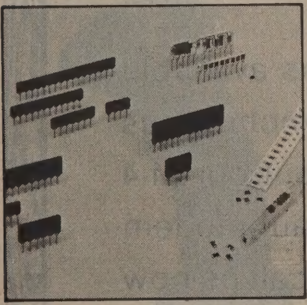
KEYBOARDS

Standard and custom keyboards, fully assembled including switches, keytops, PC board, matrix circuit, encoder circuit. NEW!—Series KFL Low Profile Keyboards meet all the latest European DIN standards for full-travel key switches with reduced profile dimensions.



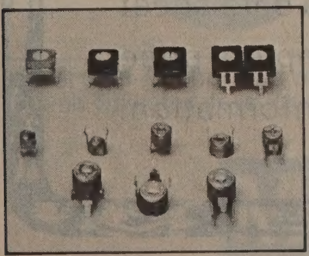
SWITCHES

Alps produces more than 900,000,000 switches per year, including some of the world's smallest, in a variety of types—rotary, push, slide, lever, power, flex and digital—all noteworthy for their unsurpassed smooth-action performance, built-in quality and long-life reliability.



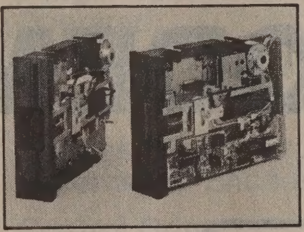
RESISTOR NETWORKS & CHIP RESISTORS

Thick film cermet element on alumina substrate, for extremely high stability. Networks in SIP configuration, from 4 to 17 pins, with resistance values from 10 ohms to 1 megohm. Chips are international standard size, 1.6 × 3.2 × .55 mm, with values from 10 ohms to 10 megohms. Available in bulk, reel tape, or plastic magazine for automatic chip placement machines.



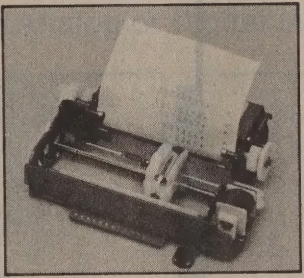
TRIMMER CAPACITORS

Ceramic or film elements, trimmer ranges from 2.5–6 pF to 10–150 pF. Snap-in terminals, with standard, reverse or side mounting—front or rear adjustment. Minimum drift, with virtually linear temperature characteristics. Precision structure protects dielectric from contamination by flux or wax.



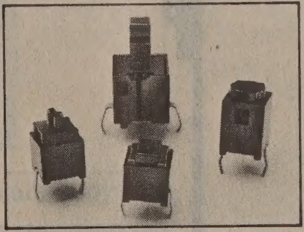
FLOPPY DISK DRIVES

New Series 2000, for 5¼″ disks, offers super-slim profile—only 1.69″ thick, half the conventional thickness. Standard features include fast access time, automatic eject, long-life ceramic head, and surprisingly low price! Available with or without built-in electronics control board.



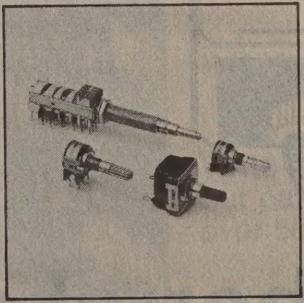
MICROMINIATURE PRINTERS

An incredible example of "The Alps Advantage" in technical innovation, Series DPG printers handle Alpha-Numeric-Graphic requirements, actually *writing* with microminiature ball point pens (1 or 4 colors!) invented by Alps using exclusive ink technology. Available for 2¼″ or 4½″ ordinary plain paper. Their small size and small price will astound you!



TACT SWITCHES

Tactile key switches with a "snap" (conductive rubber) or "click" (metal contacts) feeling to signal when contact is made. Available in a wide range of life cycle ratings, shapes, sizes, and "feelings"—ideal for many types of mini-keyboard applications.



VARIABLE RESISTORS

Rotary and slide types, ranges from 500 ohms to 2 megohms, with a wide variety of diameters, strokes, tapers, mounting, shafts, levers, etc. Exclusive lubricants for high quality smooth action. Miniature trimmer pots, sizes from 4mm to 16mm, with cermet, carbon film or carbon composition elements—ranges from 100 ohms to 2.2 megohms. Stick controls packaged with 2, 3 or 4 pots.

OTHER PRODUCTS now available from Alps include: telephone keypads, liquid crystal displays, magnetic heads, cassette mechanisms, RF modulators, switchers, TV tuners.

NEW GENERAL CATALOG
20 pages of products with "The Alps Advantage"—
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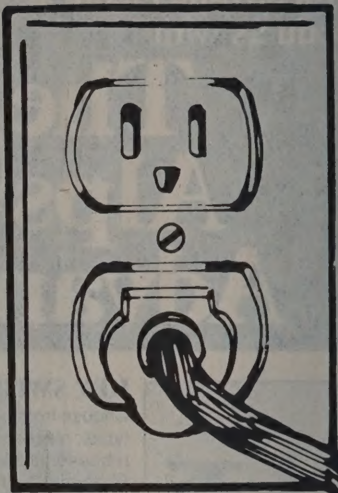
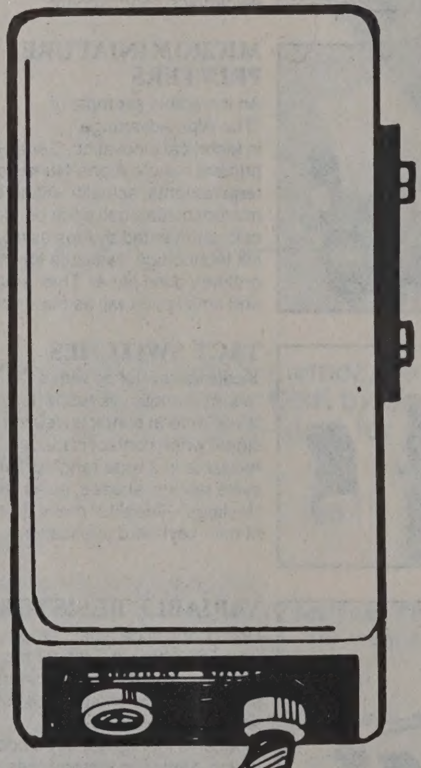
For More Information. Circle No. 70

Announcing THE M-1A $96.00 MODEM*



If you don't need dial-up and you're looking for an inexpensive local or in-house communication link that's RS-232 compatible, then consider a pair of our M-1A asynchronous short haul modems. Many companies have found that our M-1A'S are a cost effective way to solve communication problems up to 10 miles or 9600 bps.



Rack mount configuration is available also. If you need synchronous transmission ask about our M-4 synchronous short haul modem

Write or call us now for a data sheet and complete price information.

bo-sherrel co.

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*100 Quantity

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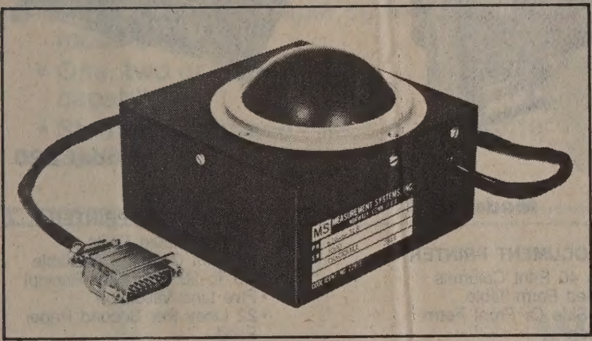
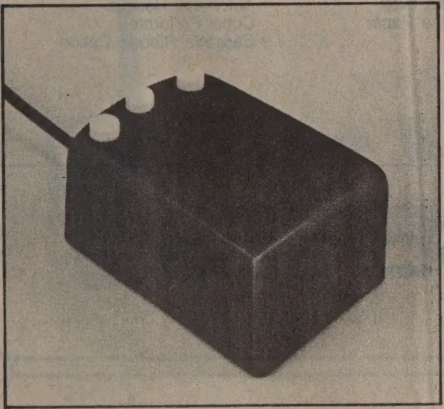
Positioning and Tracking Controls For the Human Operator

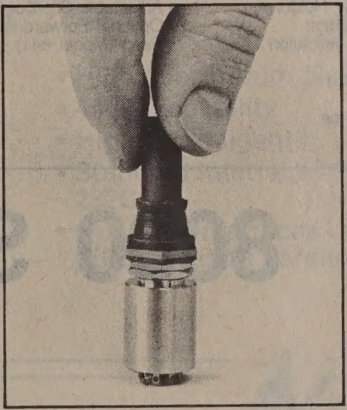


Model 636 3 Axis Trackball

- ☐ Joysticks - Force Operated, Miniature (Finger Operated) to Large (Hand Operated)
- ☐ Joysticks - Displacement, Potentiometer, Switching. All Sizes
- ☐ Trackballs - 2, 3 or 3½ inch sizes, Mice, Incremental Encoders
- ☐ Control Grips
- ☐ Analog or Digital Interfaces



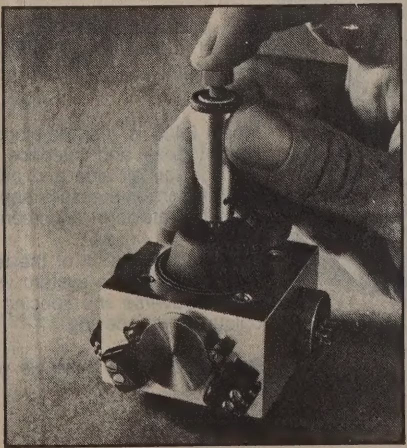
Model 122 Mouse



Model 469B Miniature Joystick

Model 544 Gimbal Joystick

Model 1500 Control Grip with Thumb Operated Joystick



Model 531 Displacement Joystick

Write or phone for our catalog listing over 50 standard items.

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800 SERIES

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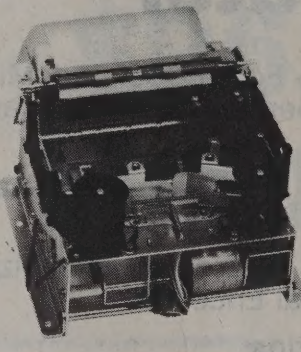
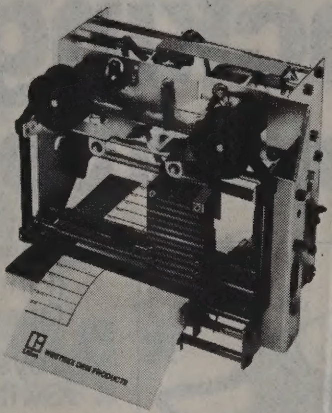


Model 850

JOURNAL PRINTER

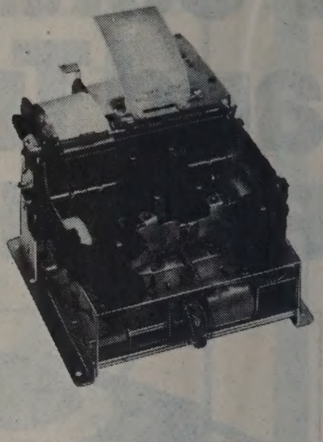
- 51 print Columns
- Integral Paper Supply Holder
- Easy Top Paper Insertion
- Full Line Document Validation Capability
- Multiple Line Validation
- Tear-Off Blade
- Manual Paper Advance
- Optional Rewind



Model 840

SLIP/DOCUMENT PRINTER

- Up To 40 Print Columns
- Flat Bed Form Table
- Easy Side Or Front Form Insertion
- Top And Bottom-Of-Form Sensors
- Adjustable Slip/Document Stop
- Optional Forward/Reverse Paper Feed (Model 841)



Model 820

SPLIT PLATEN PRINTER

- Various Platen Splits
- 46 Print Columns Available
- Up To 30 Character Receipt
- Five Line Validation
- 22 Lines Per Second Paper Feed
- Paper-Supply And Take Up
- Logo Printing
- Automatic Receipt Cutter/Perforator
- Cassette Ribbon Option

WESTREX 8000 SERIES

DOT MATRIX PRINTERS

STAND-ALONE COMPACTS

Model 8400/8410

SLIP/DOCUMENT PRINTERS

150 characters per second @ 12 cpi; 40 characters per line, standard.

Two, packaged, desk-top, dot matrix printers are the first models to be offered in this new WESTREX 8000 Series. Each model contains the basic printing mechanism found in the corresponding WESTREX 800 Series.

Model 8400 is a stand-alone slip/document printer complete with control drive and interface electronics. It permits form insertion from the front or left side and provides bi-directional printing, multiple print lines and carbon or pressure sensitive copy. An adjustable slip stop for fast and accurate form alignment is also standard.

Model 8410 has all of the features of the Model 8400 plus a stepping motor paper drive system which permits variable and programmable forward/reverse line spacing for applications requiring line selection and/or unique form indexing.

Both models are available with either Parallel, Serial RS-232C or TTY interface.

For full details, write or call us

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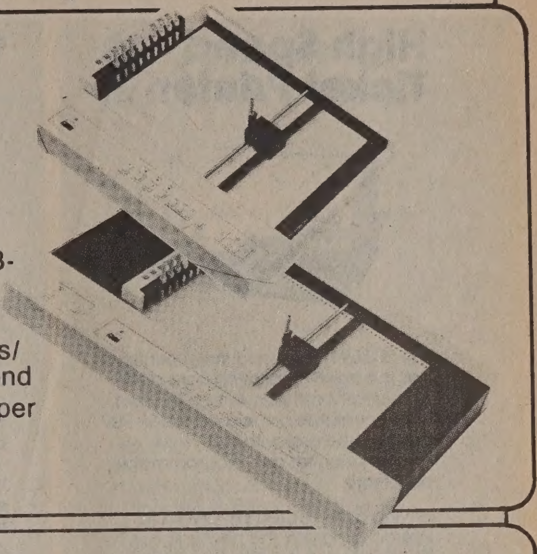
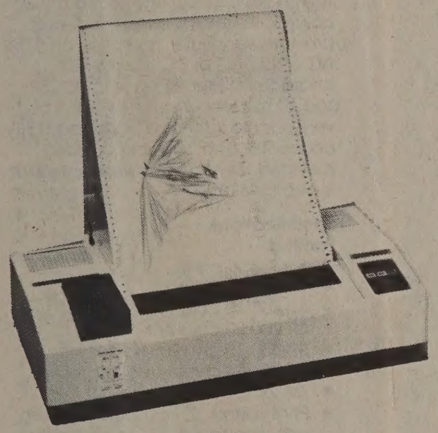
WESTERN GRAPHTEC

digital plotters

WX 4630 SERIES



- Highly intelligent
- Available in sheet, roll feed or roll feed with paper cutter models
- One, two or 10 pen capability
- Standard Interface - RS 232C
- Optional Interfaces - GPIB-IEEE and 8 bit parallel
- Plotting area 15″ x 10″
- Plotting speeds: 10 inches/second or 16 inches/second
- T models have built in paper cutter

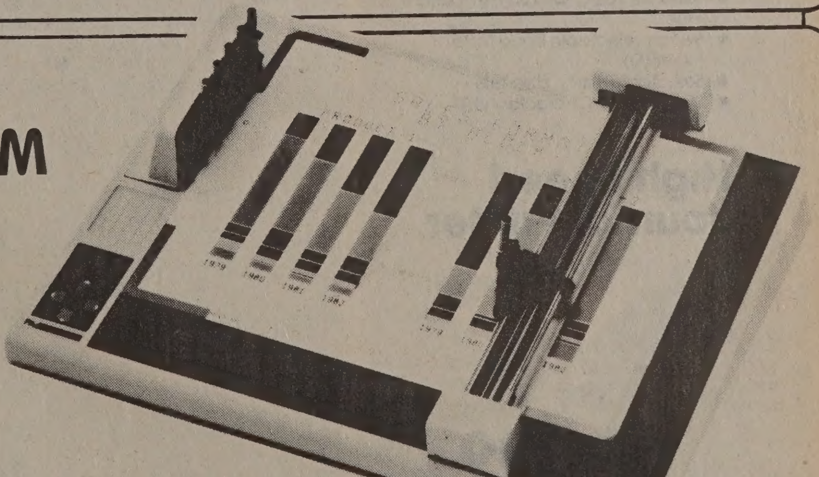


WX 4731 PLOTWRITER

- High speed drum plotter
- 4 pen capability
- Highly intelligent
- Standard Interface - RS 232C
- Optional Interfaces - GPIB-IEEE and 8 bit parallel
- Plotting area 11.3″ × 39.3″
- Plotting speed - 8 inches/second
- Print mode - 7 characters/second
- Built-in printer function

MP 1000 SYSTEM

- Plotting speed 6 inches/second
- Six pen capability
- Plotting area 14.2″ x 10.6″
- Interface: 8 bit parallel, RS 232C or GPIB-IEEE
- Single ASCII character instruction set
- Sold through distributor network to OEM's in minimum 50 unit quantities
- Business graphic software, cable and interface included.



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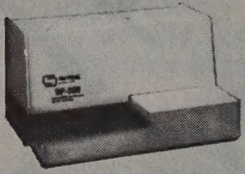
SYNTEST...gives you more.

High Speed Ticket Printer



The SP-309 high speed ticket printer has the ability to print on card stock and credit card slips. With a thru-put of 120 charcters per second the SP-309 provides the user with a 2K RAM character buffer and programmable baud rate.

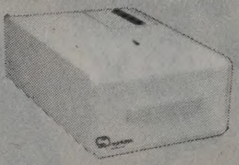
Having a dedicated EPROM for its internal program, this new unit can be modified to its users specifications. The character set as well as print size and other features can be modified as the user desires. Handshaking options include "busy" and X ON X OFF protocall.

The SP-315 high speed journal printer has many of the same specifications as the SP-309. The SP-315 provides a journal take-up for single or multiple copy printouts.

Specifications
Printing
- 5 x 7 dot matrix
- Impact printing
- 40 columns
- 120 characters per second
- 256 Byte Character Buffer
- Front & Side Form Entry
- Bi-directional printing

Input
- Serial RS 232-C and 20 mA current loop
- Switch selectable Baud Rate (50-9600)
- Selectable Parity, stop bits
- Standard 64 Character ASCII Subset

High Speed Journal Printer



SP-309
SP-315

12 VDC Printer

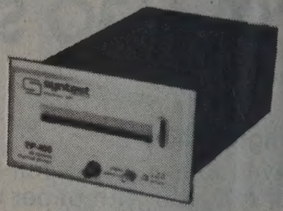
The SP-314 is specifically designed for applications where only 12V DC is available as a power source. This hard copy device features an extra rugged aluminum enclosure allowing it to withstand the rigor of operating in harsh environments. With horizontal elongation and graphics capability, the SP-314 has the versatility to perform the most demanding printing job. Designed primarily for mobile or marine operation, the SP-314 is also ideal for small computer systems that need battery backup.

Specifications
Printing
- 5 x 7 dot matrix
- Impact printing
- 40 columns
- 10 characters per inch
- .130 inch character height
- 2 L.P.S. print speed
- Multiple copy capability

Input
- Serial TTL and RS-232
- Parallel TTL
- Crystal baud rate
- TTL and RS-232 Busy

SP-314

Panel Mounted or Mobile Printer

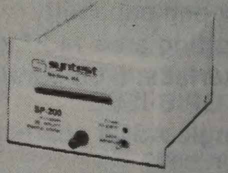


The SP-400 is a low cost miniature 40 column thermal printer. This printer provides very quiet operation on 115V AC or 12V AC or DC input. A 40 character buffer along with RS-232 and 20 mA loop input make this unit very easy to interface. A standard EIA connector and busy line are also provided.

The SP-200 is a low cost miniature 20 column thermal printer. This printer provides very quiet operation on 115V AC or 12V AC or DC input. A 20 character buffer along with RS-232 and 20 mA loop input make this unit very easy to interface. A standard EIA connector and busy line are also provided. Centronics parallel interface is also available.

Specifications
Printing
- 5 x 7 dot matrix
- Thermal printing
- SP-400 40 columns; SP-200 20 columns
- SP-400 15 characters per inch; SP-200 11 characters per inch
- .08 inch character height
- Print speed, SP-400 24 characters per second; SP-200 16 characters per second
- XTAL baud rate 50 – 9600 baud with dip switch

Input
- Serial RS232-C and 20 mA current loop internal jumper selectable
- RS232-C busy signal
- Rear EIA connector
- Mating connector Cinch DB 25-P
- Centronics parallel input (optional)



SP-400
SP-200

syntest
CORPORATION

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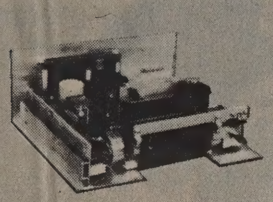
Printer with Paper Cutter



The SP-450 is a special purpose Z-80A controlled 40 column printer. Its outstanding feature is the ability to cut its paper at the end of printing a message with an ASCII control command. This is particularly useful when a printer is required in a public place for unattended use.

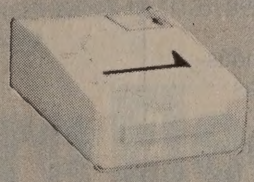
Also, the controller for this unit has a 240 character receive buffer and 4K program memory, providing ample space for special programs. Logo printing, large character buffer, bidirectional communications etc. are just some of the possibilities with this very versatile printer.

Specifications
Printing
- 5 x 7 dot matrix
- Impact printing
- 40 columns
- 12 characters per inch
- .104 inch character height
- 100 characters per second print speed
- Multiple copy capability
- XTAL baud rate 9600 baud with dip switch
- 1X, 2X, 3X, 4X print sizes

Input
- Serial RS232-C and 20 mA current loop internal jumper selectable
- RS232-C busy signal
- Rear EIA connector
- Mating connector Cinch DB25-P
- Print Alignment
  Bidirectional ±.015
  Unidirectional ±.005
- Self Test Available

SP-450

Two Color Printer



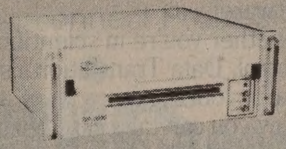
The SP-700 is a very low cost two color 40 column impact printer. This unit provides red or black print, double width characters, and also data and text mode printing. The printer produces hard copy on 115V AC or 12V AC or DC power inputs. A 40 character buffer along with RS-232 and 20 mA current loop input makes this unit very simple to interface. A standard EIA connector and a busy line are also provided. The SP-700's simplicity of design and high MTBF make it a cost effective solution for various hard copy problems.

Specifications
Printing
- 5 x 7 dot matrix
- Impact printing
- Red or black print
- Double width characters
- Data or text mode
- 40 columns
- 18 characters per inch
- .1 inch height by .05 width of character
- Average print speed 60 characters per second
- XTAL baud rate 150 - 9600 bps with dip switch

Input
- Serial RS-232-C and 20 mA current loop internal jumper selectable
- RS-232-C busy signal
- Rear EIA connector
- Mating connector cinch DB25-P

SP-700

80 Column Rack Mounted



The SP-2000 is a low cost microprocessor controlled intelligent printer, which performs functions not available on standard printers. These functions include multiple size printing, tabs, and multiple line feeds. The SP-2000 is rack mounted saving valuable bench or floor space. Simplicity of design and high MTBF make the SP- series a cost effective solution for many hard copy problems.

Specifications
Printing
- 5 x 7 dot matrix
- Impact printing
- 80 columns
- 12 characters per inch
- .122 inch character height
- 100 characters per second print speed
- Multiple copy capability
- XTAL baud rate 110 – 9600 baud with dip switch

Input
- Serial RS232-C and 20 mA current loop internal jumper selectable
- RS232-C busy signal
- Rear EIA connector
- Mating connector Cinch DB25-P
- Print Alignment
  Bidirectional ±.015
  Unidirectional ±.005
- Self Test Available

SP-2000

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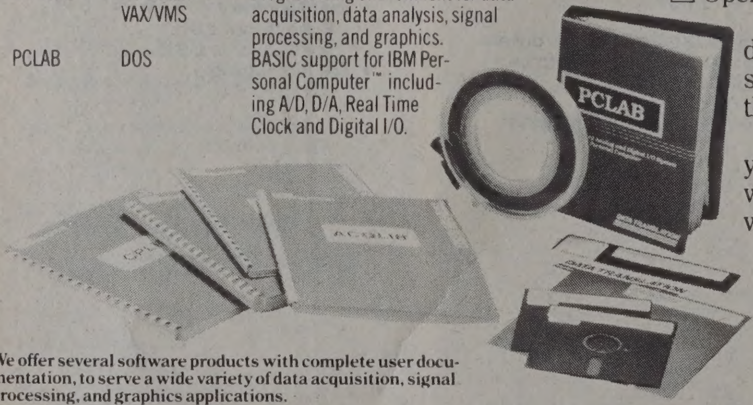
DTLIB	RT-11	FORTRAN support for LSI-11™ interfaces, including A/D, D/A, Real Time Clock, and Digital I/O **(incl. ADVII-C, AXVII-C, AAVII-C, and KWVII-C).**
CPLIB	RT-11	FORTRAN support for LSI-11 CONTINUOUS PERFORMANCE interfaces, including A/D, D/A, and Real Time Clock.
DTBASIC	RT-11	BASIC support for LSI-11 interfaces, including A/D, D/A, Real Time Clock, and Digital I/O.
RSXLIB	RSX-11M	FORTRAN support for LSI-11 and UNIBUS™ interfaces, including A/D, D/A, and Real Time Clock **(incl. ADVII-C, AXVII-C, AAVII-C, and KWVII-C).**
ACQLIB	RSX-11M	FORTRAN support for LSI-11 Dual Port Architecture boards including A/D, D/A, and Real Time Clock.
DT-DATS	RSX-11M VAX/VMS	Programming environment for data acquisition, data analysis, signal processing, and graphics.
PCLAB	DOS	BASIC support for IBM Personal Computer™ including A/D, D/A, Real Time Clock and Digital I/O.



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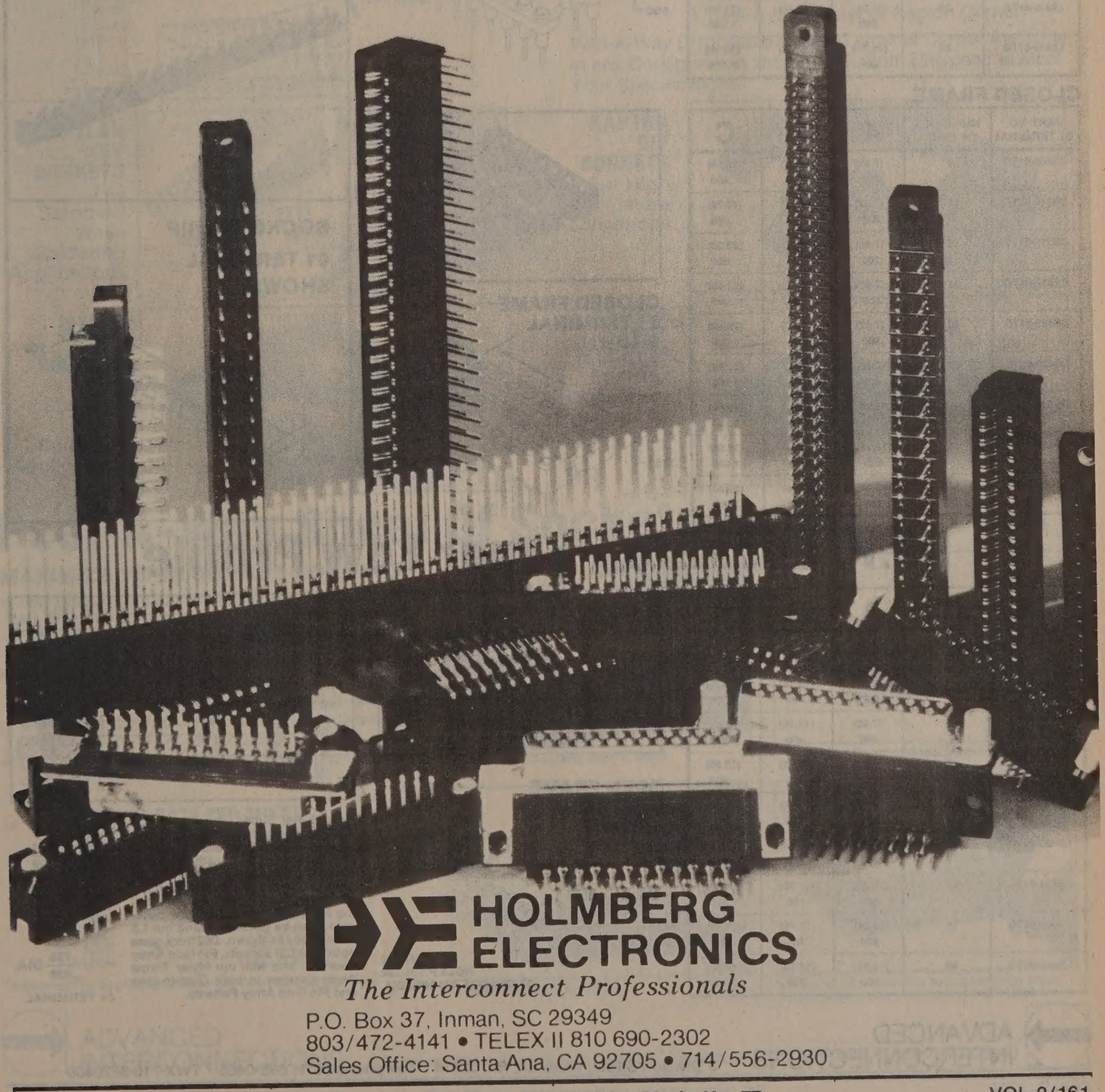
For complete details on our full Analog I/O product line, turn to our Vol. III D.T.I. of Gold Book, or complete and return the post card included in the Gold Book Post Card Pack.

For More Information. Circle No. 76

You expect quality connectors from Holmberg . . . and that's what you get. But what you may not expect in this business is the kind of extraordinary service Holmberg supplies every day—from sample parts to favorable pricing. From truly attentive personal attention to special product design. Thirty years of electronics experience is behind us, and what we've learned best is that service counts!

For a wide range of D-subminiature connectors, all-plastic and metal shell, and PC card edge connectors, call Holmberg for service. Call us once, and you'll see why we're "The Interconnect Professionals."

Holmberg Electronics... The Service Connection



HOLMBERG ELECTRONICS

The Interconnect Professionals

P.O. Box 37, Inman, SC 29349
803/472-4141 • TELEX II 810 690-2302
Sales Office: Santa Ana, CA 92705 • 714/556-2930

For More Information. Circle No. 77

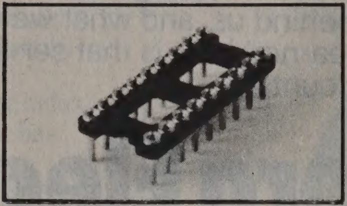
ADVANCED D.I.P. Sockets

OPEN FRAME

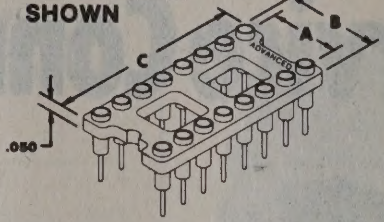
PART NO. 01 TERMINAL	NUMBER OF PINS	A	B	C
LS308-01TG	8	(7.62) .300	(10.16) .400	(10.16) .400
LS314-01TG	14	(7.62) .300	(10.16) .400	(17.78) .700
LS316-01TG	16	(7.62) .300	(10.16) .400	(20.32) .800
LS318-01TG	18	(7.62) .300	(10.16) .400	(22.86) .900
LS320-01TG	20	(7.62) .300	(10.16) .400	(25.40) 1.000
LS422-01TG	22	(10.16) .400	(12.70) .500	(27.94) 1.100
LS624-01TG	24	(15.24) .600	(17.78) .700	(30.48) 1.200
LS628-01TG	28	(15.24) .600	(17.78) .700	(35.56) 1.400
LS640-01TG	40	(15.24) .600	(17.78) .700	(50.80) 2.000

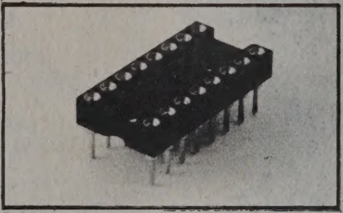
CLOSED FRAME

PART NO. 01 TERMINAL	NUMBER OF PINS	A	B	C
DS308-01TG	8	(7.62) .300	(10.16) .400	(10.16) .400
DS314-01TG	14	(7.62) .300	(10.16) .400	(17.78) .700
DS316-01TG	16	(7.62) .300	(10.16) .400	(20.32) .800
DS318-01TG	18	(7.62) .300	(10.16) .400	(22.86) .900
DS320-01TG	20	(7.62) .300	(10.16) .400	(25.40) 1.000
DS422-01TG	22	(10.16) .400	(12.70) .500	(27.94) 1.100
DS624-01TG	24	(15.24) .600	(17.78) .700	(30.48) 1.200
DS628-01TG	28	(15.24) .600	(17.78) .700	(35.56) 1.400
DS640-01TG	40	(15.24) .600	(17.78) .700	(50.80) 2.000

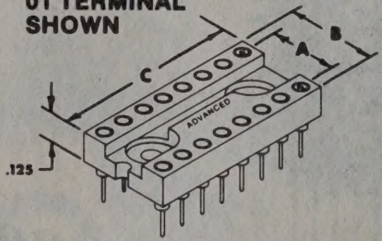


OPEN FRAME
01 TERMINAL
SHOWN



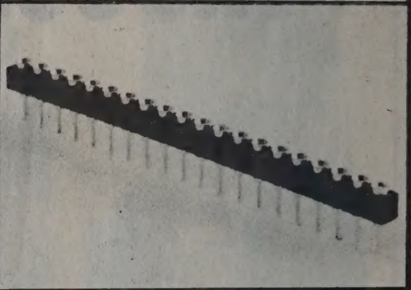


CLOSED FRAME
01 TERMINAL
SHOWN

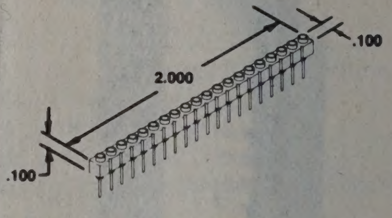


SINGLE IN-LINE BREAKAWAY SOCKET STRIP

PART NO. 01 TERMINAL	NUMBER OF PINS
SS020-01TG	20

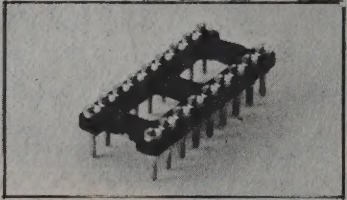


SOCKET STRIP
01 TERMINAL
SHOWN

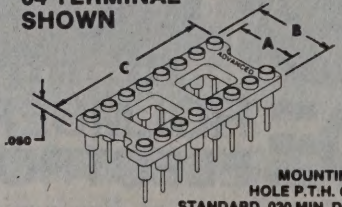


D.I.P. Sockets - Super Low Profile

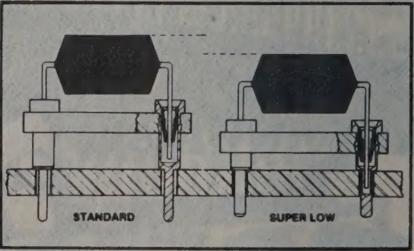
PART NO. -04 TERMINAL	NUMBER OF PINS	A	B	C
LS308-04TG	8	(7.62) .300	(10.16) .400	(10.16) .400
LS314-04TG	14	(7.62) .300	(10.16) .400	(17.78) .700
LS316-04TG	16	(7.62) .300	(10.16) .400	(20.32) .800
LS318-04TG	18	(7.62) .300	(10.16) .400	(22.86) .900
LS320-04TG	20	(7.62) .300	(10.16) .400	(25.40) 1.000
LS422-04TG	22	(10.16) .400	(12.70) .500	(27.94) 1.100
LS624-04TG	24	(15.24) .600	(17.78) .700	(30.48) 1.200
LS628-04TG	28	(15.24) .600	(17.78) .700	(35.56) 1.400
LS640-04TG	40	(15.24) .600	(17.78) .700	(50.80) 2.000



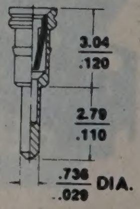
OPEN FRAME
04 TERMINAL
SHOWN



MOUNTING
HOLE P.T.H. OR
STANDARD .030 MIN. DIA.



New Hi-Rel Super Low Dip Socket with hollow-tailed terminal and .050 thick open-frame body allows for greater PCB packaging density. New terminal design utilizes standard PCB hole diameters. With IC leg sitting into the PCB, a decrease in the mounting height occurs. Super Low packaging can be obtained using our LS series body as shown, .062 thick glass epoxy for LSI sockets, Pin Grid Array sockets , and with our Mylar Throw Away Carriers in both Dual-In-Line and Pin Grid Array Patterns.



04 TERMINAL

ADVANCED
INTERCONNECTIONS

5 Division Street, Warwick, R.I. 02818 Telephone (401) 885-0485 TWX 710 3820400

For More Information. Circle No. 78

ADVANCED Peel-A-Way™ Sockets

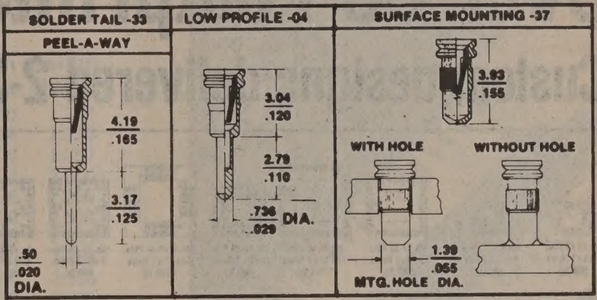
D.I.P. and P.G.A. (Patent Pending)

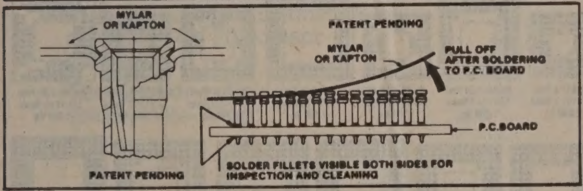
Mylar ® and Kapton ® Socket Terminal Carriers

Features:
- Throw-Away Carrier
- Peels off after Soldering
- Complete Soldering Visibility on both sides of PCB
- Footprint to Customer Requirement
- Maximum Air Flow
- Better Flux Rinse
- No Contact Damage Due to Pin Carrier Insertion
- No Contact Pull Out Due to Extraction of Pin Carrier

Material:
Body: Mylar® or Kapton® Type H
Terminal: Brass per QQ-B-626
Contact: Beryllium Copper per QQ-C-530

Plating:
Terminal: Gold over Nickel or Tin over Nickel
Contact: Gold over Nickel

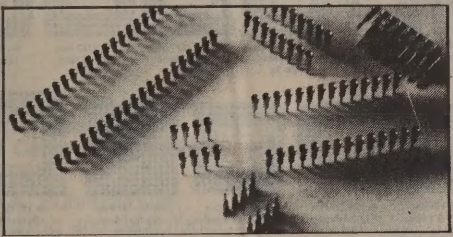

SOLDER TAIL -33
PEEL-A-WAY
4.19
.165
3.17
.125
.50
.020
DIA.
LOW PROFILE -04
3.04
.120
2.79
.110
.736
.029
DIA.
SURFACE MOUNTING -37
3.93
.155
WITH HOLE
WITHOUT HOLE
1.39
.055
MTG. HOLE DIA.


MYLAR OR KAPTON
PATENT PENDING
PATENT PENDING
MYLAR OR KAPTON
PULL OFF AFTER SOLDERING TO P.C. BOARD
P.C.BOARD
SOLDER FILLETS VISIBLE BOTH SIDES FOR INSPECTION AND CLEANING

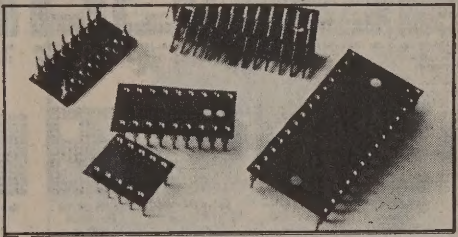
How to Use:
1. Place Socket in P.C. Board
2. Send P.C. Board and Socket thru soldering operation
3. Peel-A-Way Mylar or Kapton Carrier

Peel-A-Way Disposable Socket Terminal Carrier Available in any Configuration shown or Custom Designed to Meet Your Specifications.

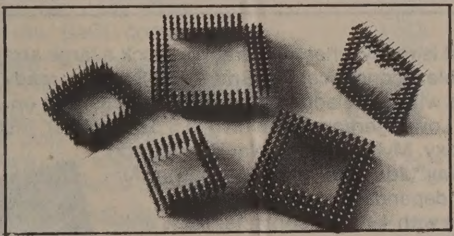
MYLAR DIP SOCKETS For Standard Wave Soldering Applications



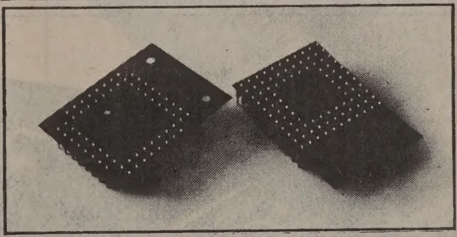
KAPTON DIP SOCKETS For High Temperature Applications



MYLAR PGA SOCKETS For Standard Wave Soldering Applications



KAPTON PGA SOCKETS For High Temperature Applications



Peel-A-Way Sheet Of Sockets (Patent Pending)

MAXIMIZE YOUR SOCKET LOADING

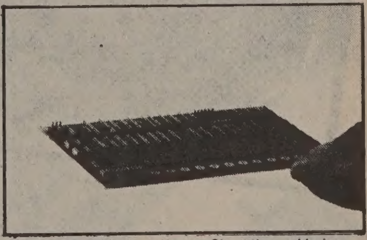
- This unique concept in terminal loading features all the standard advantages of Mylar/Kapton Peel-A-Way sockets plus an exceptionally fast P.C. Loading Rate of pins or socket positions.
- No expensive tooling or machinery is required. Just send your P.C. board or copy of artwork and Advanced will produce a finished sheet loaded with sockets and ready for your soldering operation.
- Cut out areas for loading caps, resistors, I.C.'s or other hardware may be incorporated into the sheet.

LOADING RATE PER SHEET*

PINS PER BOARD/SHEET	PINS LOADED PER HR.
100	18,000/HR
500	90,000/HR
1000	180,000/HR
2000	360,000/HR
3000	540,000/HR
4000	720,000/HR
5000	900,000/HR
10,000	1,800,000/HR

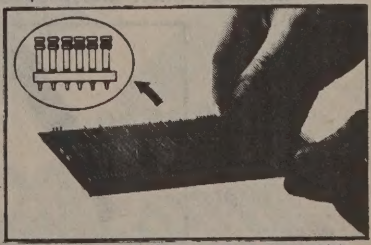
*20 Seconds Typ. Loading Rate Shown Will Vary With Operator's Skill

1. Place sheet of sockets into P.C. Board.



2. Send P.C. & Mylar or Kapton Sheet thru soldering operation.

3. Peel-A-Way Mylar®/Kapton®.



4. Results in free standing socket terminals which allow ease of flux cleaning and final inspection

ADVANCED INTERCONNECTIONS 5 Division Street, Warwick, R.I. 02818 Telephone (401) 885-0485 TWX 710 3820400

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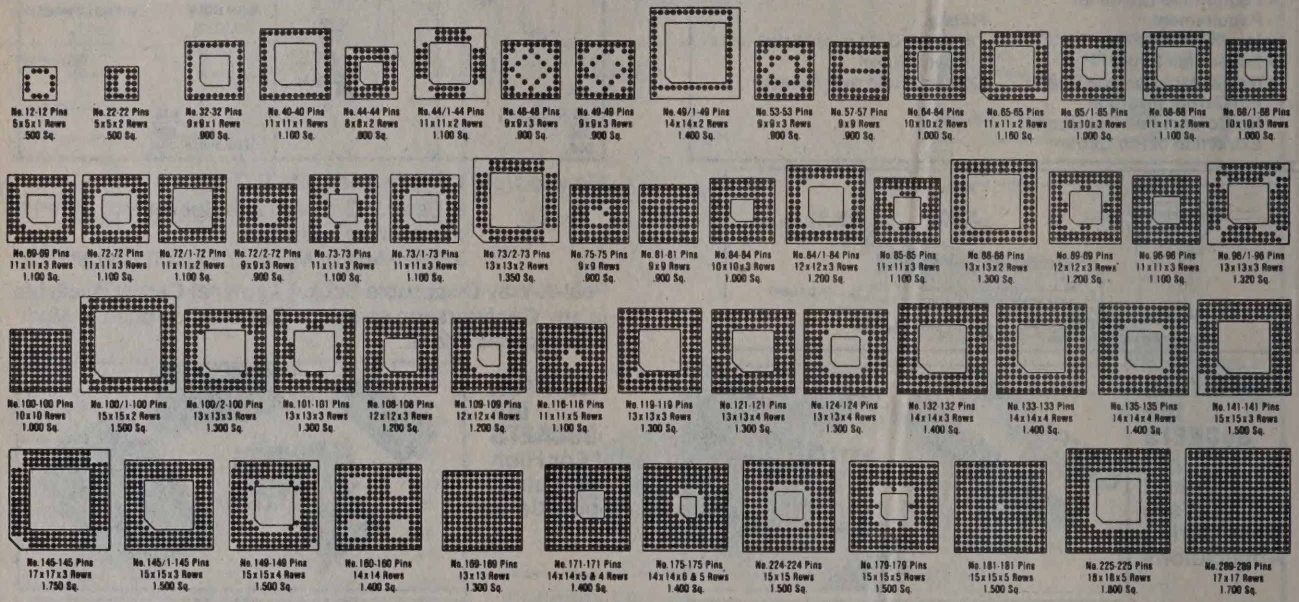
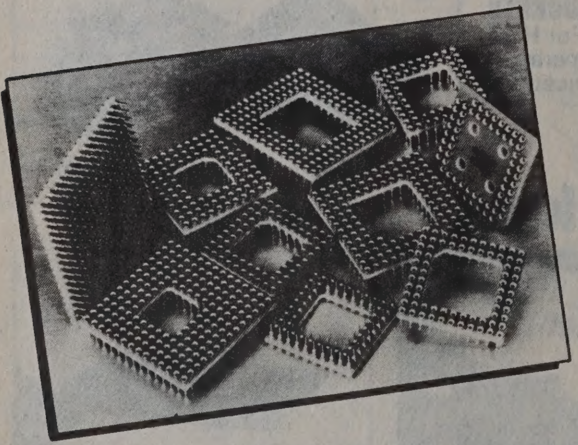
Pin Grid Array Sockets

Over 60 Footprints. In Stock. Now!

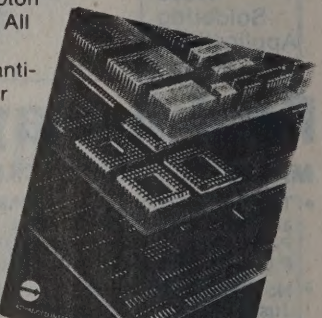
Custom designs delivered 2-3 weeks after approval


No. 12-12 Pins
5x5x1 Rows
.500 Sq.
No. 22-22 Pins
5x5x2 Rows
.500 Sq.
No. 32-32 Pins
9x9x1 Rows
.900 Sq.
No. 40-40 Pins
11x11x1 Rows
1.100 Sq.
No. 44-44 Pins
8x8x2 Rows
.800 Sq.
No. 44/1-44 Pins
11x11x2 Rows
1.100 Sq.
No. 48-48 Pins
9x9x3 Rows
.900 Sq.
No. 49-49 Pins
9x9x3 Rows
.900 Sq.
No. 49/1-49 Pins
14x14x2 Rows
1.400 Sq.
No. 53-53 Pins
9x9x3 Rows
.900 Sq.
No. 57-57 Pins
9x9 Rows
.900 Sq.
No. 64-64 Pins
10x10x2 Rows
1.000 Sq.
No. 65-65 Pins
11x11x2 Rows
1.160 Sq.
No. 65/1-65 Pins
10x10x3 Rows
1.000 Sq.
No. 68-68 Pins
11x11x2 Rows
1.100 Sq.
No. 68/1-68 Pins
10x10x3 Rows
1.000 Sq.
No. 69-69 Pins
11x11x3 Rows
1.100 Sq.
No. 72-72 Pins
11x11x3 Rows
1.100 Sq.
No. 72/1-72 Pins
11x11x2 Rows
1.100 Sq.
No. 72/2-72 Pins
9x9x3 Rows
.900 Sq.
No. 73-73 Pins
11x11x3 Rows
1.100 Sq.
No. 73/1-73 Pins
11x11x3 Rows
1.100 Sq.
No. 73/2-73 Pins
13x13x2 Rows
1.350 Sq.
No. 75-75 Pins
9x9 Rows
.900 Sq.
No. 81-81 Pins
9x9 Rows
.900 Sq.
No. 84-84 Pins
10x10x3 Rows
1.000 Sq.
No. 84/1-84 Pins
12x12x3 Rows
1.200 Sq.
No. 85-85 Pins
11x11x3 Rows
1.100 Sq.
No. 88-88 Pins
13x13x2 Rows
1.300 Sq.
No. 89-89 Pins
12x12x3 Rows
1.200 Sq.
No. 96-96 Pins
11x11x3 Rows
1.100 Sq.
No. 96/1-96 Pins
13x13x3 Rows
1.320 Sq.
No. 100-100 Pins
10x10 Rows
1.000 Sq.
No. 100/1-100 Pins
15x15x2 Rows
1.500 Sq.
No. 100/2-100 Pins
13x13x3 Rows
1.300 Sq.
No. 101-101 Pins
13x13x3 Rows
1.300 Sq.
No. 108-108 Pins
12x12x3 Rows
1.200 Sq.
No. 109-109 Pins
12x12x4 Rows
1.200 Sq.
No. 116-116 Pins
11x11x5 Rows
1.100 Sq.
No. 119-119 Pins
13x13x3 Rows
1.300 Sq.
No. 121-121 Pins
13x13x4 Rows
1.300 Sq.
No. 124-124 Pins
13x13x4 Rows
1.300 Sq.
No. 132-132 Pins
14x14x3 Rows
1.400 Sq.
No. 133-133 Pins
14x14x4 Rows
1.400 Sq.
No. 135-135 Pins
14x14x4 Rows
1.400 Sq.
No. 141-141 Pins
15x15x3 Rows
1.500 Sq.
No. 145-145 Pins
17x17x3 Rows
1.750 Sq.
No. 145/1-145 Pins
15x15x3 Rows
1.500 Sq.
No. 149-149 Pins
15x15x4 Rows
1.500 Sq.
No. 160-160 Pins
14x14 Rows
1.400 Sq.
No. 169-169 Pins
13x13 Rows
1.300 Sq.
No. 171-171 Pins
14x14x5 & 4 Rows
1.400 Sq.
No. 175-175 Pins
14x14x6 & 5 Rows
1.400 Sq.
No. 224-224 Pins
15x15 Rows
1.500 Sq.
No. 179-179 Pins
15x15x5 Rows
1.500 Sq.
No. 181-181 Pins
15x15x5 Rows
1.500 Sq.
No. 225-225 Pins
18x18x5 Rows
1.800 Sq.
No. 289-289 Pins
17x17 Rows
1.700 Sq.



Advanced is ready when you are! We stock a large array of our dependable, economical Pin Grid Array Sockets, ready to go! Over 60 footprints with more added monthly. 12 to 289 pins on .100 grid spacing. Low Insertion Force (avg. 3.5 oz. per line). Insulators of .062 glass-epoxy, Mylar* Peel-A-Way™ or Kapton* Peel-A-Way™ for vapor phase soldering. All featuring dependable Advanced Socket Terminals with 4-finger contacts, 100% anti-wicking of solder, and tapered entries for easier insertion. In your choice of standard or super low profile and Wire-Wrap* terminals. Custom designs, too, shipped 2 to 3 weeks after your design OK. Advance **your** technology today!

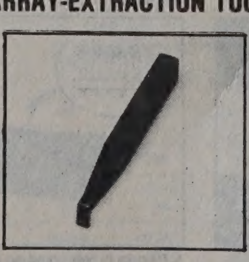
*Mylar and Kapton © Dupont Chemical
Wire-Wrap © Gardner-Denver



Ask for your copy of our new tell-all 20-page catalog.

PIN GRID ARRAY-EXTRACTION TOOLS

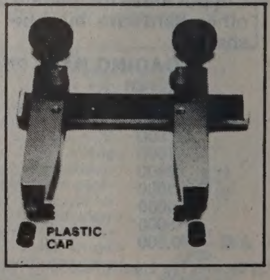
Pry Out Tool
Advanced Part #1107



Pull Out Tool
Advanced Part #1109

PLASTIC CAP

Universal Pull Out Tool
Advanced Part #1114


PLASTIC CAP

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AirBorn Connectors
4321 AirBorn Drive
Post Office Box 519
Addison, Texas 75001-0519
Telephone 214-931-3200 / TWX 910-860-5230

PC BOARD AND CHASSIS COMBINATIONS

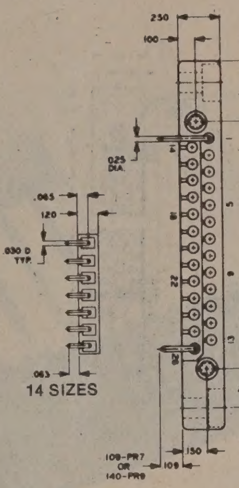
AirBorn Connectors for PC Card to Chassis or Mother Board Connections

Two series of subminiature, right-angle .030″ dia. BeCu pin to socket connectors.

Series WT: Single-row connectors on .100″ centers.

Series WTB: Double-row connectors on .100″ centers, offset .050″. Three or six 50-ohm Coax available with 20-contact connectors.

Terminations: Soldercup, wave solder, Wire-Wrap*.



Contacts	Length Overall
10	1.350
14	1.550
20	1.850
24	2.050
26	2.150
30	2.350
36	2.650
40	2.850
44	3.050
50	3.350
54	3.550
56	3.650
60	3.850
66	4.150
70	4.350
90	5.650
100	6.150
120	7.150
20+3	2.850
20+6	4.050

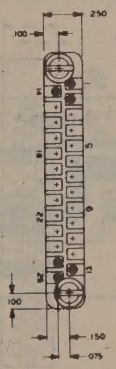
AirBorn Connectors for PC Board Input-Output, Cable to Panel and Cable to Chassis Connections

Series WTA: Subminiature, rectangular plug and receptacle, .100″ centers, two rows offset .050″, .030″ dia. BeCu contacts.

Terminations: Soldercup, wave solder, and Wire-Wrap*: Flexcable.

Series WTD: Subminiature, rectangular plug and receptacle, .100″ centers, two rows offset .050″, .030″ dia. BeCu contacts.

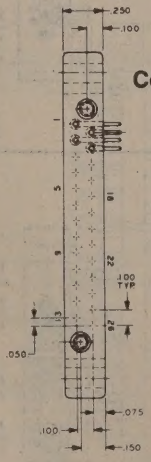
Terminations: Crimp Removable Socket.



Contacts	Overall Length
10	.850
14	1.050
20	1.350
24	1.550
26	1.650
30	1.850
36	2.150
40	2.350
44	2.550
50	2.850
54	3.050
56	3.150
60	3.350
66	3.650
70	3.850

AirBorn Connectors for Extender Board and Test Applications

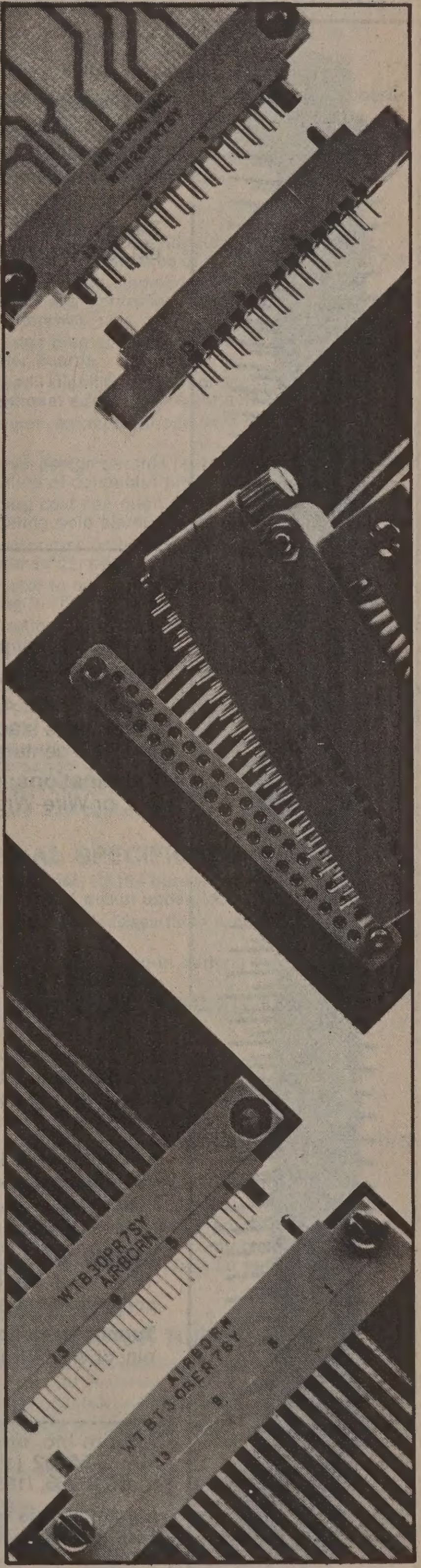
Series WTBT: Right angle receptacles combine with right angle plugs for extender board applications. Available in combinations from 10 to 70 contacts. Choice of .109″ or .140″ termination lengths. Also provides a test vehicle using conventional plugs with guiding or jackscrew locking devices.



Contacts	Length Overall
10	1.350
14	1.550
20	1.850
24	2.050
26	2.150
30	2.350
36	2.650
40	2.850
44	3.050
50	3.350
54	3.550
56	3.650
60	3.850
66	4.150
70	4.350

AirBorn Inc. originated connectors for MIL-C-55302 (slash sheets M55302/55 through /66, /138, and /139).

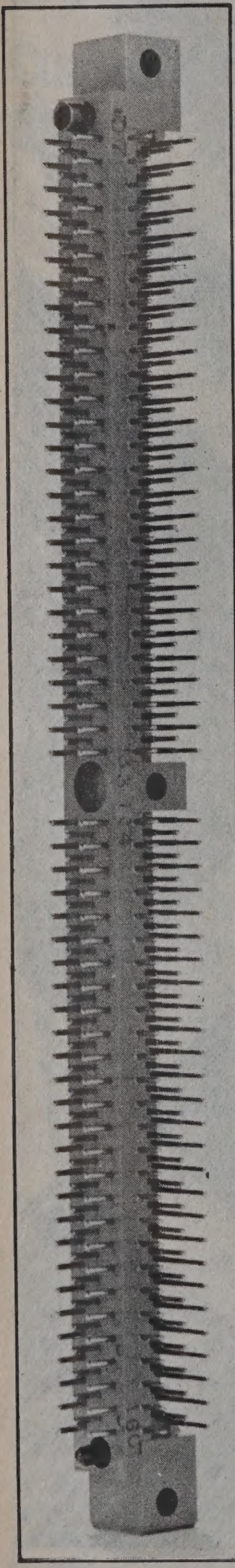
Also available with *low-force* contacts. Average force per contact: .115 lbs. or 1.840 oz.



*Registered TM of Gardner-Denver Company.

AirBorn Connectors
4321 AirBorn Drive
Post Office Box 519
Addison, Texas 75001-0519
Telephone 214-931-3200 / TWX 910-860-5230

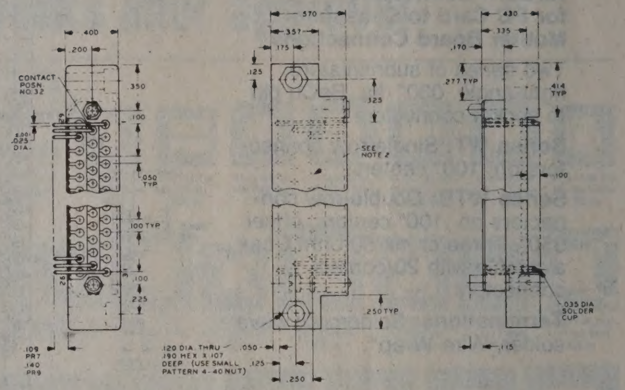
PC CONNECTORS/3-ROW HIGH DENSITY



92 Contacts PCB to MB
PCB to Chassis

Series WGE: 3.9″ long
Three rows staggered with contacts centered on .100″

Terminations: solder cup, dip pin, or Wire-Wrap*.

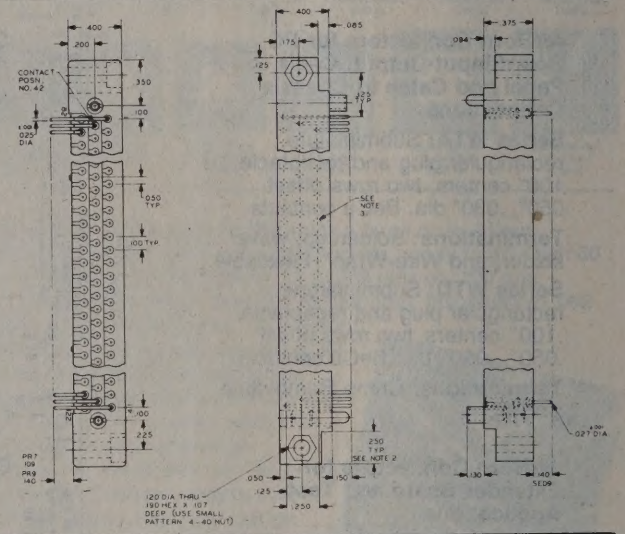


CONTACT POSN. NO. 32
.400
.200
.350
.100
.050 TYP
100 TYP
.225
.109 PR7
.140 PR9
.120 DIA. THRU .190 HEX X .107 DEEP (USE SMALL PATTERN 4-40 NUT)
.570
.357
.175
.125
.325
SEE NOTE 2
.250 TYP
.050
.125
.250
.430
.335
.170
.414 TYP
.035 DIA SOLDER CUP
.115

122 Contacts PCB to MB
PCB to Chassis

Series WGA: 4.9″ long
Three rows staggered with contacts centered on .100″

Terminations: solder cup, dip pin, or Wire-Wrap*.



CONTACT POSN. NO. 42
.400
.200
.350
.100
.050 TYP
100 TYP
.225
PR7 .109
PR9 .140
.120 DIA. THRU .190 HEX X .107 DEEP (USE SMALL PATTERN 4-40 NUT)
.085
.175
.125
SEE NOTE 3
.250 TYP SEE NOTE 2
.050
.125
.150
.250
.375
.094
.027 DIA
.130
.140 SED9

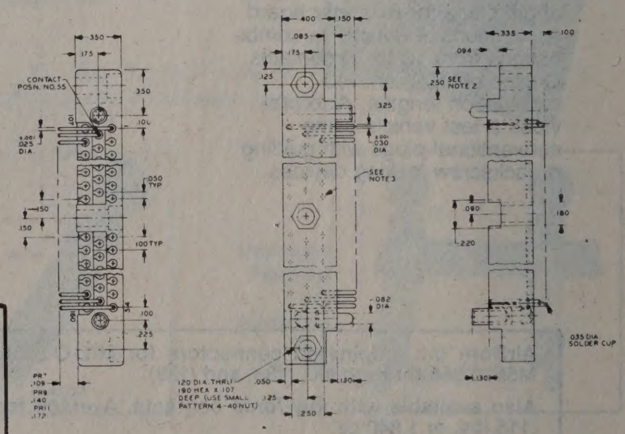
80 Contacts — 3.5″ long
160 Contacts — 6.4″ long
PCB to MB
PCB to Chassis

SERIES WG
Three rows staggered with contacts centered on .100″

Terminations: solder cup, dip pin, or Wire-Wrap*

AirBorn Inc. originated connectors for MIL-C-55302 (slash sheets M55302/55 through /66, /138, and /139).

Also available with *low-force* contacts. Average force per contact: .115 lbs. or 1.840 oz.



CONTACT POSN. NO. 55
.350
.175
.350
.100
.050 TYP
.150
100 TYP
.225
PR7 .109
PR9 .140
PR11 .172
.120 DIA. THRU .190 HEX X .107 DEEP (USE SMALL PATTERN 4-40 NUT)
.400
.150
.085
.125
.325
.030 DIA
SEE NOTE 3
.082 DIA
.050
.125
.130
.250
.335
.100
.094
.250 SEE NOTE 2
.090
.180
.220
.035 DIA SOLDER CUP
.130

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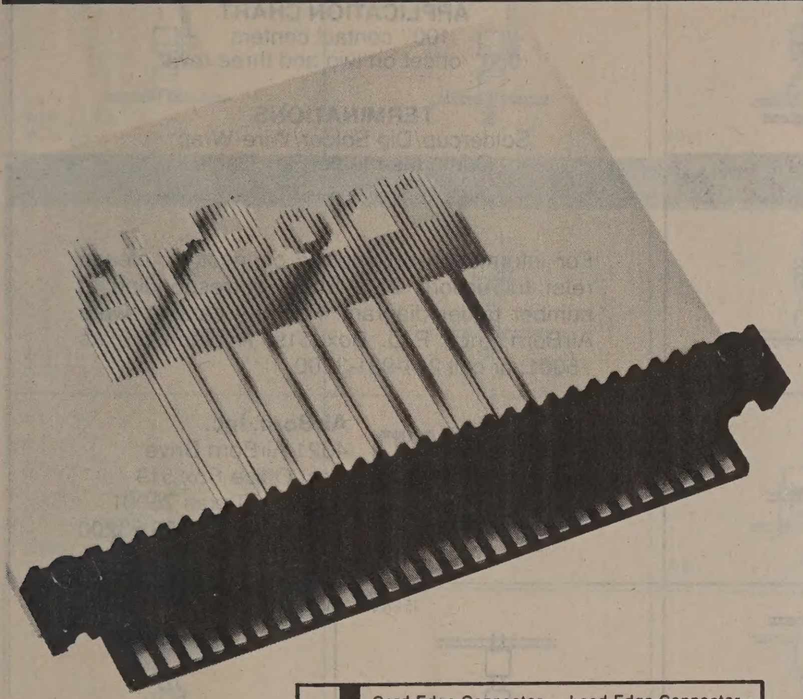
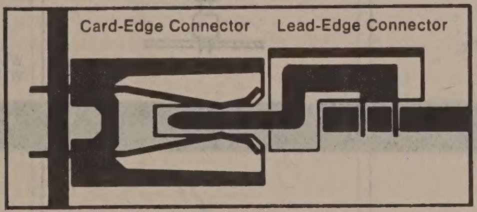
AirBorn Connectors
4321 AirBorn Drive
Post Office Box 519
Addison, Texas 75001-0519
Telephone 214-931-3200 / TWX 910-860-5230





LEAD-EDGE™ CONNECTORS

- Designed as a daughter board component on a two-piece mated connector system.
- Compatible with most edgeboard connectors.
- Replaces gold plated fingers on printed wiring boards.
- Provides superior electrical and mechanical performance. Eliminates the variables which degrade the plated fingers approach in conventional edgeboard interconnections.

FEATURES

- Precision molded Lead-Edge connecting surface provides narrow tolerance of ±.003 on .066 thickness.
- Molded body and stamped contacts assure consistent and controlled forces for board insertion and withdrawal.
- Lead-Edge plug accepts various "thin" or "thick" daughter boards.
- Improved reliability of interconnection while using conventional edgeboard receptacle.
- Connector replacement can save expensive daughter board.
- Coplaner design permits retrofit with relative ease. Centerline of connector and PCB are conincident.
- Low plug cost can often reduce total costs by eliminating gold plated fingers and adding reliability.
- Connector may be assembled with other components on wave solder pass.
- Connector to board clearance enables maximum flushing for flux removal.
- Polarization or keying is available through contact or rib modification.
- Simple masking of gold plated contact surfaces facilitates assembly.
- Either plastic snap-in or standard #4 metal hardware (nuts and screws) is available.
- Eliminates costly gold plating equipment, inventory and personnel for circuit board fingers.
- Eliminates corrosive effects of plating bath fumes.
- Standard .125 centerline spacing applies.

MATERIAL SPECIFICATIONS

Contact Material: CA194 base metal, 30μ″ gold minimum over nickel underplate.

Insulating Material: Glass filled polyester, UL94V-0 Rating.

Hardware: Optional snap-in buttons or #4 nuts and screws for mounting.

PERFORMANCE SPECIFICATIONS

Spacing: .125″

Current Ratings: 3 amperes

Contact Resistance: 15 milliohms max.

Insulation Resistance: 5000 megohms min.

Capacitance: 2 picofarads max.

Dielectric Withstanding Voltage: .125″ —1500 VRMS min.

Operating Voltage: 600 VDC

Operating Temperature: −65°C to 125°C

Humidity (40°C, 96 hours) Ref. MIL-C-21097: 90-95%

Mates with most edgeboard connectors.

Leading edge (contacts) coplanar with PWB.

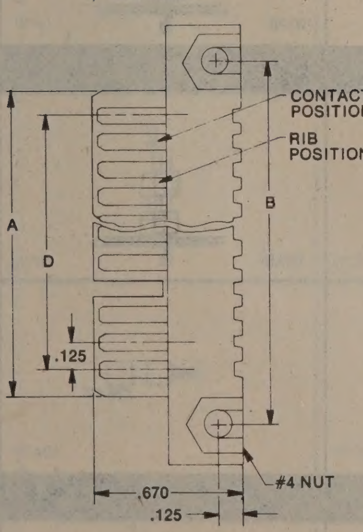
POLARIZATION ON CONTACT OR RIB POSITION

Indicate odd contact number for polarization position or rib position. Not available at either end position.

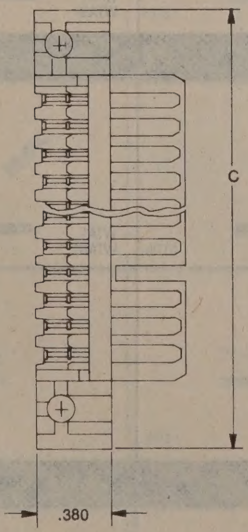
On contact position — omit contact pair .

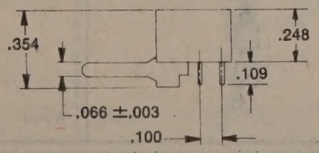
On rib position — omit two contact pairs (one on each side of rib).

TOP VIEW



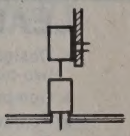
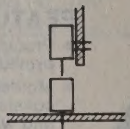
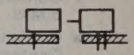
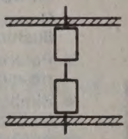
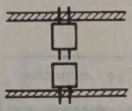
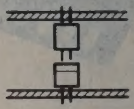
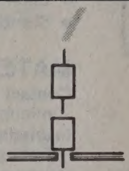
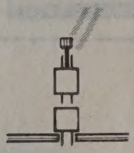
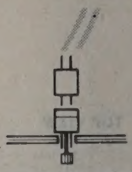
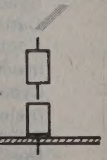
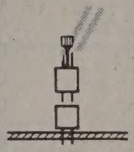
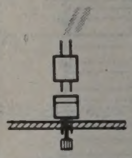
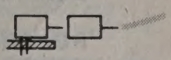
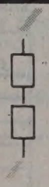
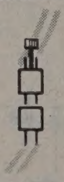
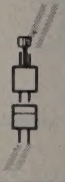
BOTTOM VIEW





Positions	Dimensions			
	A	B	C	D
28	3.615	3.371	4.215	3.375
30	3.865	4.121	4.465	3.625
35	4.490	4.746	5.090	4.250
40	5.115	5.371	5.715	4.875
50	6.365	6.621	6.965	6.125

AirBorn Connectors

APPLICATION	WT	WTA	WTAB
PC BOARD TO CHASSIS	6 SIZES — 6 THRU 16  WT1		
PC BOARD TO MOTHER BOARD PERPENDICULAR	 WT1		
PARALLEL	 WT1		
SANDWICH	 WT2	15 SIZES — 10 THRU 70  WTA2	 WTA2 WTB1
CABLE TO CHASSIS	 WT2	 WTA1 WTAB1	 WTAB1
CABLE TO PC BOARD PERPENDICULAR	 WT2	 WTA1 WTAB1	 WTAB1
PARALLEL	 WT1		
CABLE TO CABLE	 WT2	 WTA1	 WTAB1

APPLICATION CHART
.100″ contact centers
.050″ offset on two and three rows

TERMINATIONS
Soldercup/Dip Solder/Wire-Wrap*/
Crimp Insertable/Flex Cable

*Registered Trademark of Gardner-Denver Company

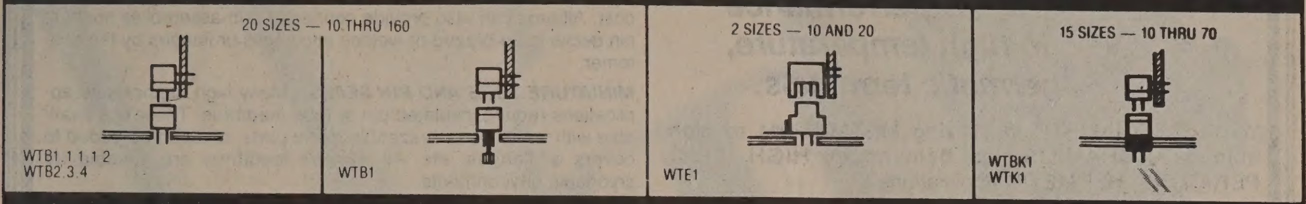
For information on specific connectors, please refer to AirBorn Data Sheet corresponding to number under diagram. For free catalog, write AirBorn, Inc., P.O. Box 519, Addison, Texas 75001; or call 214-931-3200.

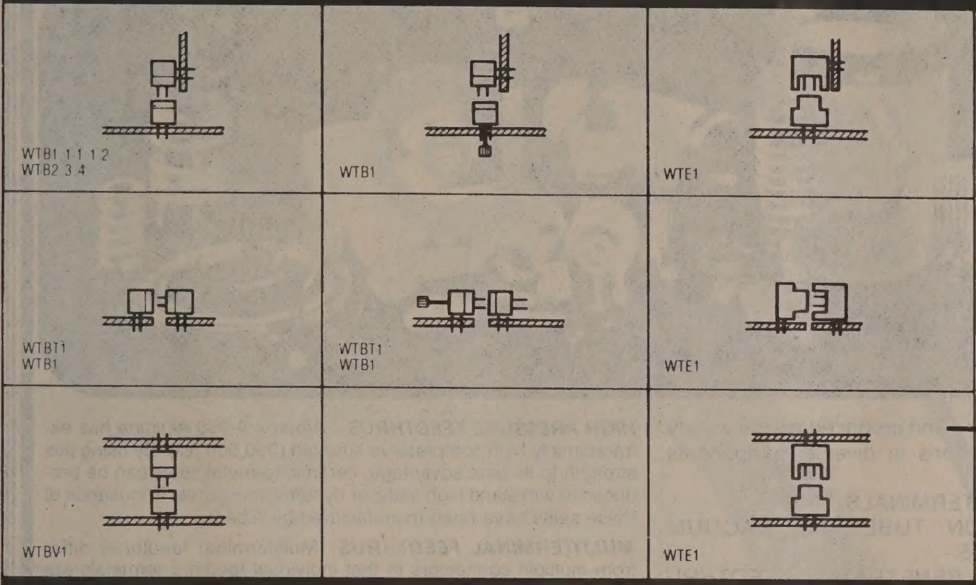
AirBorn

AirBorn, Inc.
4321 AirBorn Drive
Post Office Box 519
Addison, Texas 75001
Telephone: 214-931-3200

For More Information. Circle No. 79

WTB-WTAB-COAX | WTE | WTK


20 SIZES — 10 THRU 160
WTB1 1 1 1 2
WTB2 3 4
WTB1
2 SIZES — 10 AND 20
WTE1
15 SIZES — 10 THRU 70
WTBK1
WTK1

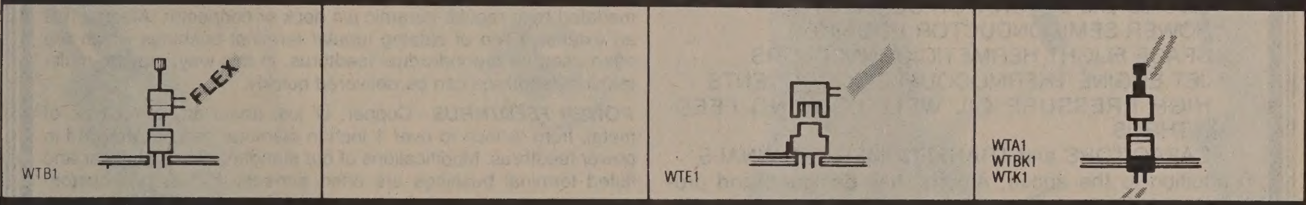

WTB1 1 1 1 2
WTB2 3 4
WTB1
WTE1
WTBT1
WTB1
WTBT1
WTB1
WTE1
WTBV1
WTE1

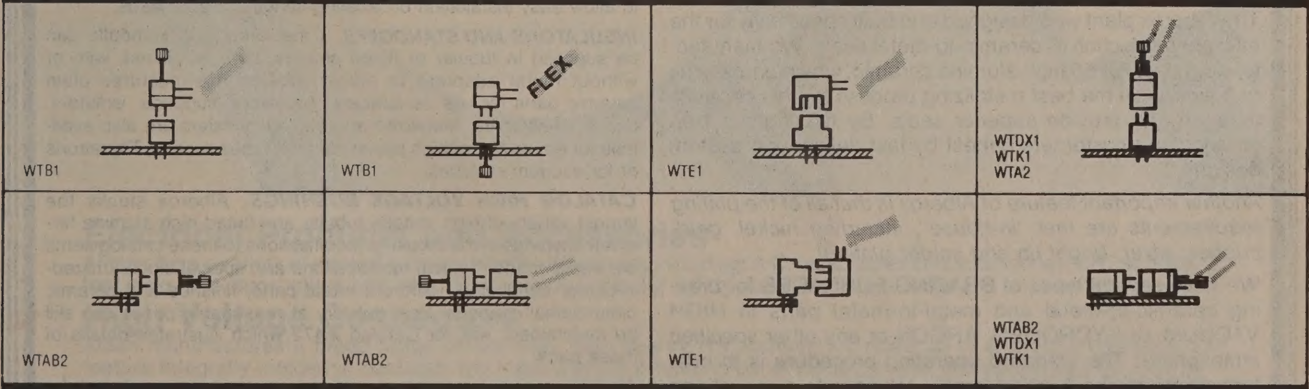
LOW FORCE CONNECTORS

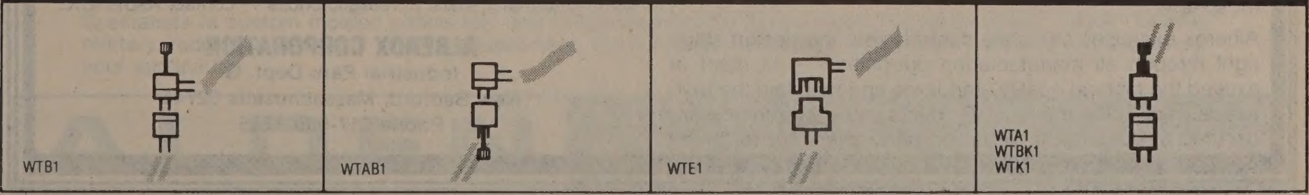
Size	Mating Forces*
3-row connectors	
WG 160	18.5 lbs.
WGA122	14.5 lbs.
WGR 92	11.0 lbs.
WG 80	9.5 lbs.
2-row connectors	
WTB120	14.0 lbs.
WTB100	12.0 lbs.
WTB 90	10.5 lbs.
WTB 70	8.1 lbs.

*Average force per contact for above sizes: .115 lbs. or 1.840 oz.

Low force contacts are now standard for connector sizes 70 through 160. No change in connector code is required. Previously assigned low force codes will continue to be honored.


FLEX
WTB1
WTE1
WTA1
WTBK1
WTK1


WTB1
FLEX
WTB1
WTE1
WTDX1
WTK1
WTA2
WTAB2
WTAB2
WTE1
WTAB2
WTDX1
WTK1

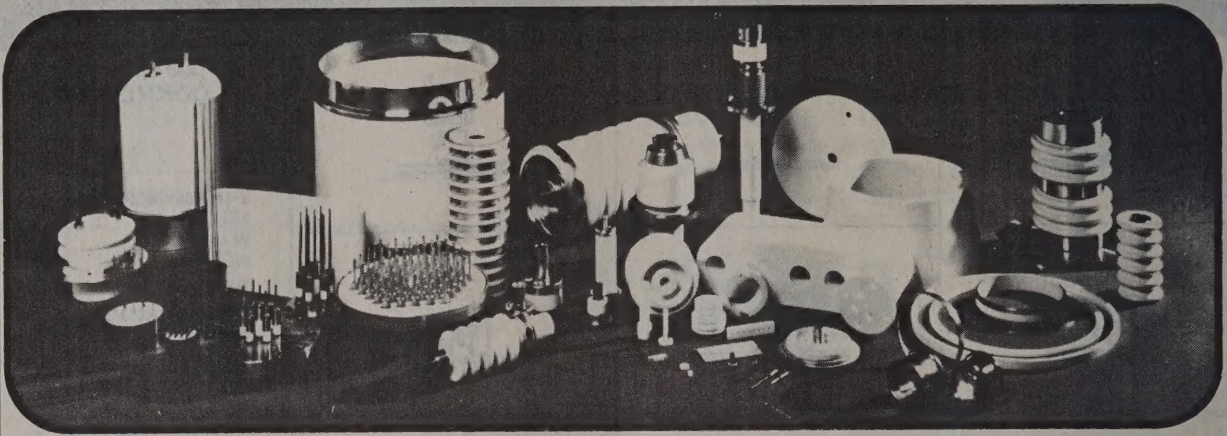

WTB1
WTAB1
WTE1
WTA1
WTBK1
WTK1

ALBEROX ... *For outstanding performance in high temperature, hermetic terminals.*

We're SPECIALISTS in brazing METAL parts to high alumina CERAMICS for demanding HIGH TEMPERATURE, HERMETIC applications.

CUSTOM HERMETIC CONNECTORS Multipin hermetic connectors for demanding vacuum and space applications requiring 400°C. bakeout — conditions where glass connectors won't stand up — are being produced in a variety of configurations. To save cost, Alberox can also provide connector sub-assemblies such as pin decks to be brazed or welded into shells or flanges by the customer.

MINIATURE TUBE AND PIN SEALS Many high temperature applications require insulated pin or tube feedthrus. These are available with weldable or brazeable metal parts, and can be added to covers or flanges, etc. All Alberox feedthrus are suitable for cryogenic environments.



Since 1961, we have designed and produced a wide variety of seals for custom applications in diverse components such as . . .

VACUUM FEEDTHRU TERMINALS
CERAMIC ELECTRON TUBE AND VACUUM SWITCH ENVELOPES
NUCLEAR REACTOR PENETRATOR FEEDTHRU TERMINALS and INSULATORS
SQUIBB and DETONATOR CONNECTORS
POWER SEMICONDUCTOR HOUSINGS
SPACE FLIGHT HERMETIC CONNECTORS
JET ENGINE THERMOCOUPLE COMPONENTS
HIGH PRESSURE OIL WELL LOGGING FEEDTHRUS
CAPACITORS and TRANSFORMER TERMINALS

In addition to the above, Alberox has designed and produced state-of-the-art components for critical nuclear devices.

The Alberox plant was designed and built specifically for the efficient production of ceramic-to-metal seals. We manufacture our own A-950 high alumina ceramic, which enables us to optimize on the best metalizing process for this ceramic; thus we can provide superior seals. By making our own ceramic, our customers benefit by fast delivery on custom designs.

Another important feature of Alberox is that all of the plating requirements are met "in-house", including nickel, gold, copper, silver, bright tin and solder plating!

We have several types of BRAZING FURNACES for brazing ceramic-to-metal and metal-to-metal parts in HIGH VACUUM, or HYDROGEN, ARGON or any other specified atmosphere! The standard operating procedure is to custom program the brazing cycle, taking into account the ceramic, the types of metals, braze materials and the atmosphere.

Alberox exercises complete control, from the design stage right through all manufacturing operations — to meet or exceed the highest quality standards and maintain the fastest delivery in the industry. Products made by Alberox are assured to outperform all design parameters set for them!

HIGH PRESSURE FEEDTHRUS *Alberox A-950 Alumina* has extraordinarily high compressive strength (350,000 psi). By using this strength to its best advantage, ceramic-to-metal seals can be produced to withstand high static or dynamic pressures. Thousands of these seals have been manufactured by Alberox.

MULTITERMINAL FEEDTHRUS Multiterminal feedthrus differ from multipin connectors in that individual feedthru terminals are brazed or welded into a metal deck or flange. These feedthrus are generally used for higher voltage applications than can be accommodated by a regular ceramic pin deck or connector. Alberox has an extensive line of catalog tubular terminal bushings which are often used for the individual feedthrus. In this way, custom multiterminal feedthrus can be delivered quickly.

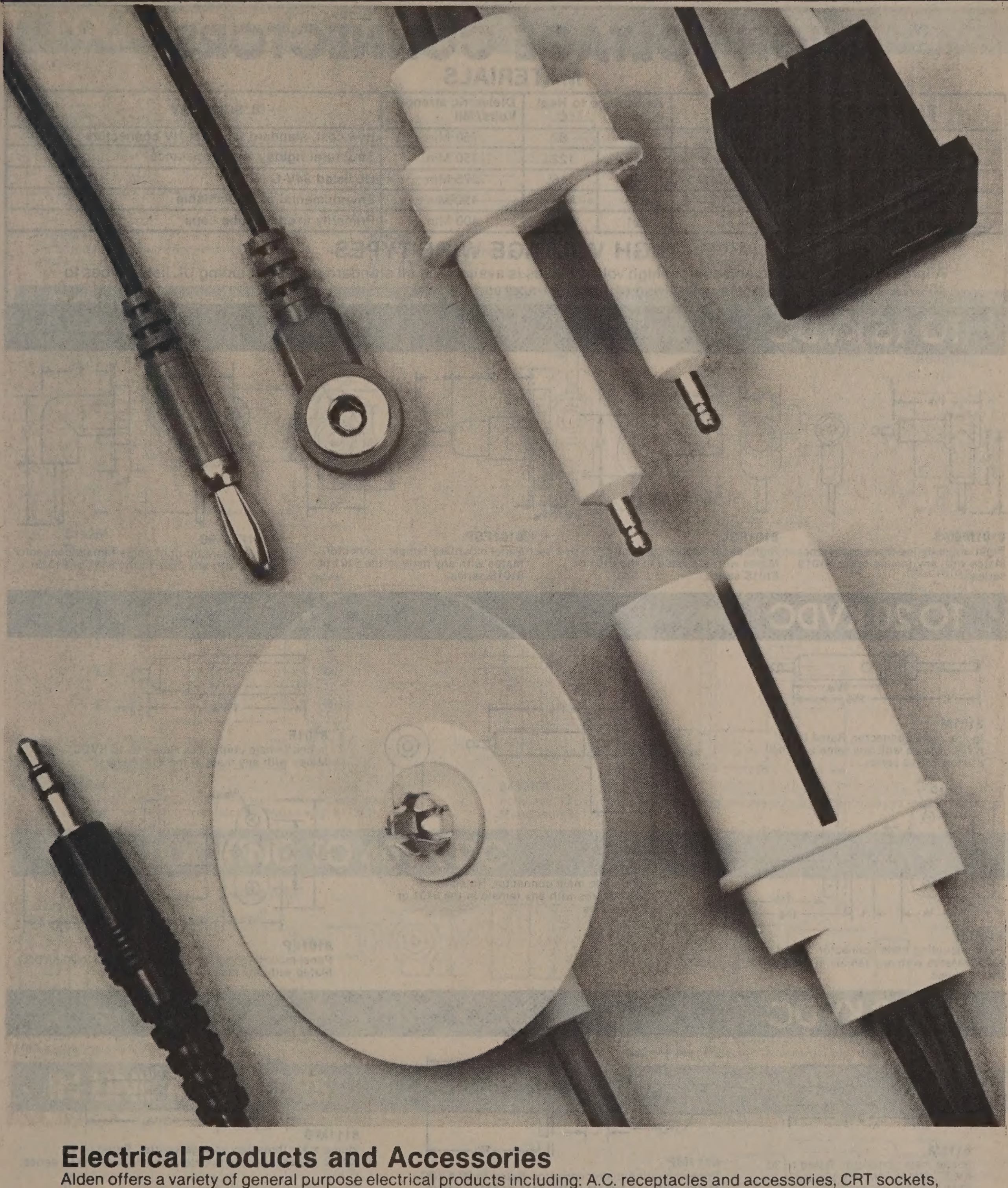
POWER FEEDTHRUS Copper, or just about any other type of metal, from ⅛ inch to over 1 inch in diameter can be provided in power feedthrus. Modifications of our standard catalog tubular and fluted terminal bushings are often perfectly suited, and custom ceramic-to-metal seal designs can be easily accommodated. Weldable or brazeable flanges also can be added to the feedthrus to allow easy installation on existing flanges or bulkheads.

INSULATORS AND STANDOFFS Insulators and standoffs can be supplied in tubular or fluted shapes, bare or glazed, with or without metal adapters or studs. Alberox manufactures plain ceramic parts for use as spacers, insulators, supports, isolators, decks, or washers. Metalized and glazed cylinders are also available for envelopes of high power electron tubes such as Thyratrons or for vacuum switches.

CATALOG HIGH VOLTAGE BUSHINGS Alberox stocks the largest variety of high voltage tubular and fluted high alumina terminal bushings in the industry. Modifications to these catalog items are easily made. Typical modifications are: special studs, brazed-in-center conductors, different metal parts, finishes and ceramic dimensional changes. Fast delivery at reasonable prices can still be maintained. Ask for Catalog #472 which illustrates details of these parts.

Alberox is ready to assist you with your ceramic-to-metal seal design requirements. When you need FAST DELIVERY of SUPERB ceramic-to-metal seals, at realistic prices — contact ALBEROX.

ALBEROX CORPORATION
Industrial Park Dept. G
New Bedford, Massachusetts 02745
Phone 617-995-1725



Electrical Products and Accessories

Alden offers a variety of general purpose electrical products including: A.C. receptacles and accessories, CRT sockets, test jacks and plugs, plugs and sockets, terminals, indicator lights, static discharge cords and relay sockets.

High Voltage Connectors

Alden manufactures a broad range of low cost, high quality H.V. connectors rated up to 40 KVDC. Connectors feature integrally molded-in contacts and leads and are offered in panel mount, in-line, and polarized, multi-circuit configurations.

Custom Molding

Specialists in custom molded connectors and circuit modules for applications including copiers, lasers, medical, military, radar, business and scientific equipment. Contact Alden's Product Engineers for prompt assistance on your application.

ALDEN

ALDEN PRODUCTS COMPANY
P.O. Box 860, 117 North Main Street, Brockton, MA 02403
Tel.: (617) 583-0160 • Telex 924451

HIGH VOLTAGE CONNECTORS

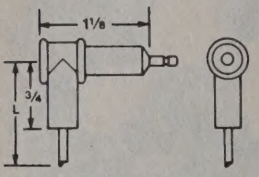
MATERIALS

THERMOPLASTIC	Resistance to Heat °F	°C	Dielectric strength Volts/Mil	SUMMARY
LDPE – Low Density Polyethylene	180	82	750 Min	Low cost, standard for most HV connectors
HDPE – High Density Polyethylene	250	122	750 Min	Structural rigidity, heat resistance
FRPP – Flame Retardant Polypropylene	240	116	875 Min	UL listed 94V-O
E-CTFE – Fluoropolymer	330	165	490 Min	Environmental, nonflammable
Nylon – Polyamide	221	105	400 Min	Primarily used for tube caps

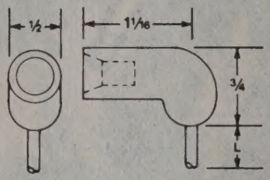
HIGH VOLTAGE WIRE TYPES

A large stock of standard and custom high voltage wires is available in all standard gages, including UL listed types to 40KVDC. Our Sales Engineers will advise of the most appropriate type.

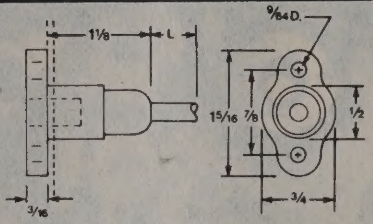
TO 15 KVDC



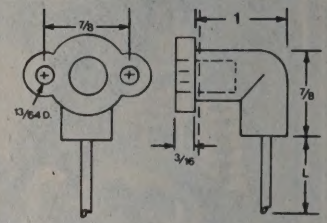
8101M90-S
Right angle in-line male connector. Mates with any female in the 8101S series.



8101FSL
Right angle female connector. Mates with any male in the 8101 or 8101S series.

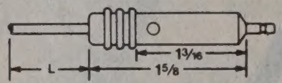


8101FSP
Panel-mounting female connector. Mates with any male in the 8101 or 8101S series.

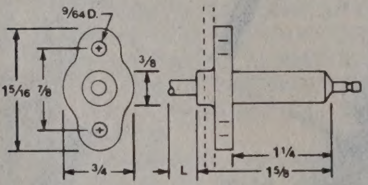


8101FSP-90
Panel-mounting right angle female connector. Mates with any male in the 8101 or 8101S series.

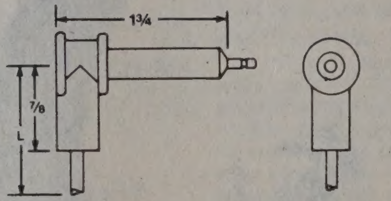
TO 20 KVDC



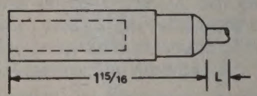
8101M
In-line male connector. Rated to 20 KVDC. Mates with any female in the 8101 or 8101S series.



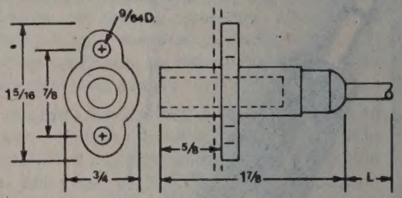
8101MP
Panel-mounting male connector. Rated to 15 KVDC. Mates with any female in the 8101 or 8101S series.



8101M-90
Right angle male connector. Rates to 15 KVDC. Mates with any female in the 8101 or 8101S series.

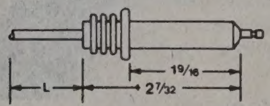


8101F
In-line female connector. Rated to 15 KVDC. Mates with any male in the 8101 series.

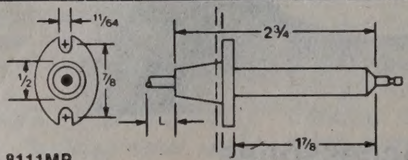


8101FP
Panel-mounting female connector. Rated to 20 KVDC. Mates with any male in the 8101 series.

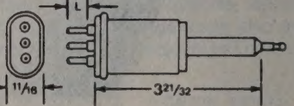
TO 30 KVDC



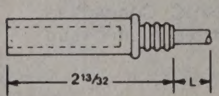
8111M
In-line male connector. Rated to 30 KVDC. Mates with any female in the 8111 or 8111L series.



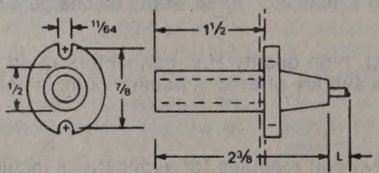
8111MP
Panel-mounting male connector. Rated to 30 KVDC. Mates with any female in the 8111 or 8111L series.



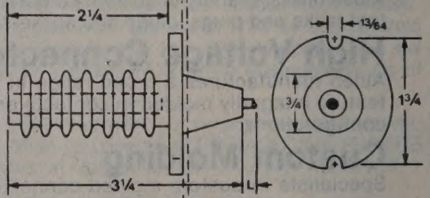
8111M-3
In-line male three-way voltage splitter. Rated to 40 KVDC. Mates with any female in the 8111 or 8111L series.



8111F
In-line female connector. Rated to 20 KVDC. Mates with any male in the 8111 or 8111L series.



8111SFP
Panel-mounting female connector. Rated to 25 KVDC. Mates with any male in the 8111 or 8111L series.



8111FP
Panel-mounting female connector. Rated to 30 KVDC. Mates with any male in the 8111 or 8111L series.

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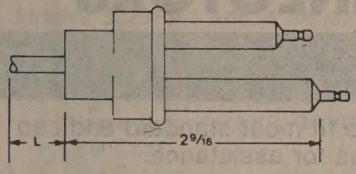
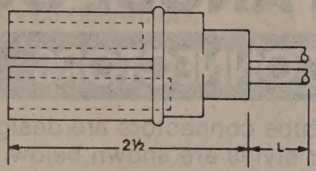
For More Information. Circle No. 81

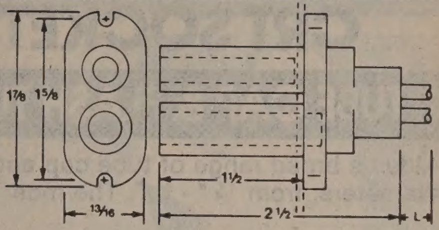
POLARIZED TO 15 KVDC



8102M
Polarized in-line male connector. Mates with 8102F and 8102FP.

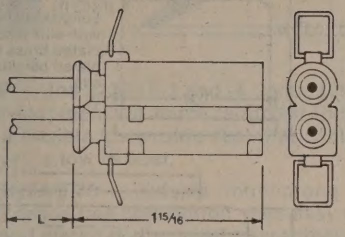


8102F
Polarized in-line female connector. Mates with 8102M.

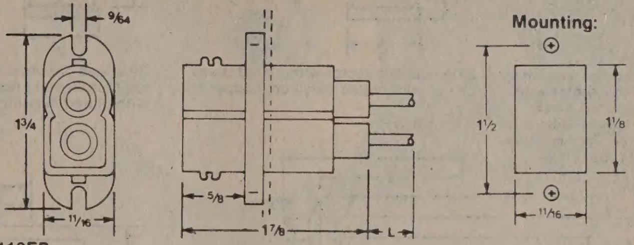

1⅞
1⅝
¹³⁄₁₆
1½
2½
L

8102FP
Polarized panel-moutning female connector. Mates with 8102M.

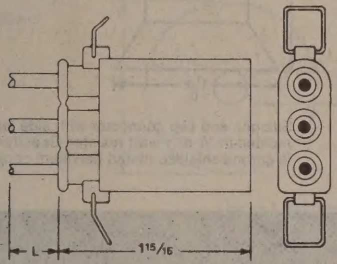
POLARIZED TO 30 KVDC



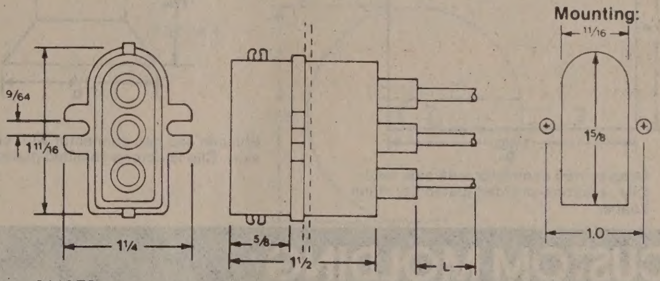
8112M
Polarized two-circuit, male connector with optional locking wire latches. Mates with 8112FP.


⁹⁄₆₄
1¾
¹¹⁄₁₆
⅝
1⅞
L
Mounting:
1½
1⅛
¹¹⁄₁₆

8112FP
Polarized two-circuit, panel-mounting, female connector. Mates with 8112M.

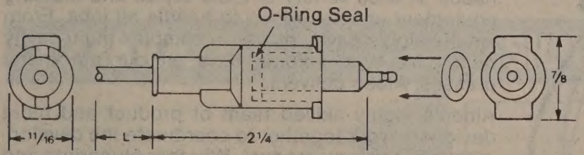


8113M
Polarized, two-circuit, male connector with ground lead and optional locking wire latches. Mates with 8113FP.

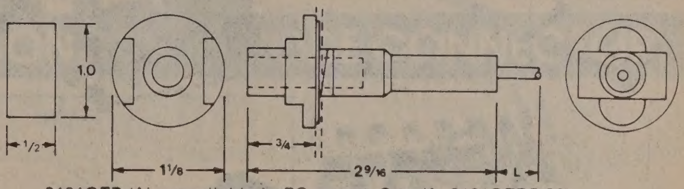

⁹⁄₆₄
1¹¹⁄₁₆
1¼
⅝
1½
L
Mounting:
¹¹⁄₁₆
1⅝
1.0

8113FP
Polarized, two-circuit, panel-mounting, female connector with ground lead. Mates with 8113M.

TWIST LOCKING TO 40 KVDC

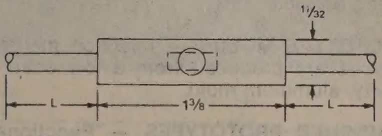

O-Ring Seal
⅞
¹¹⁄₁₆
L
2¼

8101QM/8101QMM
Quick-locking male connector. 8101QMM supplied without lead. Available with .125", .140" ID for insertion of lead, or specify. Mates with the 8101QFP.

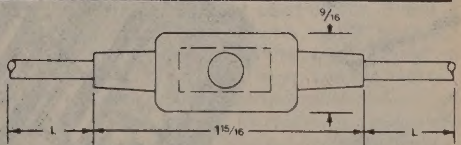

1.0
½
1⅛
¾
2⁹⁄₁₆
L

8101QFP (Also available in PC mount. Specify 8101QFPC-90)
Quick panel-mounting female connector. Mates with any male in the 8101 series.

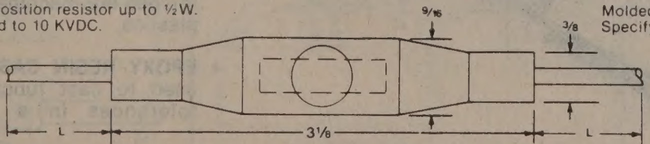
IN-LINE RESISTORS



4178RI
Molded in-line carbon composition resistor up to ½W. Specify resistor value. Rated to 10 KVDC.


⁹⁄₁₆
L
1¹⁵⁄₁₆
L

4174RI
Molded in-line carbon composition resistor up to 2W. Specify resistor value. Rated to 15 KVDC.



4176RI
Molded in-line special high voltage resistor (ACI HVW series, or other). Specify resistor value. Rated to 30 KVDC.

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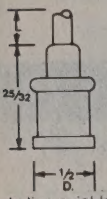
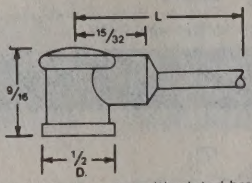
END CAP CONNECTORS CRT SOCKETS & ANODE CONNECTORS

TUBE CAP & FLASH TUBE CONNECTORS

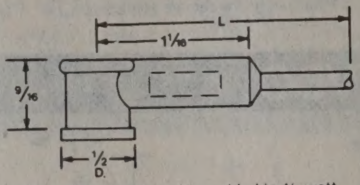
Alden's broad range of tube cap and flash tube connectors are designed to fit most standard end cap diameters, from ¼″ - 9/16″. The most popular styles are shown below. Call us for assistance.



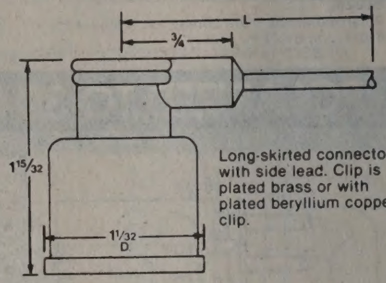
In-line axial lead connector with plated brass clip or with plated beryllium copper clip.



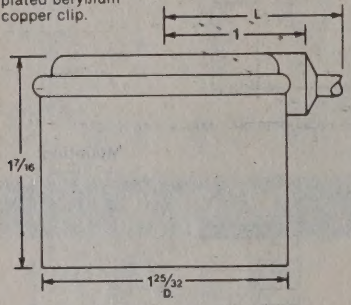
Side lead connector with plated brass clip or with plated beryllium copper clip.



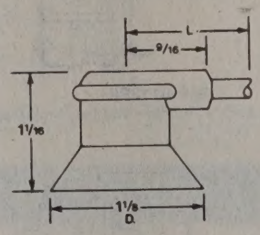
Side lead connector with molded-in ½ watt resistor. Specify resistor. Plated brass clip or with plated beryllium copper clip.



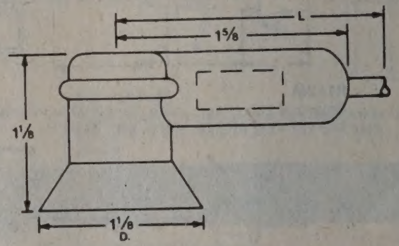
Long-skirted connector with side lead. Clip is plated brass or with plated beryllium copper clip.



Deep-skirted connector with side lead. Clip is corona-shielded plated beryllium copper.

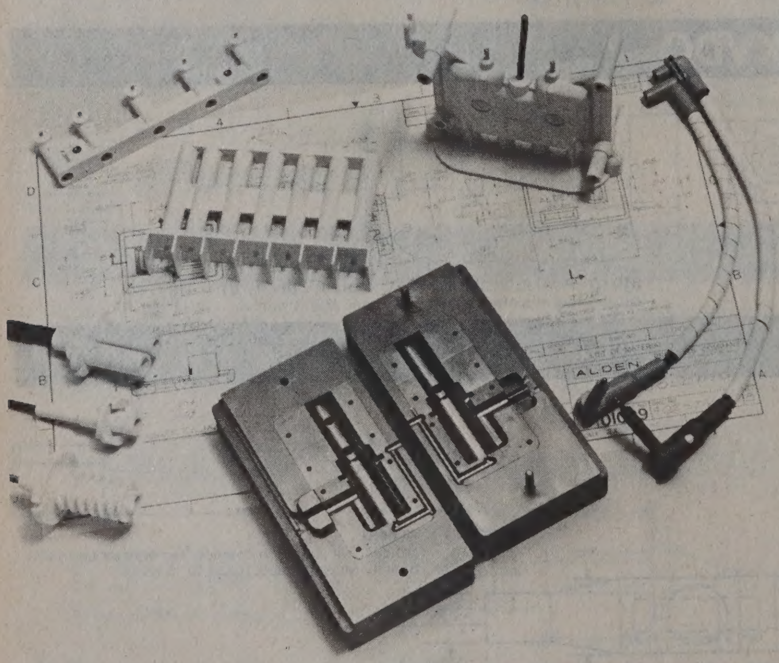


Silicone end cap connector with side lead and flared skirt. Clip is corona-shielded plated beryllium copper.



Silicone end cap connector with side lead, and molded-in ½ or 1 watt resistor. Specify resistor. Clip is corona-shielded plated beryllium copper.

CUSTOM MOLDING



Alden maintains a fully equipped in-house tool room and mold making facility with the capability and flexibility to serve each customer's specific needs. A wide variety of mold styles and molding equipment enables Alden to handle all jobs. From simple single cavity molds to complex multi-cavity molds for high volume runs on our automatic presses, Alden delivers.

Alden's highly skilled team of product and mold designers work together to coordinate the development of each new product. Whether blueprints and specifications are submitted or design effort is required, Alden welcomes all inquiries.

PROTOTYPES — As a means of proving a new design or providing functional parts before tooling a production mold, Alden offers the following prototyping options.

- **PROTOTYPE MOLDS** — Injection molded prototypes are produced from a low cost, single cavity, aluminum mold.
- **MACHINED PROTOTYPES** — Functional prototypes are machined from modern engineering plastics.
- **EPOXY RESIN CASTING** — Liquid resins are used to cast functional prototypes to close tolerances in a temporary rubber mold.

ALDEN

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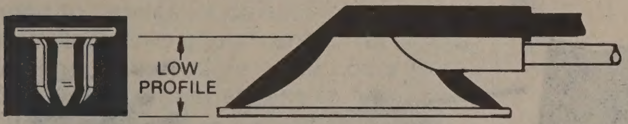
3228-RA SERIES CRT ANODE CONNECTORS

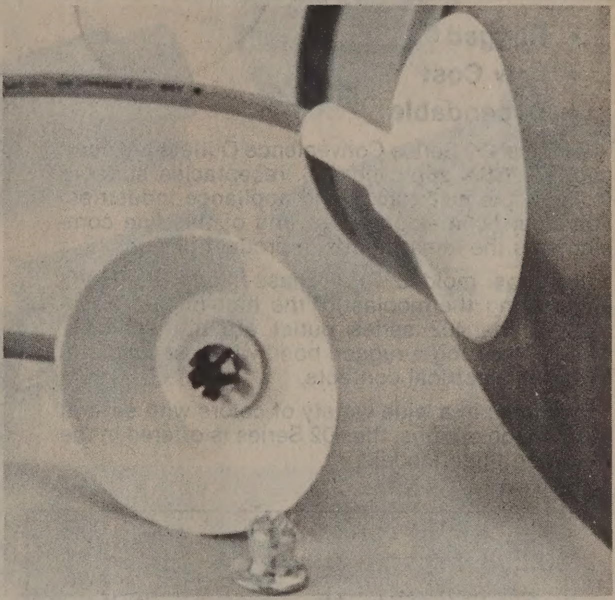
Alden's 3228RA-3 and -4 Series CRT Anode Connectors are designed to meet current demands for J1-21 style CRT receptacles with the following important features:

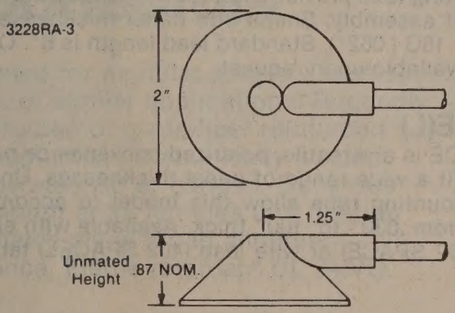
- High Voltage (to 40KVDC)
- Flame Retardant (UL 94-VO)
- Low Cost
- Low Profile
- High Flexibility

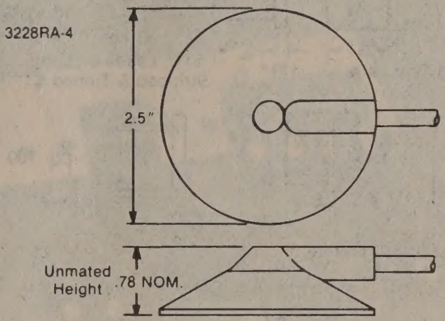


THE CAP — the 3228RA-3 and -4 Series takes advantage of the latest developments in flame retardant thermoplastic rubber to achieve a flexible low-profile seal that rivals silicones in performance, yet is low in cost.

THE CONTACT — Alden's multi-prong contact insures a positive corona-free connection, plus easy removal and installation. Nickel plated spring steel guarantees long contact life.

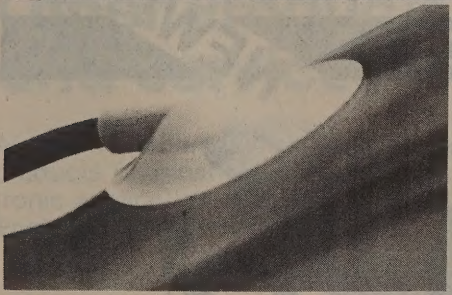


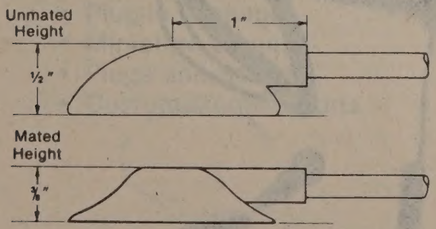


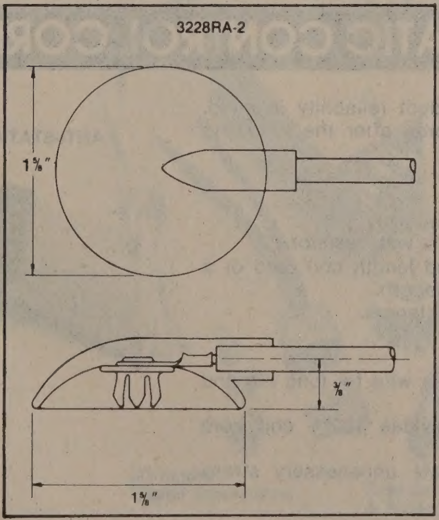


Alden's exclusive integral molding technique of directly molding onto lead wires maximizes high voltage performance. Standard wire is fully rated at 40 KVDC and meets UL 3239 VW-1 105°C. Other wires and configurations available upon request.

3228RA-2 SILICONE CRT ANODE CONNECTOR







NEW!

The 3228RA-2 is an integrally molded anode cap/lead assembly incorporating the same multi-prong positive contact used on the -3 and -4 models. The silicone rubber boot actually bonds to the wire insulation maximizing its high voltage performance. A super low profile allows this anode cap to fit minimum clearance applications where only potting epoxies could be used before.

Alden offers a variety of other anode connectors as well as CRT sockets. For additional information please contact our sales office directly.

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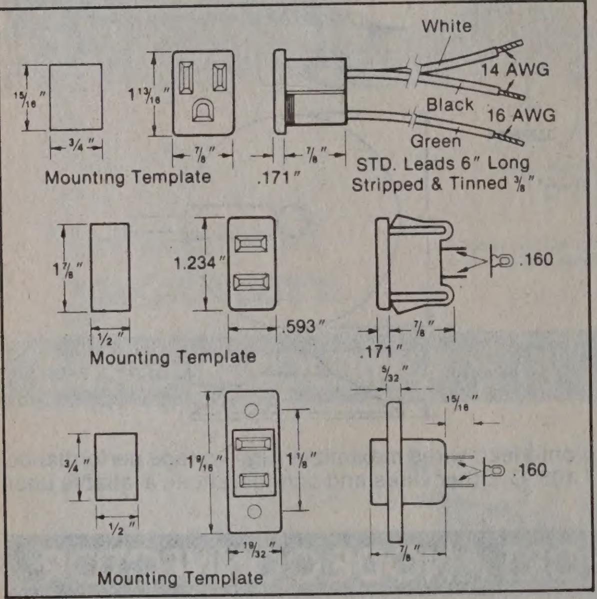
402 SERIES CONVENIENCE OUTLETS

- **Rugged**
- **Low Cost**
- **Dependable**

Alden's 402 Series Convenience Outlets are compact, UL/CSA approved A.C. receptacles suitable for both the electronics and appliance industries. The clean, contemporary styling of this line complements the latest trends in product design.

Injection molded in a glass-filled, UL 94-VO engineering thermoplastic, the high-impact housings of the 402 series outlet are ultrasonically welded, creating a rugged bond which securely retains the electrical contacts.

Available in a wide variety of colors with several termination options, the 402 Series is offered in the following three models.



402 SACGL-1

This compact, polarized A.C. receptacle with ground circuit fits neatly into even the most crowded panel. Integrally molded mounting tabs provide the user with a fast, inexpensive means of assembly. Snaps into panel thicknesses of 24G (.025″) to 16G (.062″). Standard lead length is 6″. Other lengths are available upon request.

402 SPACE(L)

The 302 SPACE is a versatile, polarized convenience outlet designed to fit a wide range of panel thicknesses. Unique dual-range mounting tabs allow this model to accommodate panels from .030″ to .100″ thick. Available with either solder tab (402 SPACE) or wire lead (402 SPACEL) terminations.

402 PACE

The 402 PACE is one of the smallest UL/CSA approved convenience outlets available. This rugged polarized A.C. outlet fits where ordinary outlets are too bulky, making them ideal for all types of electronic equipment. Eyelet, rivet or screw mounting to chassis with standard production tools.

HIGH QUALITY STATIC CONTROL CORDS

NEW!

Designed with user comfort and product reliability in mind, Alden's 2200 Series static control cords offer the following features:

VERSATILE
- Available in a variety of snap fastener sizes.
- Order with or without one megohm ¼ watt resistor.
- Offered with a practical 6′ extended length coil cord or a straight cord of customer specified length.
- Banana plug fits all standard mat fasteners.

RELIABLE
- Standard 24 AWG, 105 strand copper wire for long life and flexibility.
- Tough polyurethane insulation provides 100% coil cord memory.
- Flexible vinyl strain reliefs eliminate unnecessary stress on cord.

ANTI-STATIC

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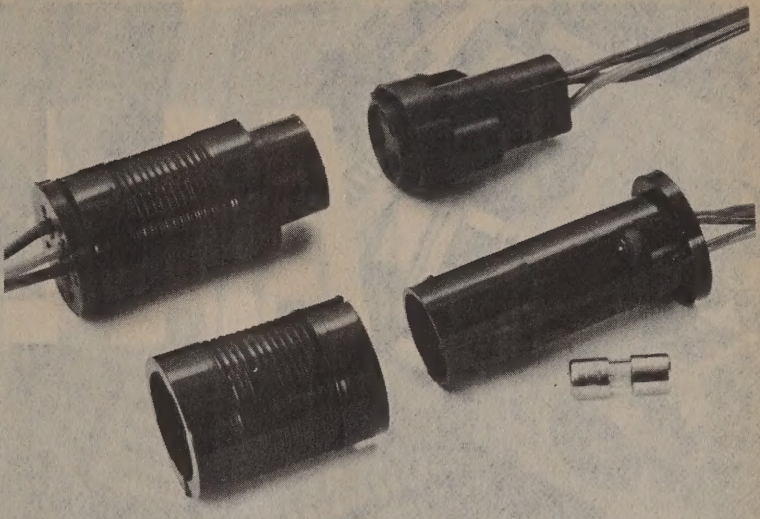
For More Information. Circle No. 81

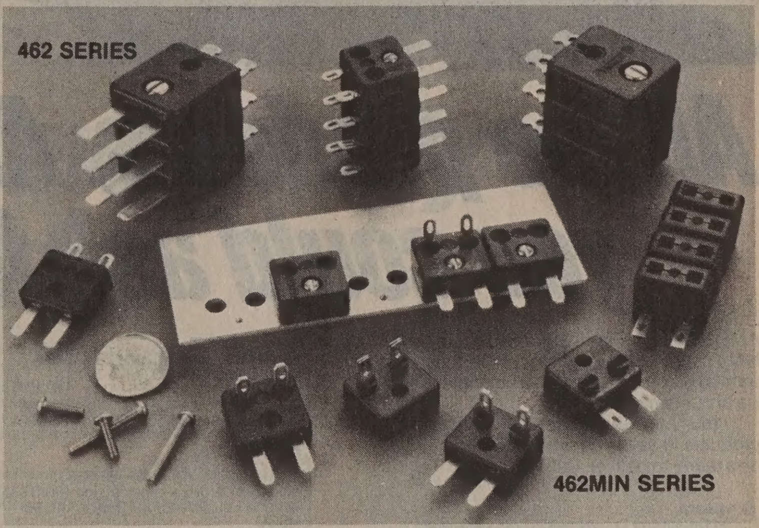
General Purpose Fused Connector

Alden's 4440 Series Fused Connector Assemblies permit the external design of critical fused circuits. Eliminate the need to service or disassemble expensive electronic equipment to replace a 5¢ fuse. Simply slide outer collar from connector to gain access to fuses. These 3 pin connectors are designed with two fused and one ground circuit.



Back Connectors

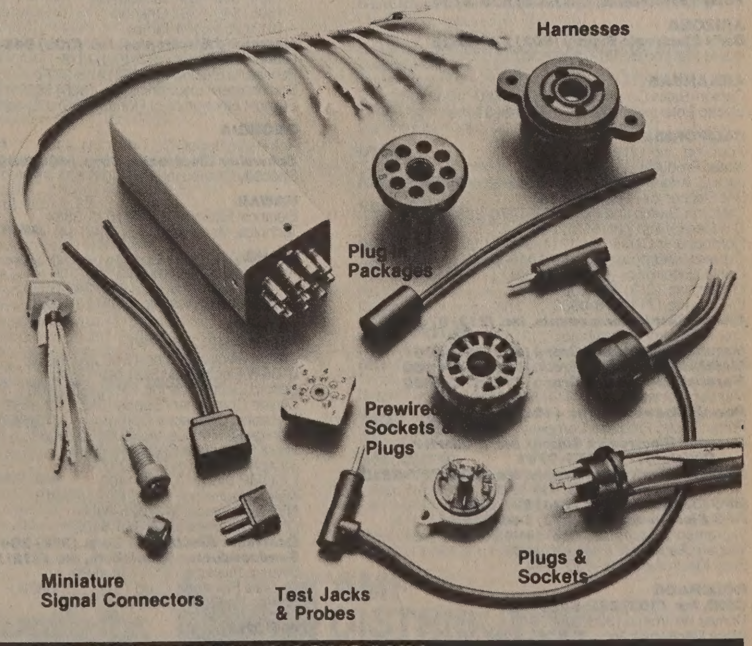
Designed for modular plug-in chassis, doors, or similar applications. Ruggedly constructed of glass-fiber reinforced thermoplastic, ultrasonically welded. Can be stacked or ganged. Generous bell mouth entry females and floating clip males allow broad alignment tolerance. Flame retardant UL 94-VO.


462 SERIES
462MIN SERIES

Other Products and Services

Alden has hundreds of other low-cost products for most electrical and electronic applications. Contact our Sales Engineers for prompt assistance.

- Harnesses
- Plug-in Packages
- Miniature Signal
- Plugs and Sockets
- Custom Modifications


Harnesses
Plug-in Packages
Prewired Sockets & Plugs
Plugs & Sockets
Miniature Signal Connectors
Test Jacks & Probes

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Inland Electronics (602) 889-5301

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Marshall Electronics Group (714) 578-9600
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RPS Electronics, Inc. (714) 521-5230
RPS Electronics, Inc. (213) 744-0355
Sacramento Electronics (916) 441-4821
Western Radio, Inc. (619) 268-4400
Zack Electronics (415) 626-1444

COLORADO
CSID, Inc. (303) 292-9594
Denver Wintronics (303) 934-2406
Waco Electronics, Inc. (303) 289-4743

CONNECTICUT
Cronin Electronics (203) 265-3134
Electro/Comp., Inc. (203) 375-5811
Park Distributors (203) 853-2010
Pilgrim Electronics (203) 792-7274
R & S Electronic Distributors (203) 528-9901

FLORIDA
AFCOM (305) 699-9500
Dow Electronics, Inc. (813) 365-3393
Electro Standards Laboratories, Inc. (305) 633-6973
Electronic Equipment, Inc. (305) 871-3500
EMSCO
  (305) 973-7103 Ft. Lauderdale
  (904) 356-4851 Jacksonville
  (305) 849-6362 Orlando
  (813) 253-0104 Tampa
Hammond Electronics, Inc. (305) 849-6060
Leader Electronics (813) 870-3315
Pensacola Electronics (904) 478-3771
Southeastern Electronics, Inc. (305) 563-4131
Summit Electronics of Florida (305) 920-6263

GEORGIA
Ack Radio Supply Co. (404) 351-6340
Schweber Electronics Corp. (404) 449-9170
Specialty Distributing Co. (404) 873-2521

HAWAII
Electrical Equipment (808) 533-3884
Technical Marketing Corp. (808) 841-4175

IDAHO
Al Electronics Supply (208) 623-3111
Kimball Electronics, Inc. (208) 342-3559
Kimball Electronics, Inc. (208) 232-2201

ILLINOIS
AFCOM (312) 228-0760
Advent Electronics, Inc. (312) 297-6200
B-B&W Electronics (312) 749-1710
Belford Electronics, Inc. (312) 865-2400
Classic Component Supply (312) 272-9650
Electronic Connector Corporation (312) 767-2200
George Electronics, Inc. (312) 331-1983
Hawk Electronics (312) 459-4030
Joseph Electronics (312) 297-4200
L COMP, Inc. (312) 628-1400
Melvin Electronics, Inc. (312) 279-5015
NEP Electronics (312) 625-8400
Ohm Electronics (312) 359-5500
Schweber Electronics Corp. (312) 364-3750
Semiconductor Specialists, Inc. (312) 279-1005
Stranco Products (312) 738-1580
Tri-State Electronic Corp. (312) 255-0600
Warren Radio Co. (309) 674-5998

INDIANA
Advent Electronics, Inc. (317) 872-4910
Graham Electronics (317) 634-8202
Hutch & Son, Inc. (812) 425-7201
Meunier Electronics (317) 635-3511

IOWA
Deeco, Inc. (319) 365-7551

KANSAS
C. Tennant, Sons & Co. (913) 441-1801

KENTUCKY
Peerless Electronic Equipment Co., Inc. (502) 637-7674

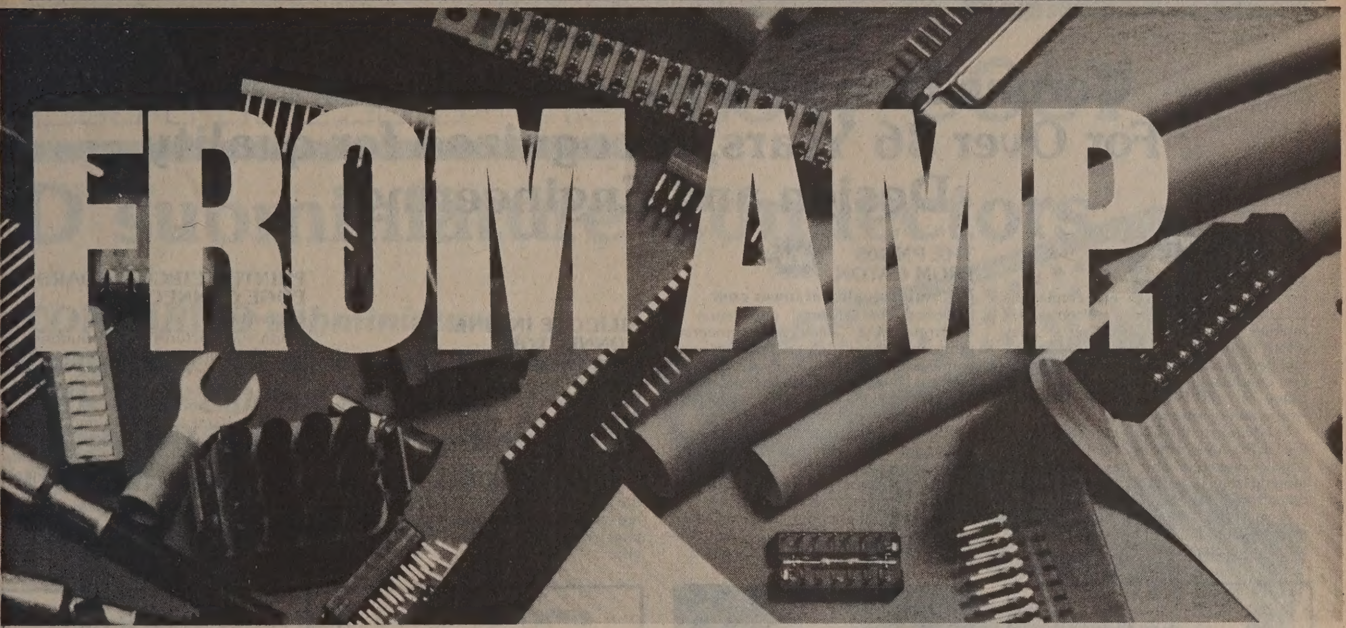
LOUISIANA
AFG Electronic Supply (504) 368-9696
Wm. B. Allen Supply Co., Inc. (504) 525-8222
Industrial Electronic Supply (318) 222-9459
Radio Parts, Inc. (504) 581-5959
Ralph's Electronics Supply (318) 233-0105
Southern Radio Supply Co., Inc. (504) 524-2343

MARYLAND
Capitol Radio Wholesalers, Inc. (301) 881-2270
Harco Electronics, Inc. (301) 838-7990
MS Electronics, Inc. (301) 340-6400
Powell Electronics (301) 621-4070
Whitney Distributors, Inc. (301) 944-8080

MASSACHUSETTS
Abbott Electronics, Inc. (617) 935-2040
ACI Electronics (617) 935-7230
ADD Electronics (617) 478-4200
AFCOM (617) 935-3200
Aved Electronics, Inc. (617) 657-8310
Controller Service and Sales Co. (617) 269-1300
Cronin Electronics (617) 449-0500
Future Electronics Corporation (617) 366-2400
Glynn Electronics – (617) 947-4262
Heilind Electronics (617) 272-5610
Impact Sales Co. (617) 821-1500
In-Stock Products Co. (617) 964-6200
J. V. Electronics (617) 273-4300
Land Electronics Supply Co., Inc. (617) 592-2220
March Electronics (617) 899-4220
Pilgrim Electronics (617) 251-8746
Powell Electronics/NE (617) 366-6100
QPL Electronics (617) 891-0460
Rush Industries (617) 729-5800
Semtex Industrial Corp. (617) 935-2466
Vantage Electronics Corporation (617) 894-8690
You Do It Electronics (617) 449-1005

MICHIGAN
Northern Wire & Cable, Inc. (313) 589-0510
RM Electronics Co., Inc. (616) 531-9300
RS Electronics (313) 525-1155
RS Electronics (616) 241-3483
S-F Electronic Supply, Inc. (616) 459-0216
Shand Electronics, Inc. (313) 743-8940

For More Information. Circle No. 82



All the local availability AMP distributor.

MINNESOTA
Electronic Center, Inc. (612) 371-5200
Gopher Electronics Co. (612) 483-3322
Stark Elec. Supply, Inc. (612) 332-1325

MISSISSIPPI
Hooper Electronic Supply (601) 762-9383

MISSOURI
Electronic Supply Co., Inc. (816) 931-0250
Franklin Electronics (314) 993-5333
Lectronix Inc. (314) 946-6424
Olive Electronics, Inc. (314) 426-4500
Van Sickle Radio Electronics, Inc. (314) 621-5000

NEBRASKA
Scott Electronics Supply Corp. (402) 466-8221

NEVADA
CRW, Inc. (702) 451-5490

NEW HAMPSHIRE
C & H Electronics (603) 882-1133
Yankee Electronic Supply, Inc. (603) 625-9746

NEW JERSEY
Alatec Products (201) 227-8140
Federated Purchaser (201) 272-0505
Kappe Industries, Inc. (201) 790-1999
Route Electronics 22, Inc. (201) 379-7710
State Electronics (201) 887-2550
William Electronics (201) 985-3700

NEW MEXICO
Electronic Parts Co. (505) 293-6161

NEW YORK
Ancar Electronics Supply (914) 592-7100
Brooklyn Electronics (212) 748-1300
Chief Electronics (914) 471-1300
Davis Electronics Corporation (516) 483-9200
Delmar Electronics, Inc. (516) 420-1234
Genesee Radio & Parts Co., Inc (716) 873-9661
Grimmer's Electronics (518) 374-8480
Harrison Radio Corporation (516) 293-7990
Help Electronics, Inc. (607) 729-3528
March Electronics (516) 486-6511
Masline Electronics (716) 546-5373
Peerless Radio Corporation (516) 593-2121
Rochester Radio Supply Co. (716) 454-7800
Rome Electronics, Inc. (315) 337-5400
Summit Distributors, Inc. (716) 884-3450
Wise Components, Inc. (914) 939-8600

NORTH CAROLINA
Hammond Electronics (919) 275-6391
Powell Electronics (919) 467-1212
Southeastern Electronics (919) 828-2311

OHIO
Akron Electronic Supply Co., (216) 762-8818
E.S.C.O., Inc. (513) 226-1133
Hughes-Peters, Inc. (614) 294-5351
Hughes-Peters, Inc. (513) 351-2000
LRP Electronics, Inc. (419) 228-1220
REM Electronics Supply Co., Inc. (216) 373-1300
Repco Electronics (216) 248-8900
Schuster Electric Company, Inc. (216) 425-8134
Servex Electronic Distributing, Inc. (614) 383-3117
Stotts-Friedman Company, Inc. (513) 298-5555
Target Electronics Corp. (216) 248-7930
Thompson Electronics (614) 228-6191
U.R.I. Electronics (513) 761-4030
Whitehead Electronics (614) 224-1186

OKLAHOMA
Combined Technology Companies (918) 582-8242
Electro-Enterprise (405) 478-1752
Electronic Supply Company (405) 232-5215
Radio, Inc. (918) 587-9123

PENNSYLVANIA
Allegheny Electronics (814) 946-0871
Almo Electronics Corporation (215) 698-4000
Arch Electronics Co. (215) 563-4660
Barbey Electronics (215) 376-6116
Delphi Wire and Cable (215) 534-3900
Kass Electronics Distributors (215) 449-2300
Leff Radio Parts Co. (412) 351-5000
P. A. Peters, Inc. (215) 434-5237
Peak Electronics Corporation (215) 293-9000
Powell Electronics, Inc. (215) 365-1900
Tri-Com, Inc. (215) 521-3080

RHODE ISLAND
Jabbour Electronics (401) 728-4600
Major Electronic Supply (401) 725-7400

SOUTH CAROLINA
Dixie Electronics, Inc. (803) 779-5332
Hammond Electronics (803) 233-4121
Wholesale Industrial Electronics (803) 722-2634

TENNESSEE
Curle Electronics (615) 266-4727
Electra Distributing Co. (615) 329-3971

TEXAS
Douglas Electronics (512) 883-5103
Electronic Packaging Components, Inc. (713) 447-5800
Electrotex (713) 526-3456
ESI Supply (915) 694-9657
Geophysical Supply Co. (713) 666-4100
Ideal Industrial Electronic Supply, Inc. (915) 779-6647
Industrial Electronics, Inc. (817) 731-7321
Kent Electronics Corporation (713) 780-7770
Kent Electronics Corporation (214) 669-2600
Kent Electronics Corporation (512) 834-1900
LBI Electro-optics (214) 358-4251
Powerline Products, Inc. (713) 461-9791
Solid State Electronics Co. (214) 438-5700
Swieco, Inc. (817) 335-6521
Target Electronics Industries, Inc. (214) 350-6853
Texas Connector Corp. (817) 246-0109
Texas International Cable (512) 366-3648
Wallace Electronics Co., Inc. (214) 340-0400

UTAH
Central Utah Electronics Supply (801) 373-7522
Kimball Electronics, Inc. (801) 328-2075

VERMONT
S.A.I. Semispecialists of America (802) 775-7126

VIRGINIA
Avec Electronics Corporation (804) 359-6071
Mexitronics (703) 342-4444
Priest Electronics, Inc. (804) 855-0105
Sterling Electronics (804) 226-2190

WASHINGTON
Connector World Supply (206) 767-6773
Interface Electronics Corporation (206) 872-5800
Pacific Electronics (206) 575-1050
Radar Electronic Co. Inc. (206) 282-2511

WEST VIRGINIA
State Electric Supply Co. (304) 523-7491

WISCONSIN
Electronics Industries (414) 235-8930
Fedco Electronics, Inc. (414) 922-6490
Industrial Electronics Corporation of Wisconsin
(414) 276-1212
Marsh Electronics (414) 475-6000
Superior Electronic Parts Company (608) 257-1477

AMP means productivity.

AMP
DISTRIBUTOR
MARKETING

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For More Information. Circle No. 82

Caton Connector Corona-Free Connectors & Assemblies For Over 36 Years, recognized for quality Design and Engineering

MODIFIED MS CONNECTORS

CCM Series

Positive contact screw-on connectors features self-centering tapered contours of molded resilient silicone inserts. They afford high dependability with their positive peripheral seal. The dielectric inserts are unaffected by temperatures in the range of −70 F to +400 F. They are ozone and corona resistant.

In addition to the single contact version, the CCM series come in 2, 3, 4, 5, 7 and 8 contact versions and have shell sizes ranging from 12 to 24. They carry voltage rates from 20 to 50 KVDC.

A line of accessories including protective caps and cable clamps are available throughout the ranges offered.

THE PM 105 FROM CATON NEW

PM Series quality at lower cost

Designed for universal application in electronic and electrical engineering programs, these fully molded silicone connectors are ideal for marine and medical installations, automotive and business machine assemblies, aircraft and space technology.

The PM 105 series is vibration proof, watertight and waterproof, tested for underwater engineering projects, with high wear resistance capability. Connectors are manufactured with UL approved material, can be panel mounted, field assembled. 1000 to 5KV operating voltage. Available sheathed or unsheathed.

SILICONE IN-LINE CONNECTORS

PM200-PM300 Series

These all silicone positive end pieces snap together forming a watertight connection that can easily be disassembled or changed. The units are fully molded and offer high reliability and long life. The units are corona free and leak proof.

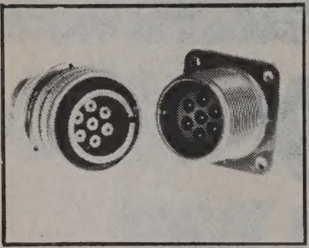
The PM 200 series is for 30 KVDC and the PM series is for 50 KVDC. Both series are available with grommet type ends for panel mounting or with optional finger grip.

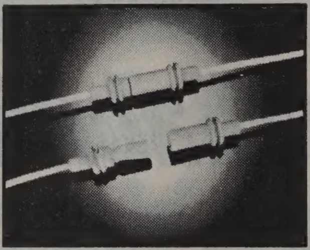
PRINTED CIRCUIT BOARD EDGE CONNECTORS

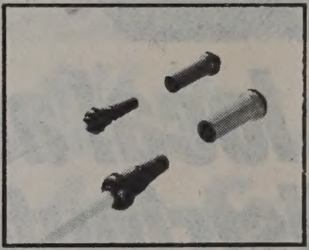
EC Series

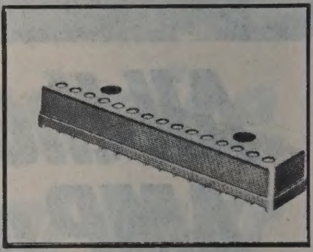
Caton manufactures literally hundreds of printed circuit board connectors including the entire line of H.H. Buggie products under a license agreement. The socket contacts are phosphor bronze with gold plating and are available in mineral filled diallyl phthalate or phenolic to meet the various MIL-M-14F type requirements. Each series comes with plugs and female receptacles.

Operating voltage is 250 volts AC RMS with a current rating of 5 amperes. Operating temperatures are −55 C to +125 C.



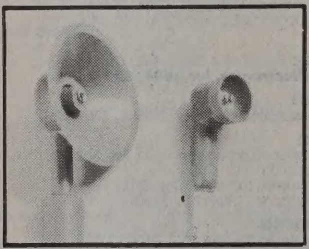


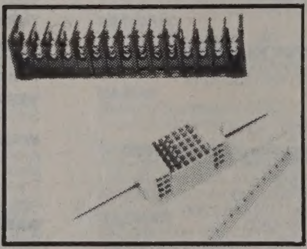


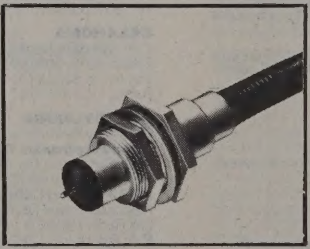


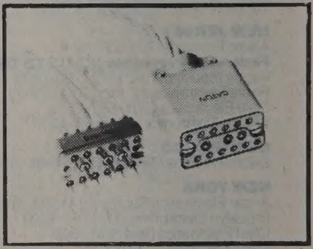
CATON

"We know what will work. . . and we have learned how many ideas will not work."









CRT ANODE LEADS

CCR Series

Caton CRT anode leads are leak proof and corona free. The lead assemblies are molded silicone with heat treated contacts. They offer excellent fire and heat resistance with ambient temperatures over 150 C.

The connectors adapt perfectly to JI-22 or JI-25 anode ball contacts. Capabilities range from 5 KV to 30 KV.

TERMINAL BLOCKS

MMC Series*

A high density series of terminal blocks are offered with a simple crimp-type snap in contacts. They come in standard and miniature designs and are modular in construction.

RADAR-PULSE-HI VOLTAGE CABLE ASSEMBLIES

CA 123 Series

Our high voltage cable assemblies feature factory molded ends that assure the highest possible corona free construction. Corona extinction is measured in accordance with MIL-C-17.

These cable assemblies are the industry standard and are used in virtually all radar installations world-wide. Their corona free capabilities range from 10-30 KVAC and the Hi-Pot tests from 25-75 KVAC.

The CA series comes in numerous configurations to interface with most any high-voltage/pulsed voltage requirements.

RACK & PANEL CONNECTORS

PD 15 Series*

This series is used to connect power sources to receivers, modulators and transmitters. They come in removable crimp-type and solder contacts.

®

*Manufactures under license from the Burndy Corporation

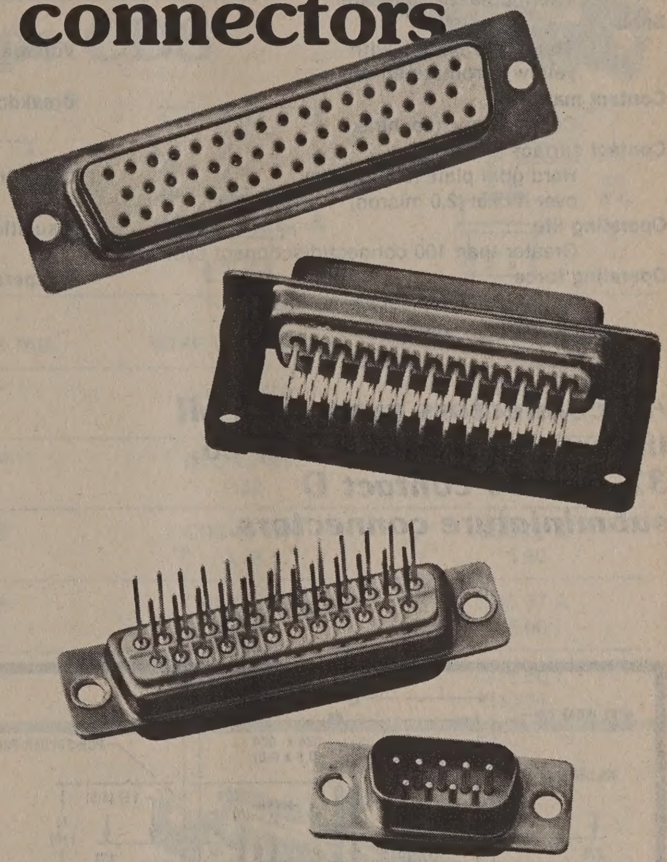
CATON

Caton Connector Corporation
Jones River Industrial Park
Kingston, Massachusetts 02364
617-585-4315 TWX 710-391-7546

PLEASE SEE OUR IMMEDIATE ACTION CARD

amlan inc. LOW COST

D subminiature connectors



COMPARE D subminiature connector prices in this catalog with your current supplier - THEN ORDER FROM amlan. Quantity discounts are available. ALL ITEMS IN STOCK.

- **High quality connectors. Design conforms to MIL-C-24308 and IEC 48B recommendations**
- **Connectors mate with all industry standard 9, 15, 25, 37, and 50 contact D subminiature connectors**
- **Solder cup, wire wrap, straight and 90° printed circuit terminations**
- **Straight and 90° hoods available**
- **15, 25, and 37 pin male and female flat cable connectors are available.**
- **Samples available. Please contact us.**

Ordering Information

Order connectors by part number selected from the charts. Prices shown are for 1 to 99 pieces. Contact amlan, Inc. for quantity discount price schedule.

Insulating connector hoods with integral cable clamps fit male and female connectors interchangeably. Both straight and 90° styles are available. Order from chart by number of contacts.

Molded, one-piece angle brackets support right angle printed circuit connectors, and hold solder tails in alignment for easy insertion in the drilled hole pattern on the board. One bracket required per connector. Order from chart by number of contacts. See mounting drawings for dimensions.

Terms and Conditions of Sale

1. All prices are F.O.B. Stamford, CT.
2. Any price or prices herein stated shall be increased to the extent of any sales tax or other tax or taxes or any terms or conditions which may be imposed by the federal and/or state governments.
3. Payment: 30 days net.
4. A minimum order charge of $5.00 will be added to orders under $50.00.
5. Prices and specifications subject to change without notice.

Distributor inquiries welcomed.

amlan inc.

97 Thornwood Road
Stamford, CT 06903
Telephone (203) 322-1913
Telex: 643647

Specifications

Insulation
Thermoplastic-polyester

Shell
Steel, zinc plated, with yellow chromate surface

Contact material
Copper alloy, machined

Contact surface
Hard gold plate (0.5 micron) over nickel (2.0 micron)

Operating life
Greater than 100 connect/disconnect cycles

Operating force
.44 lbf (2.0N) typical per contact, .75 lbf (3.4N) maximum

Current
5A max., each contact, to 96 °C ambient temperature

Voltage
125 Vac, continuous, according to VDE 110/A

Breakdown voltage
1000 Vac to 50 Hz for 1 minute; 250 Vdc; contact to contact and contact to housing

Contact resistance
Less than .0025 ohms (mated)

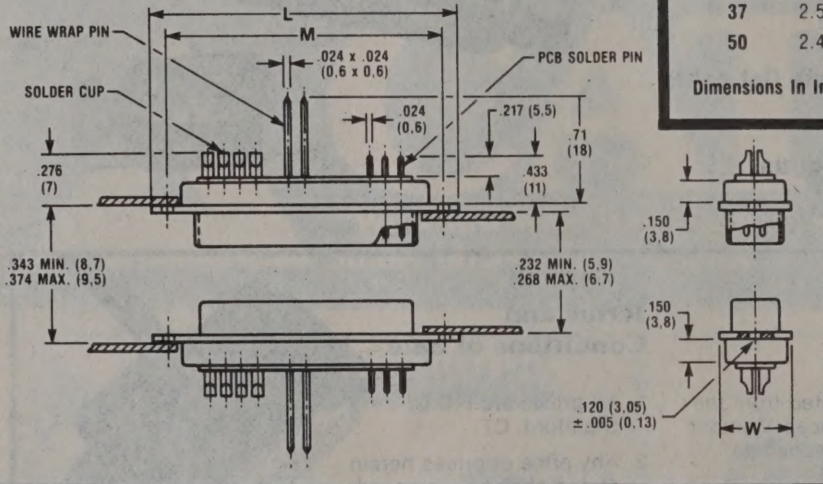
Insulation resistance
Greater than 10^{11} ohms

Temperature range
− 55° to 125°C (− 67° to 257°F).
Derate to 4A @ 110°C, to 2A @ 120°C, to 0A @ 125°C ambient temperature

All connectors mate with all industry standard 9, 15, 25, 37, and 50 contact D subminiature connectors.

NO. CONTACTS	M	L	W
9	.985 (25,0)	1.213 (30,8)	.492 (12,5)
15	1.311 (33,3)	1.544 (39,2)	.492 (12,5)
25	1.850 (47,0)	2.087 (53,0)	.492 (12,5)
37	2.500 (63,5)	2.733 (69,4)	.492 (12,5)
50	2.406 (61,1)	2.638 (67,0)	.606 (15,4)

Dimensions In Inches (mm)



Accessories

NO. CONTACTS	9	15	25	37	50
ANGLE BRACKETS (1 req'd per connector)	BR 9	BR 15	BR 25	BR 37	BR 50
CABLE HOODS STRAIGHT	CG 9 G	CG 15 G	CG 25 G	CG 37 G	CG 50 G
90°	CG 9 S	CG 15 S	CG 25 S	CG 37 S	CG 50 S

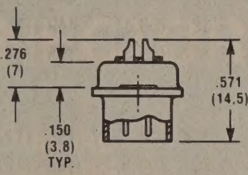
ANGLE BRACKETS $ .30 EACH, ALL SIZES
CABLE HOODS $1.00 EACH, ALL SIZES

amlan inc.
97 Thornwood Road, Stamford, CT 06903
Telephone (203) 322-1913 Telex: 643647

For More Information. Circle No. 84

Price List

Male Connectors - Type CDS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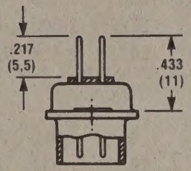
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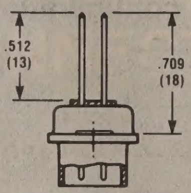
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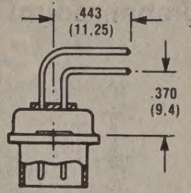
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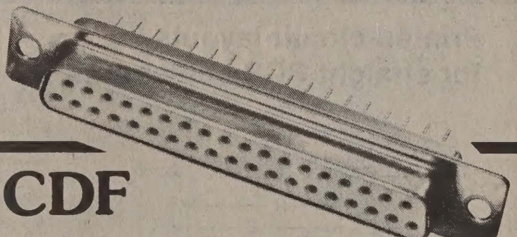
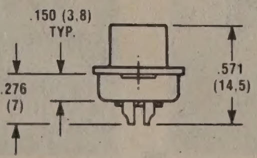
**PRICE EA.
1-99 PIECES**

NO. CONTACTS	SOLDER CUP	PCB SOLDER TAIL	WIRE WRAP POST	RIGHT ANGLE PCB
9	CDS 9 L $1.36	CDS 9 P 1.36	CDS 9 WW 1.90	CDS 9 A 2.54
15	CDS 15 L 1.84	CDS 15 P 1.84	CDS 15 WW 2.62	CDS 15 A 3.74
25	CDS 25 L 2.56	CDS 25 P 2.56	CDS 25 WW 3.78	CDS 25 A 5.60
37	CDS 37 L 3.58	CDS 37 P 3.58	CDS 37 WW 5.32	CDS 37 A 8.00
50	CDS 50 L 4.84	CDS 50 P 4.84	CDS 50 WW 7.00	CDS 50 A 10.66



Female Connectors - Type CDF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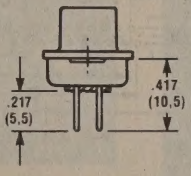
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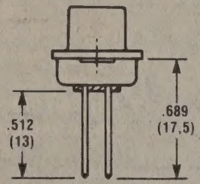
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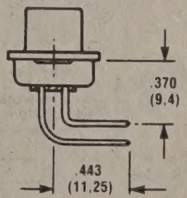
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**PRICE EA.
1-99 PIECES**

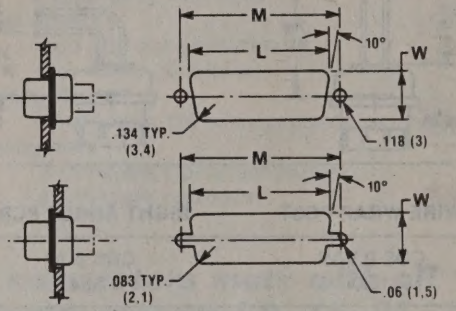
NO. CONTACTS	SOLDER CUP	PCB SOLDER TAIL	WIRE WRAP POST	RIGHT ANGLE PCB
9	CDF 9 L $1.86	CDF 9 P 2.02	CDF 9 WW 2.82	CDF 9 A 3.26
15	CDF 15 L 2.62	CDF 15 P 2.90	CDF 15 WW 4.22	CDF 15 A 4.98
25	CDF 25 L 3.84	CDF 25 P 4.36	CDF 25 WW 6.50	CDF 25 A 7.70
37	CDF 37 L 5.36	CDF 37 P 6.14	CDF 37 WW 9.30	CDF 37 A 11.08
50	CDF 50 L 7.22	CDF 50 P 8.24	CDF 50 WW 12.34	CDF 50 A 14.96

Mounting Information

Dimensions are inches (mm in parentheses).
All dimensions ±.008" (±.2 mm)

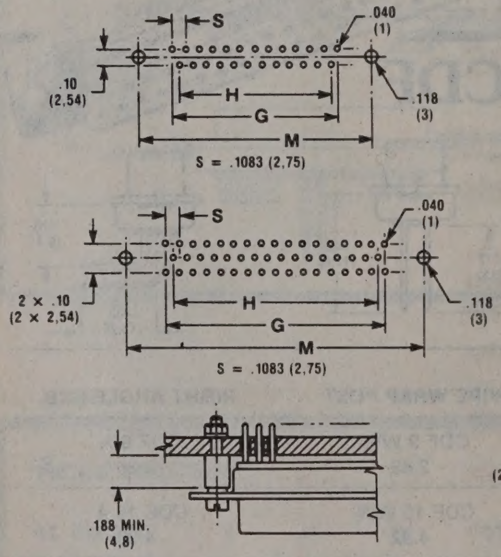
NO. CONTACTS	M	L	W
9	.985 (25,0)	.807 (20,5)	.449 (11,4)
15	1.311 (33,3)	1.134 (28,8)	.449 (11,4)
25	1.850 (47,0)	1.673 (42,5)	.449 (11,4)
37	2.500 (63,5)	2.327 (59,1)	.449 (11,4)
50	2.406 (61,1)	2.217 (56,3)	.555 (14,1)
9	.985 (25,0)	.874 (22,2)	.485 (12,3)
15	1.311 (33,3)	1.201 (30,5)	.485 (12,3)
25	1.850 (47,0)	1.744 (44,3)	.485 (12,3)
37	2.500 (63,5)	2.390 (60,7)	.485 (12,3)
50	2.406 (61,1)	2.295 (58,3)	.603 (15,3)

Panel mounting hole configurations

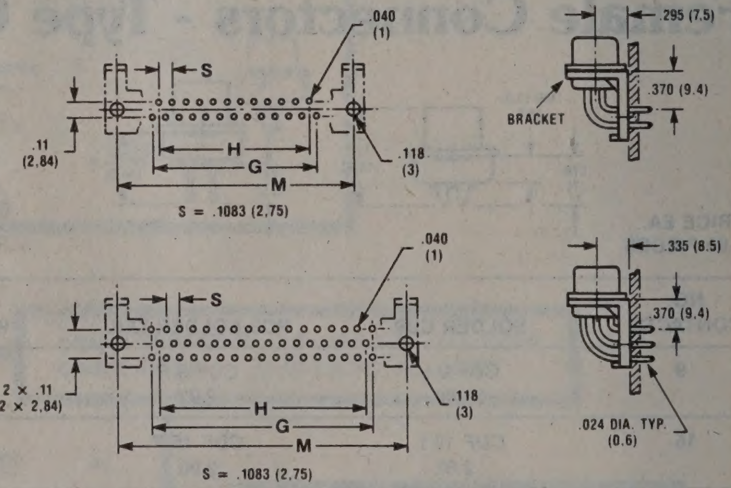

M
L
10°
W
.134 TYP.
(3,4)
.118 (3)
M
L
10°
W
.083 TYP.
(2,1)
.06 (1,5)

NO. CONTACTS	M	G	H
9	.985 (25,0)	4 x S = .433 (4 x S = 11)	3 x S = .325 (3 x S = 8,25)
15	1.311 (33,3)	7 x S = .758 (7 x S = 19,25)	6 x S = .650 (6 x S = 16,5)
25	1.850 (47.0)	12 x S = 1.300 (12 x S = 33,0)	11 x S = 1.192 (11 x S = 30,25)
37	2.500 (63.5)	18 x S = 1.950 (18 x S =49,5)	17 x S = 1.841 (17 x S = 46,75)
50	2.406 (61,1)	16 x S = 1.733 (16 x S = 44,0)	15 x S = 1.625 (15 x S = 41,25)

Printed circuit layouts for straight PCB solder pins


S
.040
(1)
.10
(2,54)
H
G
M
.118
(3)
S = .1083 (2,75)
S
.040
(1)
2 x .10
(2 x 2,54)
H
G
M
.118
(3)
S = .1083 (2,75)
.188 MIN.
(4,8)

Printed circuit layouts for right angle PCB solder pins


S
.040
(1)
.11
(2,84)
H
G
M
.118
(3)
S = .1083 (2,75)
.295 (7.5)
.370 (9.4)
BRACKET
S
.040
(1)
2 x .11
(2 x 2,84)
H
G
M
.118
(3)
S = .1083 (2,75)
.335 (8.5)
.370 (9.4)
.024 DIA. TYP.
(0.6)

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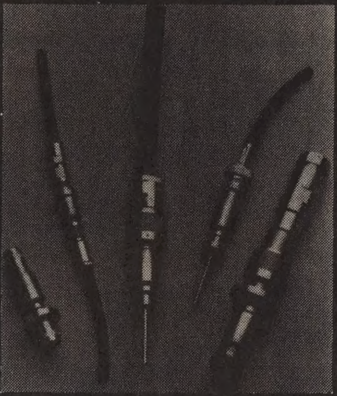
50-OHM CONNECTORS

HIGH TEMPERATURE ULTRA HIGH VACUUM

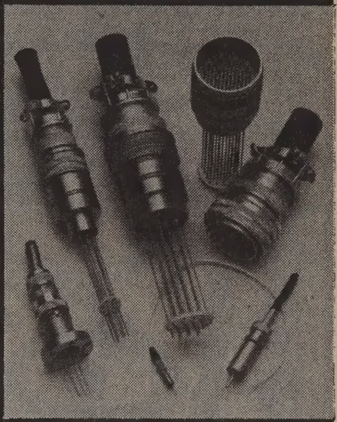
- VSWR less than 1.5 up to 6 GHz
- −50°C to +400°C
- Pressure ratings 10^{-3} to 10^{-10} torr or 1 atm. to 750 psig @ 20°C
- Operating voltage 500 volts peak
- Ceramic-metal bonded
  - ★ with plug disconnected above 200°C



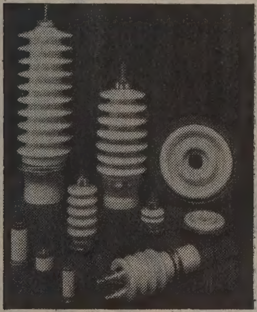
INSTRUMENTATION CONNECTORS

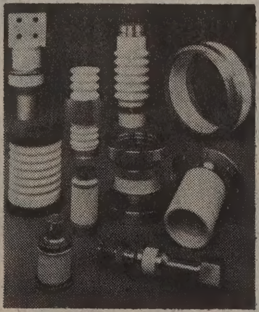
- High-temperature
- 1 to 37 pins

- operating pressures $<10^{-10}$ torr to 100 psig
- temperature range −200 to +450°C
- ceramic-metal bonded
- bakeable vacuum flange and weld adapter mountings
  - ★ with plug disconnected



Undersea to outer space... hi-temp hi-alumina ceramic-metal seals:





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  $<1 \times 10^{-9}$ torr
  $>10{,}000$ psi
- **WIDE TEMPERATURE RANGE**
  Bakeable at 450°C; operate continuously at 350°C in air; withstand cryogenic temperatures

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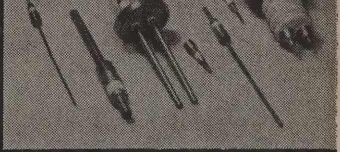
- wide temp range–450°C bakeout to cryogenic temperatures
- ratings to 100 kv-dc and 600 amps
- available in bakeable vacuum-flange and weld-adapter mountings
- compatible flanges, fittings, and hardware available



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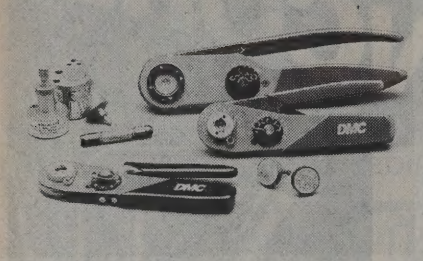
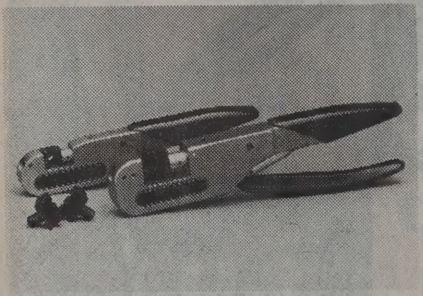
DANIELS MANUFACTURING CORPORATION



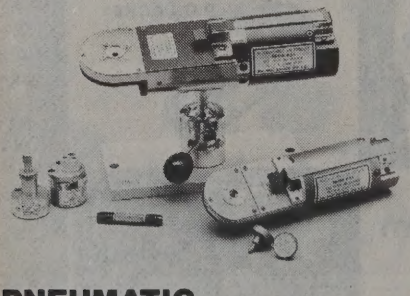
INDENT CRIMPING TOOLS

AF8(M22520/1-01)
AFM8(M22520/2-01)
MH860(M22520/7-01)



OPEN FRAME CRIMPING TOOLS

HX3(M22520/10-01)
HX4(M22520/5-01)



PNEUMATIC CRIMPING TOOLS

WA27F(M22520/29-01)
WA22(M22520/28-01)

INSTALLING/REMOVAL TOOLS (MIL-I-81969)

DMC offers a full line of military and commercial installing and removal tools. Below is a partial listing.

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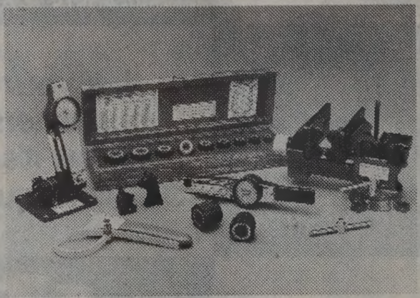
MS3447
MS3448-001
MS17805
MS17806
MS24256
MS27495
MS27534
M83723
MS90455
MS90456

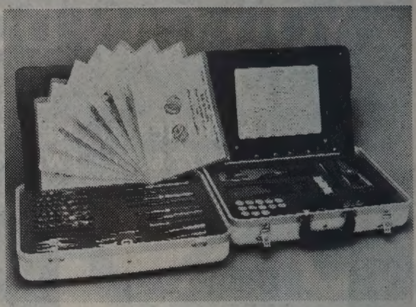
Plus many commerical tools.



NEW BETA™ TOOLS

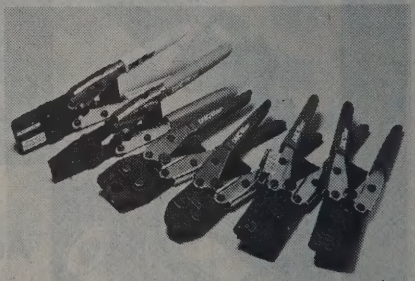
DMC offers a full line of assembly/maintenance tools for circular connector assemblies. The following elements are contained in the BETA™ kit.

- Connector adaptor holding tools
- Strap wrenches
- Circular vises for connectors
- Connector/safety wire pliers
- General purpose custom tool kits - Mil-Spec type kits or custom designed to your requirements.
- Jam nut socket tools
- Connector index/assembly tools
- Torque meters/torque wrenches



CONNECTOR SYSTEMS SERVICE KITS

A complete "Tools and Information Package." Includes tooling, cross reference part #'s and application diagrams in a durable case. Kits are designed by DMC for the assembly and service of connector systems. Typical applications include aircraft, missile systems and military vehicles.



COMPOUND LEVERAGE TOOLS (GMT)

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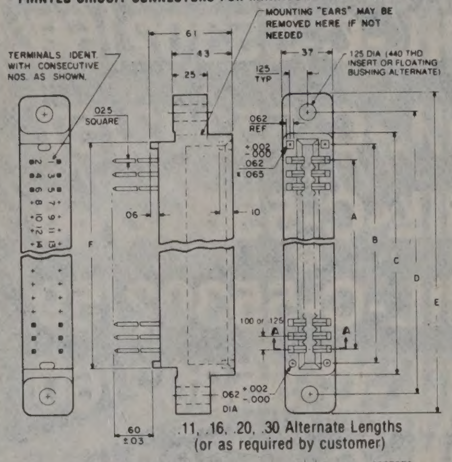
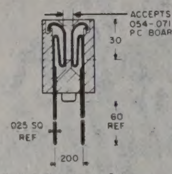
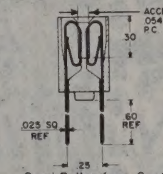

MOUNTING "EARS" MAY BE REMOVED HERE IF NOT NEEDED
TERMINALS IDENT. WITH CONSECUTIVE NOS. AS SHOWN.
.61
.43
.37
.25
.125 TYP
.125 DIA (440 THD INSERT OR FLOATING BUSHING ALTERNATE)
.025 SQUARE
.062 REF
.062 ±.002 −.000
.065
.06
.10
F
A
B
C
D
E
100 or .125
.062 +.002 −.000 DIA

.60 ±.03 .11, .16, .20, .30 Alternate Lengths (or as required by customer)


ACCEPTS .054-.071 THK P.C. BOARD
.30
.60 REF
.025 SQ REF
.200

Full Bellowform Contacts Connector with .100 Contact Centers (Series 6100-200)


ACCEPTS .054-.071 THK P.C. BOARD
.30
.60 REF
.025 SQ REF
.25

Semi Bellowform Contacts Connectors with .125 Contact Centers (Series 6125-250)

	SERIES 6100-200						SERIES 6125-250					
NO. OF	.100 CONTACT CENTERS						.125 CONTACT CENTERS					
CONTACT	A	B	C	D	E	F	A	B	C	D	E	F
6/6	.500	.700	.860	1.175	1.435	.750	.625	.875	1.035	1.295	1.555	.875
10/10	.900	1.100	1.260	1.575	1.835	1.150	1.125	1.375	1.535	1.795	2.055	1.375
15/15	1.400	1.600	1.760	2.075	2.335	1.650	1.750	2.000	2.160	2.420	2.680	2.000
17/17	1.600	1.820	1.972	2.240	2.500	1.840	—	—	—	—	—	—
18/18	1.700	1.900	2.060	2.375	2.635	1.950	2.125	2.375	2.535	2.795	3.055	2.375
20/20	1.900	2.100	2.260	2.575	2.835	2.150	2.375	2.625	2.785	3.045	3.305	2.625
22/22	2.100	2.300	2.460	2.775	3.035	2.350	2.625	2.875	3.035	3.295	3.555	2.875
24/24	2.300	2.500	2.660	2.975	3.235	2.550	—	—	—	—	—	—
25/25	2.400	2.600	2.760	3.075	3.335	2.650	3.000	3.250	3.410	3.670	3.930	3.250
26/26	2.500	2.700	2.900	3.200	3.500	2.775	—	—	—	—	—	—
28/28	2.700	2.900	3.060	3.375	3.635	2.950	3.375	3.625	3.785	4.045	4.305	3.625
30/30	2.900	3.100	3.260	3.575	3.835	3.150	3.625	3.875	4.035	4.295	4.555	3.875
31/31	—	—	—	—	—	—	3.750	4.000	4.160	4.420	4.680	4.000
35/35	3.400	3.600	3.760	4.075	4.335	3.650	4.250	4.500	4.660	4.920	5.180	4.500
36/36	3.500	3.700	3.860	4.175	4.435	3.750	4.375	4.625	4.785	5.045	5.305	4.625
40/40	3.900	4.100	4.260	4.575	4.835	4.150	4.875	5.125	5.285	5.545	5.805	5.125
43/43	4.200	4.400	4.560	4.875	5.135	4.450	5.250	5.500	5.660	5.920	6.180	5.500
44/44	4.300	4.500	4.660	4.975	5.235	4.550	—	—	—	—	—	—
48/48	4.700	4.900	5.150	5.450	5.710	5.130	—	—	—	—	—	—
49/49	—	—	—	—	—	—	6.000	6.250	6.410	6.670	6.930	6.250
50/50	4.900	5.100	5.260	5.575	5.835	5.150	6.125	6.375	6.535	6.795	7.055	6.375
60/60	5.900	6.100	6.260	6.575	6.835	6.150	7.375	7.625	7.785	8.045	8.305	7.625
65/65	6.400	6.600	6.760	7.075	7.335	6.650	8.000	8.250	8.410	8.670	8.930	8.250
75/75	7.400	7.600	7.760	8.075	8.335	7.650	9.250	9.500	9.650	9.920	10.180	9.500
100/100	9.900	10.100	10.260	10.575	10.835	10.150	12.375	12.625	7.785	13.045	13.305	12.625

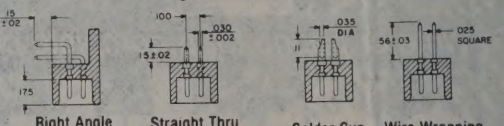
SERIES 6100-200 and 6125-250. The most extensive line of printed circuit connectors for miniature wire wrapping in the industry. All densities from 2 to 200 contacts can be supplied . . . the most popular sizes being tabulated above. Available in two grid patterns — .100 x .200 (series 6100-200) and .125 x .250 (series 6125-250) with .025 square terminals true positioned to make these particularly suitable for automatic wiring techniques. Terminal lengths to exact customer needs for one, two or three wraps; or for flow soldering to boards of any thickness. Choice of mounting styles — thru hole, thd inserts, floating bushing, flat bottom and without mounting "ears". Connector body molding material may be any of a variety of compounds for commercial and military applications. Contacts are gold plated phosphor bronze with optional plating in accordance with all MIL specs or special customer requirements.

Voltage Rating (sea level) — 1800 V. RMS (.100 spacing); 2100 V. RMS (.125 spacing) Current Rating — 3 amps continuous.

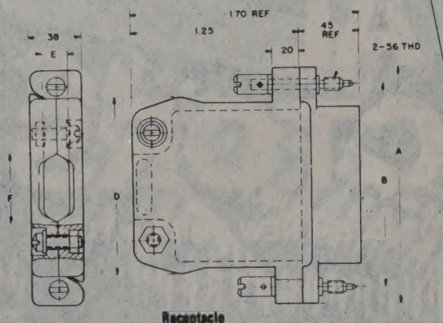
SERIES "J"
For Printed Circuit Board Applications

NO. OF	DIMENSIONS				
CONTACTS	A	B	C	D	E x F
9	1.150	.900	.400	.71	.19 x .25
11	1.250	1.000	.500	.81	.19 x .28
15	1.450	1.200	.700	1.01	.18 x .40
21	1.750	1.500	1.000	1.31	.18 x .50
25	1.950	1.700	1.200	1.51	.18 x .60
31	2.250	2.000	1.500	1.81	.18 x .70
37	2.550	2.300	1.800	2.11	.18 x .80
51	3.250	3.000	2.500	2.81	.18 x 1.15

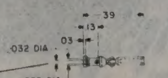
Plug Terminal Options


.15 ±.02
.175
.100
.030 ±.002
.15 ±.02
.035 DIA
.11
.56 ±.03
.025 SQUARE

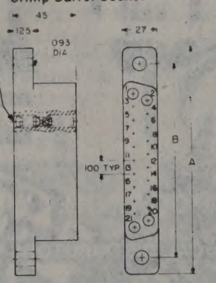
Right Angle Flow Solder · Straight Thru Flow Solder · Solder Cup · Wire Wrapping


.38
E
1.70 REF
1.25
.45 REF
.20
2-56 THD
F
D
A
B

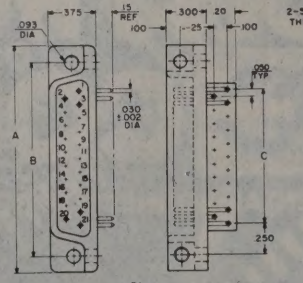
Receptacle With Plastic Hood/Turnable Screwlock


.39
.13
.03
.032 DIA
.055 DIA

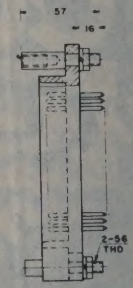
Crimp Barrel Socket


.45
.125
.093 DIA
.27
.100 TYP
B
A

Receptable


.093 DIA
.375
.15 REF
.100
.300
.20
.25
.100
.050 TYP
.030 ±.002 DIA
A
B
C
.250

Plug


.57
.16
2-56 THD

Plug with Fixed Screwlocks

SERIES J 9 to 51 contacts. Small sized, ruggedly constructed flame retardant glass phenolic with one piece molded shell on plug to protect contacts and prevent mismating. Wide choice of terminals — wire crimp removable socket contacts for receptacles; right angle mtg. or straight thru mtg. Flow solder, solder cup or wire wrapping terminals on plugs. Optional corrosion resistant steel polarizing screwlocks and thermoplastic cable support hood rated U.L. 94 V-0 for flammability. Breakdown Voltage (sea level) — 2000 V. RMS • Current Rating — 3 amps continuous. 5 amps max. • min. creepage between contacts — .047" • min. Air Space between contacts — .047" • contact center spacing — .050" • Pin Diameter — .030" • solder cup & crimp barrel — #22 AWG max. • wire wrapping — #26 AWG max.

CONTINENTAL CONNECTORS

Precision Electronic Connectors For Commercial & Military Applications

RACK AND PANEL CONNECTORS FOR VARIOUS EQUIPMENT

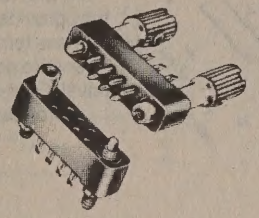
A complete line of high-reliability connectors for computers, missile, aircraft, communications and other critical electronic applications. In addition to standard specifications, these connectors can be supplied with such optional accessories as aluminum hoods, protective shells, polarizing screwlocks* and solder filled contacts. Various molding compounds are also available.

* PATENT NO. 2,746,022

MICRO-MINIATURE

SERIES MM-22 FIXED CONTACTS AND SERIES MMM CRIMP REMOVABLE CONTACTS. 5 to 104 contacts. Ruggedized to withstand shock and vibration extremes. Meet MIL-C-28748 specs or commercial types. Available with guide pins and guide sockets, polarizing screwlocks, cable brackets, aluminum hoods and glass filled Diallyl Phthalate molding.

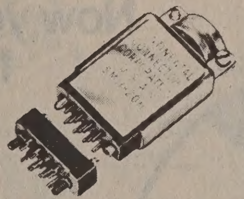
Breakdown Voltage (sea level), 2000V. RMS • Current Rating, 3A • Minimum Creepage Between Contacts, .070″ • Minimum Air Space Between Contacts, .040″ • Contact Center Spacing, .093″ • Pin Diameter, .030″ • Solder Cup, #22 AWG wire.



SUBMINIATURE

SERIES SM-20. 5 to 104 contacts. Meet or exceed applicable paragraphs of MIL-C-28748 specs. Optional features include guide pins and guide sockets, polarizing screwlocks, protective shells and aluminum hoods. Glass-filled Diallyl Phthalate molding.

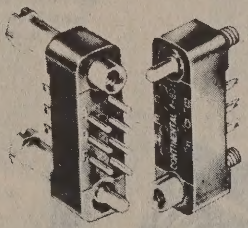
Breakdown Voltage (sea level), 2000V. RMS • Current Rating, 5A Continuous, 7.5A Maximum • Minimum Creepage Between Contacts, .078″ • Minimum Air Space Between Contacts, .045″ • Contact Center Spacing, .125″ • Pin Diameter, .040″ • Solder Cup, #20 AWG wire.



MINIATURE

SERIES 20. 4 to 104 contacts. A larger size, also available with guide pins and guide sockets, polarizing screwlocks, aluminum hoods, protective shells and various molding compounds. Meet MIL-C-28748 specs or commercial type. Can be supplied in hexagonal types with 1, 4, 5, 7, 9 and 10 contacts.

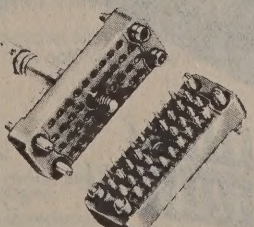
Breakdown Voltage (sea level), 3000V. RMS • Current Rating, 5A Continuous, 7.5A Maximum • Minimum Creepage Between Contacts, .125″ • Minimum Air Space Between Contacts, .070″ • Contact Center Spacing, .150″ • Pin Diameter, .040″ • Solder Cup, #20 AWG wire.



CENTER SCREWLOCK

SERIES 1900. 10, 22, 34, 50, 78, 104 and 152 contacts. Double lead thread action screwlock, stainless steel side channels and closed entry contacts for maximum reliability. Series 2500 available with 152 removable contacts.

Breakdown Voltage (sea level), 3000V. RMS • Current Rating, 10A Continuous, 13A Maximum • Pin Diameter, .062″ • Minimum Creepage Between Contacts, .110″ • Minimum Air Space Between Contacts, .050″ • Contact Center Spacing, .150″ • Solder Cup (also solderless-wrap and taper pin) #16 AWG wire.



MINIATURE AND MICROMINIATURE WITH CRIMP REMOVABLE CONTACTS

SERIES 25. Miniature and microminiature rack and panel connectors for solderless wiring with removable crimp termination contacts. Available with 7, 9, 14, 18, 20, 26, 34, 41, 42, 50, 66, 70, 75, 104 and 152 contacts. Insertion, removal and crimping tools available. Conform to MIL-C-28748 specs, U/L recognized. Series 25MM microminiature sizes: 50, 100, 200 contacts. Series MMM microminiature sizes: 5 thru 75 contacts.

FOR COMPLETE CATALOG ON ANY SERIES WRITE OR PHONE

Continental Connector Corporation / 34-63 56th St., P.O. Box 879 Dept. G Woodside, New York 11377

PHONE SALES: (718) 899-4422

For More Information. Circle No. 89

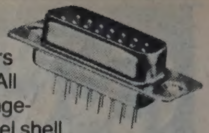
For 100 years ASMANN has combined German ingenuity and Swiss precision to produce quality products. Now, literally thousands of high-quality popular-sized sockets and connectors are available in stock for immediate shipment. ASMANN sockets and connectors feature Swiss-machined-quality contacts and plastic bodies that meet UL 94-VO specifications.

You don't have to pay a premium for quality anymore.

IDC Connectors

Available in 10-60 pins, these quality connectors are available in all popular sizes. Compatible with .050" flat cable, AWG 28, they provide fast, easy assembly of mass terminations. Locking clips assure positive retention, instant removal. Four-sided shrouded header provides added pin protection.

D-Subminiature Connectors



Offered with 9-50 pins and four terminal versions, these highly reliable connectors feature permanent machined contacts. All contact points are gold plated. Interchangeable with MIL-C-24308 types. Plated steel shell minimizes EMI.

DIP Sockets

Available in 6-64 pins, these low profile sockets offer consistently high quality. Precision machined gold-plated contacts insure continuity and provide protection against capillary action. Shock and vibration specs meet MIL-STD-202.

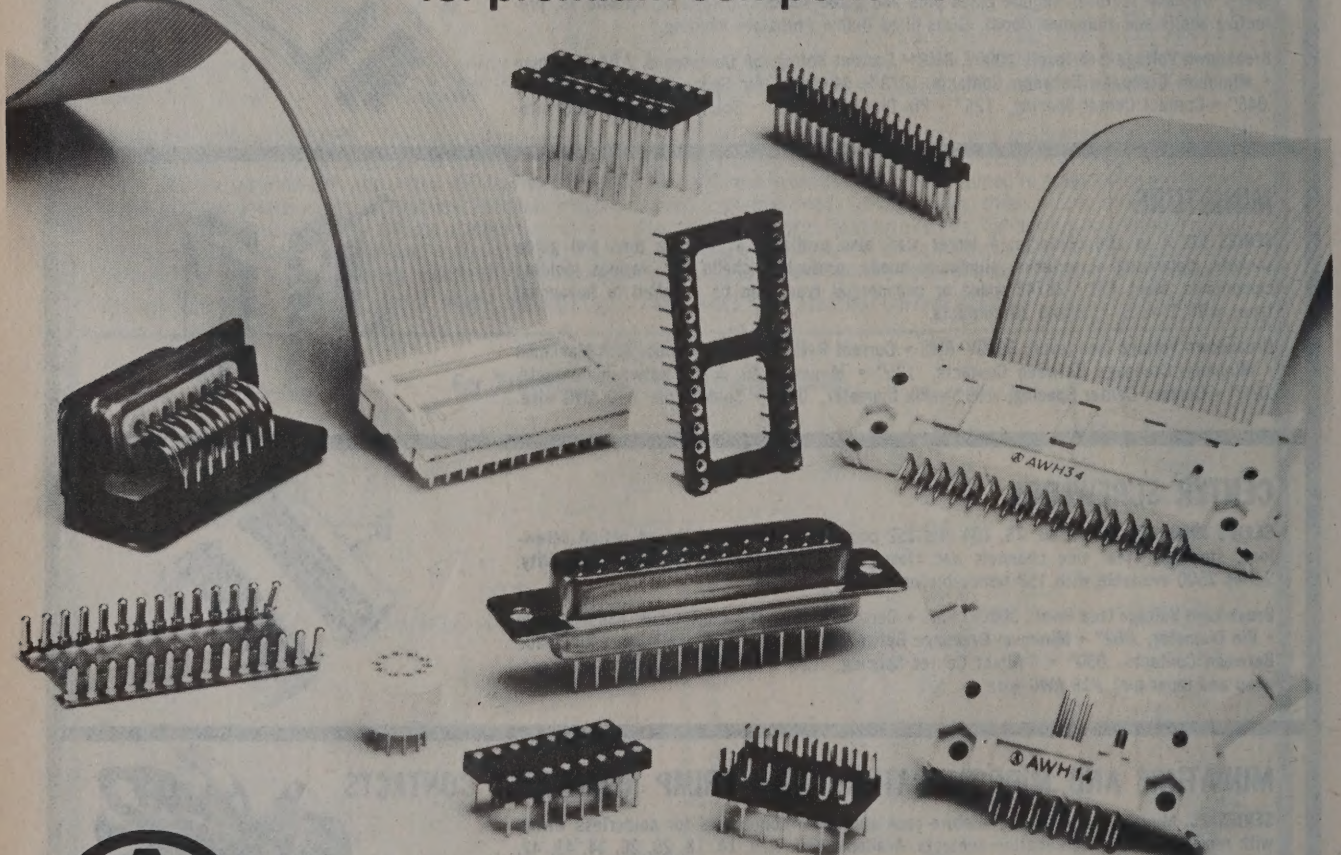
Additional ASMANN Components

Terminal Strips:	socket & wire wrap terminals; 5-20 pins; tin or gold-plated contacts.
Pin Headers:	dual in-line configuration; IDC compatible.
Carrier Assemblies:	6-40 pins; precision machined gold-plated contacts facilitate pc board assembly.
Test Sockets:	zero insertion force; 7 milliohms resistance after 1,000 insertions.
Transistor Sockets:	TO-5 and TO-3 styles; Teflon® or nylon insulators.

®Registered DuPont trademark

New ASMANN Connectors and Sockets

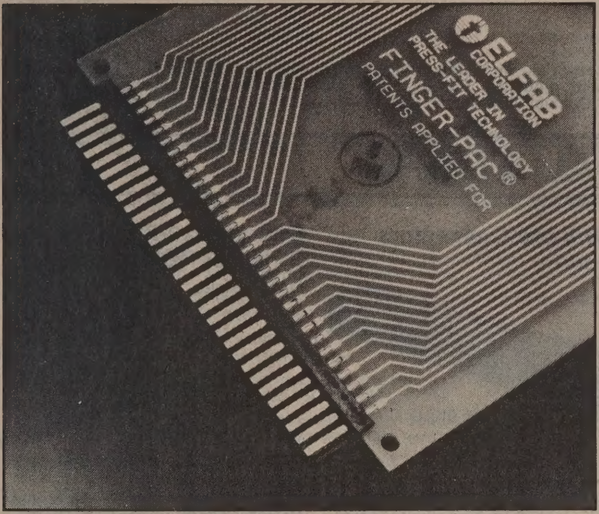
Now you don't have to pay a premium for premium components.

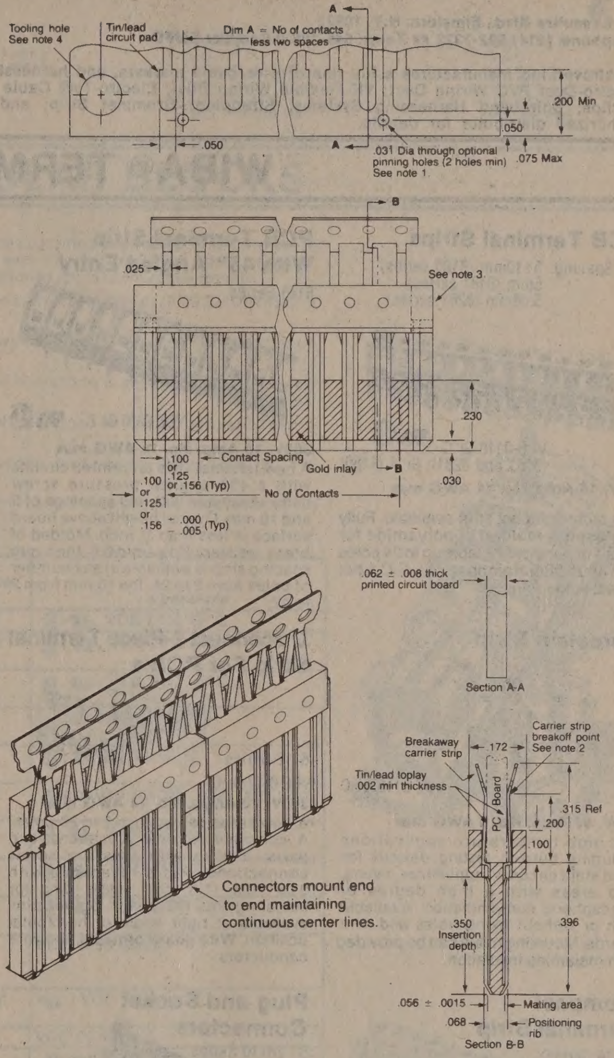


For more information, contact:

ASMANN Components
c/o ebm Industries, Inc.
525 New Britain Ave., Unionville, CT 06085
(203) 674-0118

Finger-Pac™ surface-mount connector


ELFAB CORPORATION
THE LEADER IN PRESS-FIT TECHNOLOGY
FINGER-PAC®
PATENTS APPLIED FOR


A
Tooling hole See note 4
Tin/lead circuit pad
Dim A = No of contacts less two spaces
.200 Min
.050
.050
A
.031 Dia through optional pinning holes (2 holes min) See note 1
.075 Max
B
.025
See note 3
.230
.100 or .125 or .156 (Typ)
Contact Spacing
Gold inlay
B
.030
.100 or .125 or .156 + .000 − .005 (Typ)
No of Contacts
.062 ± .008 thick printed circuit board
Section A-A
Connectors mount end to end maintaining continuous center lines.
Breakaway carrier strip
.172
Carrier strip breakoff point See note 2
Tin/lead toplay .002 min thickness
PC Board
.315 Ref
.200
.100
.350 Insertion depth
.396
.056 ± .0015
Mating area
.068
Positioning rib
Section B-B

Elfab's bold new concept in card-edge fingers will open your eyes to a new world of production economy. This form, fit and function alternative to plated gold fingers gives solid, metal-to-metal, inlaid gold contact, with reduced insertion force and less gold wear — and significant savings on your PCB production line.

Finger-Pac eliminates gold plating on the PCB. Saves time, saves labor, saves gold. And *that saves money!*

- **Finger-Pac** saves gold. Inlaid wrought gold is only 30 μin thick — for the same durability as 50-μin plated gold.
- **Finger-Pac** affords true "step-and-repeat" processing of multiple boards on large sheets of laminate, without masking.
- **Finger-Pac** is easily repairable. Each individual finger may be replaced, if required, in minutes. In some situations it may even be used as a replacement repair for damaged plated-gold fingers.
- **Finger-Pac** saves wear on mating connectors. Uniform low insertion and withdrawal forces and smooth plastic leading edge help preserve gold surfaces.
- **Finger-Pac** mates with standard card-edge connectors designed for plated gold fingers, with no change in the system. Any PCB may be adapted to Finger-Pac with little or no alteration.
- **Finger-Pac** can save expensive scrapping of gold on defective cards, for it may be installed *after* they are tested.

Part Number (Present spacing available, 0.100 and 0.125)

FPA	0100	XX	069	CD396	CG2
Finger-Pac Assembly	No. of Contact Pairs 0.100, 69 max 0.125, 55 max 0.156, 44 max	Standard	Contact Spacing 0100 = 0.100 0125 = 0.125 0156 = 0.156	Length, card edge to tip	Card-Guide Notch 0 = none 1 = one end 2 = both ends

Specifications:

Insulator — Glass-filled Zytel nylon resins, UL rated 94VO.

Contact — Base material cupro-nickel alloy 725 80/95 KSI.
Plating — Gold inlay — 30 μin 18K gold/silver alloy over 50/150 μin nickel.

Notes:

1. Optional pinning holes accept press-fit strain-relief pins for applicable military applications.
2. Connectors supplied with carrier strip attached. Strip is notched for breakoff after connector soldering.
3. Optional relief required for mating with connectors using end-card guides.
4. One tooling hole is recommended which serves to locate the connector to PCB. For applications where a tooling hole cannot be provided, consult factory for alternative recommendations.

ELFAB interconnection innovators

Elfab Corporation • P.O. Box 810555 • Dallas, Texas 75381-0555
214-233-3033 • 800-527-0753 • TWX 910-860-5460

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For More Information. Circle No. 91

ELECTROVERT INC. HIGH DENSITY METRIC

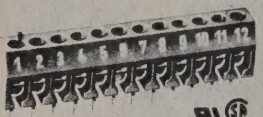
399 Executive Blvd., Elmsford, N.Y. 10523
Telephone: (914) 592-7322 ## Telex: 646-186 # Rectifier EMFD.

Electrovert Inc. manufactures a full line of wire/cable markers, and harnessing accessories, including Z type Sleeve markers; C type Clip-On Markers; Electro-Duct PVC Wiring Duct; VK-Flexible Wiring Duct; Electro-Ty® Cable Ties and Mounting Bases; Cradleclip® Harnessing Systems; Adjustable P-Clips; Spiroband Harnessing Systems; Strapping; Grommet Strip; and Hiatt Coaxial Telephone Cable Clips. Contact your Regional office or authorized distributor for details.

WIBA® TERMINAL STRIPS

PCB Terminal Strips

Pin Spacing: 5+10mm (8180 series)
5mm (8181 series)
5.08mm (8281 series)

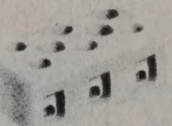


VDE 0110 Gr.C
(8181 and 8281); Gr.A (8180)

300V, 15 Amp; No. 14 AWG max

The most compact strip available. Fully enclosed & molded of polyamide for PCB's or panels. Available up to 24 poles for 5 and 5.08mm pin spacings. E-Cu, hot tinned solder pins.

Porcelain Strip



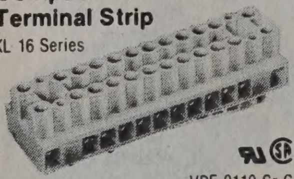
VDE 0110 Gr.C

300V, 80 Amp; No. 6 AWG max

For high temperature applications including burn-in testing devices for solid state circuitry, appliances, ovens, and areas with a high degree of atmospheric contamination. Available with or without fixing holes and wire guards. Mounting holes can be provided with melamine insulation.

Compact Terminal Strip

KL 16 Series



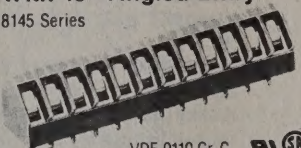
VDE 0110 Gr.C

250V, 20 Amp; No. 12 AWG max

A very compact strip for applications where space is critical. Molded of polyamide with nickel plated brass connectors. Available up to 20 poles consecutively numbered. As an indication of the compactness the 12 pole version measures only 3 inches (76.2mm).

PCB Terminal Strip With 45° Angled Entry

8145 Series



VDE 0110 Gr. C

300V, 15 Amp; No. 14 AWG max

A new terminal strip for printed circuits with a 45° angled, pressure screw entry. Available with pin spacings of 5 and 10 mm. Overall height above board surface is less than ½ inch. Molded of break resistant Polyamid 6.6, the 5 mm spacing strip is available in any number of poles from 2 to 24; the 10 mm from 2 to 12.

Disconnect 2-Piece Terminal Strip For PCB's

8112 Series

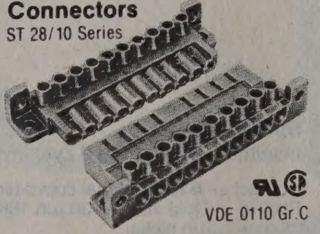
VDE 0110 Gr. C

300V, 10 Amps, No. 14 AWG max

A new series available in 2 to 20 poles. A complete terminal is made of two parts: a plug with pressure screw connections, and a receptacle with 0.05" dia. (1.3 mm) solder pins for soldering into PC board. Solder pins available at right angle or horizontal position. Wire guard protects fine wire conductors.

Plug and Socket Connectors

ST 28/10 Series



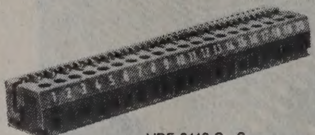
VDE 0110 Gr.C

300V, 20 Amp; No. 12 AWG max

A versatile 10-pole unit which can be mounted in any number of ways, including assembly rail. Connectors are brass with surface treatment. Poles number 1 to 10. Coding pins for 28 coding schemes to ensure use of plug with appropriate socket.

PCB Edge Connectors

LPST Series



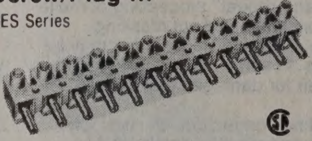
VDE 0110 Gr. C

No. 16 AWG max

New, compact series for PC boards measuring 1.4 to 1.8 mm thick, including contact surfaces. Available with pressure connectors in any number of poles from 2 to 20 (each with or without solder lugs). Molded of fiberglass reinforced polycarbonate. Silver plated, phosphore bronze contact springs are spaced 5 mm apart.

Flexible Terminal Strip Screw/Plug-In

6ES Series



VDE 0110 GR.C

300V, 20 Amp; No. 12 AWG max

Polyamid strip in any number of poles from 1-10 and 12. Mates with 6E Series. Flexible, easily cut. Available with spacers for 600V applications. UL Recognition Pending.

Disconnect 2-Piece Terminal Strip For PCB's

8140 SS Series

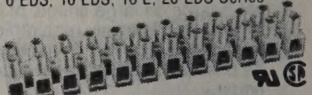
VDE 0110 Gr.B

250V, 10 Amp; No. 16 AWG max (field/factory wiring)
250V, 10 Amp; No. 14 AWG max (factory wiring)

Pin strip provides quick connect/disconnect of wiring to PCB. The 8140SS incorporates open housing design for circuit test (5 & 10mm spacing, 2 to 20 poles); the 8141SS closed body design (5mm spacing, 2 to 20 poles). Contact bushings are tin bronze, tin plated.

Flexible Terminal Strip Screw/Screw

6 EDS, 16 EDS, 16 E, 20 EDS Series



VDE 0110 Gr.C

+ **6 EDS-300V, 10 Amp; No. 16 AWG**
+ **10EDS-300V, 20 Amp; No. 12 AWG**
+ **16E-300V, 40 Amp; No. 8 AWG**
+ **20EDS-300V, 55 Amp; No. 6 AWG**

Polyamid strip in any number of poles from 1-10 and 12. Flexible, easily cut. For 600V use with spacers.

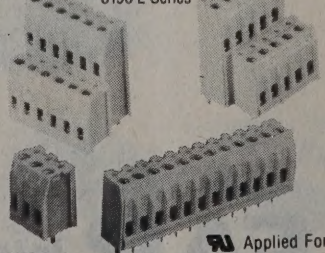
+ Higher ratings on units without wireguard.

COMPACT MODULAR BLOCKS FOR PCB's

Easily interlocked to form any number of pole configurations, reducing inventory and simplifying ordering. Incorporates the versatility and features of the modular concept. All metal parts are recessed in the break resistant, polyamid insulating body, providing circuit protection and dead front safety.

Terminal for 0.197" (5.00 mm) spacing

8190 E Series



8190 Series

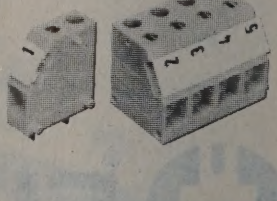
Applied For
VDE 0110 Gr.C

300V, 15 Amp: No. 14 AWG max

Two-tier version can be mixed with single level version. Solder pins (E-Cu, tin plated) are .9x .8mm. Captive connectors & screws are steel, zinc-plated, & chromated. Molded of polyamide 6.6 for continuous service temperatures up to 212°F (100°C). Built-in sockets for test plugs. With or without molded-in markings.

Terminal for 0.275" (7 mm) spacing

8375 Series



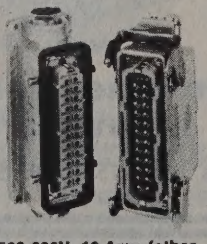
VDE 0110 Gr.C

600 V, 36 Amp; No. 12 AWG max

Each block has 2 solder pins (E-Cu, tin-plated) which provide maximum retention when soldered to the PCB. Captive terminal block connectors and screws are steel, zinc-plated and chromated. Built-in socket for test plug. Accommodates up to 3 characters for marking, as well as the Wiba® Rapid Marking System.

MULTIPOLE CONNECTORS FOR HEAVY DUTY APPLICATIONS

Available in a wide variety of hood and housing combinations with either screw, solder or crimp type terminations, these environmentally protected connectors provide rapid and secure connections between remote equipment and their respective controls. The positive locking latch is zinc plated or stainless steel. Neoprene gasket seal resists aging and oil. Meets IP Code 55 (DIN) 40050, in locked position. UL Applied For.



500-600V, 16 Amp (other versions available, consult Electrovert)

For More Information. Circle No. 92

TERMINAL BLOCKS AND STRIPS

Northeast
399 Executive Blvd.
Elmsford, NY 10523
(914) 592-7322
Telex: 646-186

Southeast
Suite C
3115 Gateway Drive,
Norcross, Georgia 30071
(404) 441-3644
Telex: 707-455

Midwest
9996 Bryn Mawr Avenue
Rosemont, Illinois 60018
(312) 678-5557
Telex: 721-518

Southwest
Suite 101
10969 Shady Trail
Dallas, Texas 75220
(214) 353-9950
Telex: 714-630-186

West
Suite D
1311 East Chestnut Ave.,
Santa Ana, California 92701
(714) 835-2033
Telex: 685-669

WIBA® MODULAR BLOCKS

Versatile and space saving, all blocks mount on standard assembly rails and can be customed assembled by Electrovert to meet customer specifications. More than 75 different types of blocks are available, each offering dead front safety, excellent resistance to corrosion and vibration, rapid marking and a complete line of accessories for custom requirements.

The WKU Series . . . features a unique universal base providing secure attachment to *both* assymetrical rail TS 32 (DIN 46277) and symmetrical rail TS35 (DIN 46277 and EN 50022).

The WK Series . . . mounts to either rail TS32 or rail TS35, but not both. Funneled wire entrance and 4 digit marking area on each side of block are unique to the series.

The 9700B Series . . . features high creepage and clearance ratings. Insulating body is polyamid 6.6, and connectors are nickel plated brass. Designed exclusively for assymetrical rail.

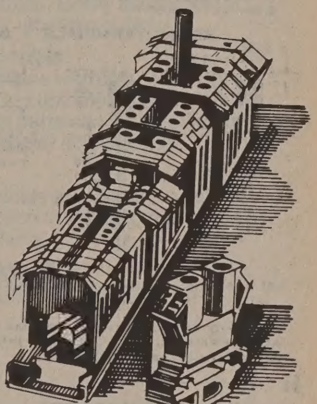
The 9200 Series . . . a miniature block with its own specially designed rail specifically designed for low voltage applications, small equipment, and/or where space limitations exist.

The 9060 Series . . . features test terminals and fuse terminals with insulating bodies made of melamine type 150. For assymetrical rail only.

And More . . . including the RFK Series of high capacity blocks, and the 9040, 9050, and 9550 Series of melamine blocks which are all UL Recognized, CSA Certified, and VDE Rated 0110 Gr.C.

Modular Block Series	Mounts on DIN Rail 46277	Insulating Material	Max. Voltage	AMP Rating	Max. Wire Size	Approvals
9200	TS15	Polyamid 6.6	600	8-30	No. 10	SP, RU, VDE 0110 Gr.C
9700	TS32 or TS35	Polyamid 6.6	600	25-140	No. 2/0	SP, RU, VDE 0110 Gr.C
WKU	TS32 and TS35	Polyamid 6.6	600	27-87	No. 4	SP, RU, VDE 0611 Gr.C
WK Double Deck	TS32 or TS35	Polyamid 6.6	600	40	No. 10	SP applied for, RU
Standard Double Deck	TS32	Polyamid 6.6	300	10	No. 14	SP, VDE 0110 Gr.C
Universal Disconnect	TS32 and TS35	Polyamid 6.6	600	20	No. 12	SP applied for, RU, VDE 0611 Gr. C
Standard Disconnect	TS32	Polyamid 6.6	600	20	No. 12	SP, RU, VDE 0110 Gr.C
Modular Fuse	TS32 or TS35	Polyamid 6.6	300	15	No. 14	SP, RU, VDE 0110 Gr.C
KK2.5 Compact	TS32 and TS35	Polyamid 6.6	600	25	No. 12	SP, RU, VDE 0611 Gr.C
Adjustable Compen-sating	TS32	Polyamid 6.6	300	N/A	No. 10	VDE 0110 Gr.C
High Capacity	TS32	Melamine 150	600	500	500MCM	RU, VDE 0110 Gr.C
Test	TS32	Melamine 150	600	N/A	No. 8	VDE 0110 Gr.C
WK Ground Connector	TS32 or TS35	Polyamid 6.6	600	N/A	6	SP and RU applied for
Standard Ground Connector	TS32	Polyamid 6.6	600	N/A	6	RU, VDE 0611 T.3

Note: Consult Electrovert for other terminal versions, including solder lug, slide on connector, and built-in-component.



600V Terminals

9700 B Series

WKU Series

A series of blocks molded of polyamid and designed to meet most general circuit requirements for pressure connector terminals. Available in a wide variety of sizes for different AWG and amperage requirements.

Diode/Fuse: a series of blocks built to incorporate various components to meet specific circuit design requirements. Supplied with silicon diode 1N 4007. Can also serve as a fuse terminal (5 × 20 mm) equipped with LED. Other components available on request. Wiring diagrams printed on top side of all terminal blocks.

2-Tier Double Deck: screw terminal connectors are arranged in a 2-tier design. As a result, twice as many wires can be attached in a given width. Molded of polyamid, this unique block measures less than ¼" in width.

Melamine Insulating: several different series (9050, 9040, 9550, 9210) of pressure connector terminal blocks molded of melamine, all VDE rated 0110 Gr.C and CSA Listed.

Solder Lug: available in a variety of types with different combinations of solder lug and pressure connectors. Insulating body is polyamid and solder lugs hot dip tinned brass.

Disconnect/Test: a series of blocks for opening and closing the circuit without disturbing permanent wiring. Disconnect plug is captive at all times, and contacts can't be damaged or the plug misplaced. Supplied with socket type pressure connector screws which allow the use of test plugs. A barrier separates each plug so that only one at a time can be either raised or lowered. Rated VDE 0110 Gr.C.

Slide-On Connectors: for use with ¼" slide-on connectors. Very compact. Available in two types, with either 4 or 3 connectors.

Built-in Circuit Component: a new double-deck type terminal block with 4 pressure connectors to serve 2 distinct circuits. These circuits can be internally connected in a variety of ways and/or the block can incorporate various components (diodes, resistors, capacitors, etc.) to meet specific circuit design requirements.

High Capacity (to 500 mcm): melamine insulating body. Available in three types with various combinations of lug and pressure connectors. Particularly suitable for main connections where terminations for cables and/or busbars are required.

Compact: a series specifically designed for all assemblies where a great number of connections have to be made within a small amount of space.

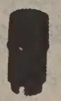
Ground Connector: ground terminal supplied in universal color coding of green/yellow.

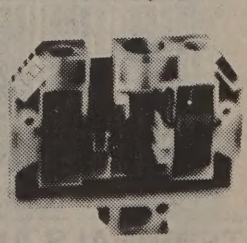
Pressure Terminals and Wire Wrap Connection: available with 2 orientations of wrap connector pin—one for horizontal and the other for vertical mounted blocks.

Micro Pressure Connector molded of polyamid with the 10 Amp version also available in polypropylene. Connectors are nickel plated brass, and suitable for solid or stranded wires.

Modular Fuse

Neon or incandescent failure indicating lamp comes into operation if the circuit is interrupted by a destroyed fuse.





WK10

Insulating body available in melamine (9060 Series) or polyamid (WK10 Series).

Adjustable Compensating: resistance terminal designed to allow for difference between actual external resistance and resistance for which an instrument is calibrated.

EMC ELECTRONIC MOLDING CORPORATION

96 MILL ST., WOONSOCKET, R.I. 02895 USA (401) 769-3800 TWX 710-387-1350

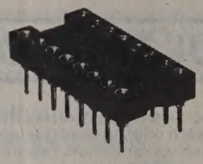
• LOW PROFILE DIP SOCKETS

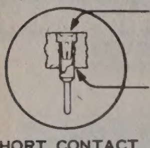
CLOSED FRAME SOCKETS/10000 SERIES
OPEN FRAME SOCKETS/17000 SERIES

6 TO 64 PINS

DESIGN CONSIDERATIONS

TERMINAL FUNNEL ENTRY SCREW MACHINE DESIGN FOR EASE OF I.C. LEAD INSERTION. THE CLOSED-END BARREL IS DESIGNED TO PREVENT SOLDER WICKING UP INTO CONTACT AREA

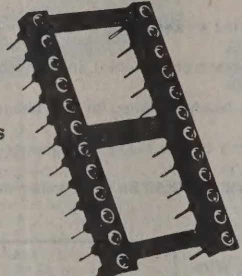




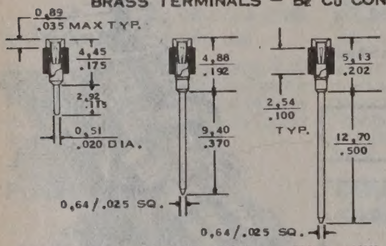
FUNNEL ENTRY FEATURE TO FACILITATE LOADING OF INTEGRATED CIRCUITS BY AUTOMATIC EQUIPMENT.

NO SOLDER WICKING
CLOSED END TERMINAL WILL NOT ALLOW SOLDER TO FLOW OR WICK UP INTO CONTACT AREA.

SHORT CONTACT
A BeCu STAMPED AND FORMED BURR-FREE FOUR FINGERED CONTACT .085 LONG TO ACCOMMODATE SHORT I.C. LEADS



BRASS TERMINALS — BeCu CONTACTS



SOLDERTAIL —01 2 LEVEL W/W —02 3 LEVEL W/W —03

ALL WIDTH DIMENSIONS ARE MAXIMUM.
ALL TERMINALS IN-LINE .100 INCH SPACING.
DIMENSIONS ARE IN INCHES.

SOLDERTAIL
-01 TERMINAL STYLE

CLOSED FRAME PART #	OPEN FRAME PART #	NO. OF PINS	CONTACT PLATING	TERMINAL PLATING	DIMENSION TYPE
10306-01-446	17306-01-446	6	GOLD	GOLD	I
10306-01-445	17306-01-445		GOLD	TIN	
10308-01-446	17308-01-446	8	GOLD	GOLD	
10308-01-445	17308-01-445		GOLD	TIN	
10310-01-446	17310-01-446	10	GOLD	GOLD	
10310-01-445	17310-01-445		GOLD	TIN	
10314-01-446	17314-01-446	14	GOLD	GOLD	
10314-01-445	17314-01-445		GOLD	TIN	
10316-01-446	17316-01-446	16	GOLD	GOLD	
10316-01-445	17316-01-445		GOLD	TIN	
10416-01-446	17416-01-446	16	GOLD	GOLD	II
10416-01-445	17416-01-445		GOLD	TIN	
10318-01-446	17318-01-446	18	GOLD	GOLD	I
10318-01-445	17318-01-445		GOLD	TIN	
10320-01-446	17320-01-446	20	GOLD	GOLD	
10320-01-445	17320-01-445		GOLD	TIN	
10422-01-446	17422-01-446	22	GOLD	GOLD	II
10422-01-445	17422-01-445		GOLD	TIN	
10424-01-446	17424-01-446	24	GOLD	GOLD	
10424-01-445	17424-01-445		GOLD	TIN	
10624-01-446	17624-01-446	24	GOLD	GOLD	III
10624-01-445	17624-01-445		GOLD	TIN	
10628-01-446	17628-01-446	28	GOLD	GOLD	
10628-01-445	17628-01-445		GOLD	TIN	
10632-01-446	17632-01-446	32	GOLD	GOLD	
10632-01-445	17632-01-445		GOLD	TIN	
10636-01-446	17636-01-446	36	GOLD	GOLD	
10636-01-445	17636-01-445		GOLD	TIN	
10640-01-446	17640-01-446	40	GOLD	GOLD	
10640-01-445	17640-01-445		GOLD	TIN	
10964-01-446	17964-01-446	64	GOLD	GOLD	
10964-01-445	17964-01-445		GOLD	TIN	

SUBSTITUTE TERMINALS
2 LEVEL W/W -02 TERMINAL STYLE
3 LEVEL W/W -03 TERMINAL STYLE

***Note – overall dimensions for solid & open frame are the same per MIL-S-83734**

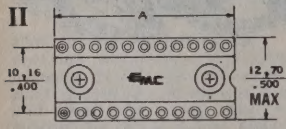
PART NUMBERS

SOCKET	ADAPTOR	A DIM.
10306	20306	.300
10308	20308	.400
10310	20310	.500
10314	20314	.700
10316	20316	.800
10318	20318	.900
10320	20320	1.000

PART NUMBERS

SOCKET	ADAPTOR	A DIM.
10624	20624	1.200
10628	20628	1.400
10632	20632	1.600
10636	20636	1.800
10640	20640	2.000

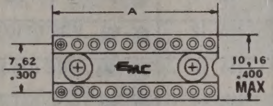
II



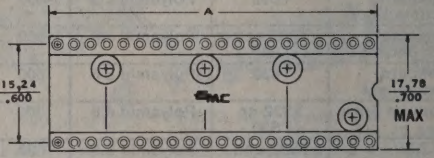
PART NUMBER

SOCKET	ADAPTOR	A DIM.
10416	20416	.800
10422	20422	1.100
10424	20424	1.200

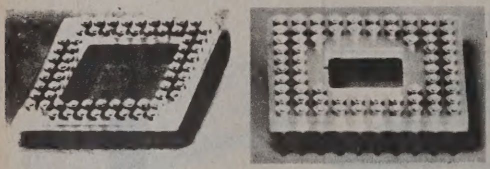
I



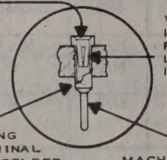
III



• MOLDED PIN GRID ARRAY SOCKETS



LAMINATE MATERIAL (AS SHOWN ABOVE) IS ALSO AVAILABLE



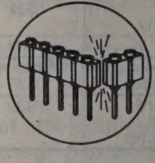
FUNNEL ENTRY FEATURE

VERY LOW INSERTION FOUR FINGERED CONTACT LESS THAN 3 OZ INSERTION

NO SOLDER WICKING CLOSED END TERMINAL WILL NOT ALLOW SOLDER TO FLOW OR WICK UP INTO CONTACT AREA

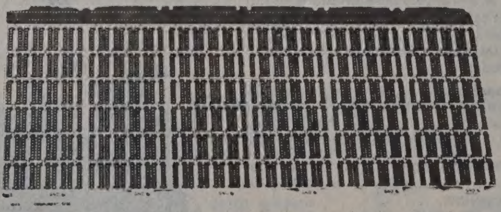
MACHINED TERMINAL

SNAP-SIP 20 PIN



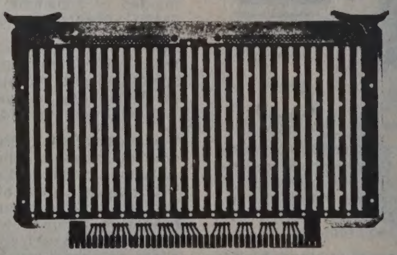
• HIGH DENSITY NURL-LOC® IC PANELS

UNIVERSAL MODULAR "UM" SERIES
PATTERN MODULAR "PM" SERIES



CC 01057-A3G-6SA

MICROPROCESSOR PANELS

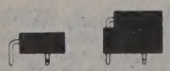


MOTOROLA-M6800 BUSS CA 09978-B2G-OHF

• TERMINALS AND ACCESSORIES

ALL TEST JACKS FEATURE BERYLLIUM COPPER CONTACT WITH PROBE DIAMETER OF .020, .025, .030, .040, .080 AND DIMENSIONS DESIGNED FOR STANDARD OR CUSTOM MOUNTING.

TYPE 77 TYPE 104



PRINTED CIRCUIT TEST JACKS

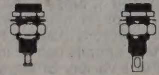
TYPE 2 TYPE 9 TYPE 8

FEED THRU TERMINALS

TYPE 89 TYPE 101 TYPE 90 TYPE 99

MOLDED STANDOFF TERMINALS

TYPE 85 TYPE 86



MILITARY TEST JACKS MIL-C-39024

TYPE 140 TYPE 141 TYPE 140A

NON-INSULATED TEST JACKS

For More Information. Circle No. 93

FISCHER
AMERICA, INC.

Precision, Swiss Made, Circular Connectors

Why Fischer?

Design, reliability and consistent quality make Fischer superior to similar type connectors.

These precision connectors are in use by Tektronix, Hewlett Packard, Texas Instruments, Phillips, Bosch and many more quality conscious companies around the world.

Prices are extremely competitive with manufacturers of similar types of connectors.

Delivery times are outstanding. Scheduled delivery on production orders can be arranged.

Applications

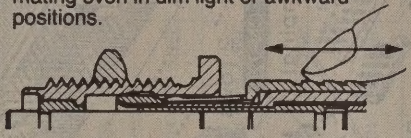
Audio, Video, Medical, R.F., Military, Aerospace, Industrial, Broadcast and Scientific.

Types

50 & 75 ohm coax, triax, waterproof, gas tight, vacuum, high radiation, thermocouple, P.C. mount, low resistance, light weight plastic, compound connectors, high temperature, high voltage, and hermetically sealed.

Automatic Locking

Superior locking/unlocking arrangement with metal half shells means easy mating even in dim light or awkward positions.



Materials

Brass, stainless steel, plastics, etc.

Insulation

PTFE (Teflon ©Dupont), ceramic, PBTP, High temperature plastics, etc.

Contacts

Machined, not stamped. Brass per QQ-B-626 or QQ-B-750 or Beryllium Bronze.

Plating

1 micron gold to MIL-G-45204C, type II over 5 microns nickel to QQ-N-290, class II.

Finish

Extremely rugged yet attractive connectors available with bright gold, satin or polished chrome finish. Other finishes may be specified. Protective rubber boots and plugs are also available.

Contact resistance

Less than 3 milliohms.

Radiation resistance

To 10^8 Rads, higher with ceramic insulators.

High temperatures

To 400°C with ceramic insulators.

Compatibility

Certain series intermate with Lemo and Kings connectors.

Other features

Space-saving design for dense panels. Simple one piece cable collet clamp for unshielded cables. Easily assembled 2 piece collet for shielded cable.

Custom & specials

When quantities warrant, connectors can be made to customer specifications. Often, existing parts can be modified at low cost for special applications.

Delivery

Small quantities are usually in factory stock. Production quantities: 4-8 weeks on standard items.

Other products

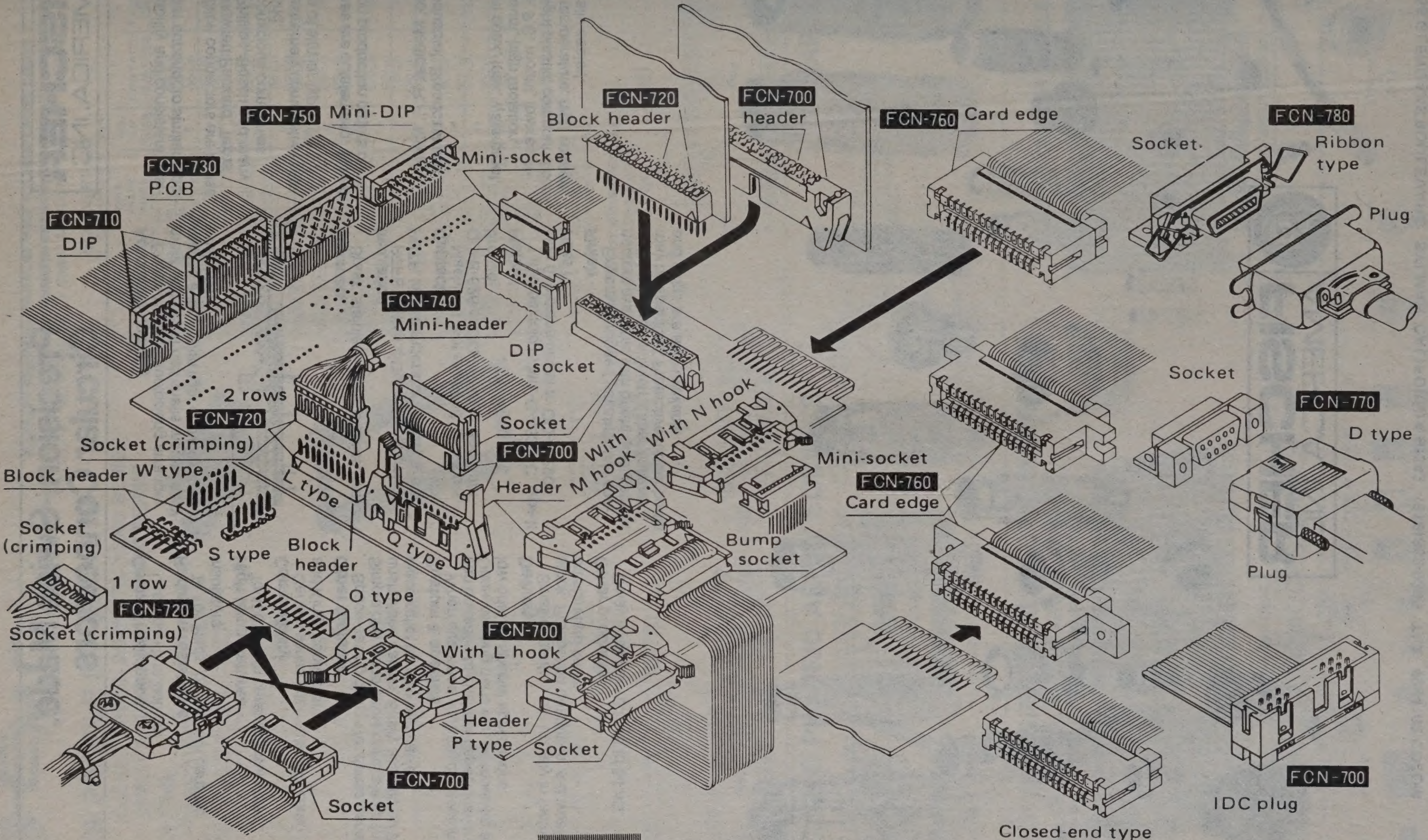
Delay lines from 0.5 nS to 64 nS.

FISCHER
AMERICA, INC.

13756 GLENOAKS BOULEVARD SYLMAR, CALIFORNIA 91342 (818)362-9396 TLX: 4994182 COCOM

A Wide Variety of 700-Series Connectors from Fujitsu

FUJITSU


FCN-750 Mini-DIP
FCN-730 P.C.B
FCN-710 DIP
Mini-socket
FCN-740 Mini-header
FCN-720 Block header
FCN-700 header
FCN-760 Card edge
FCN-780
Socket
Ribbon type
Plug
DIP socket
2 rows
FCN-720
Socket (crimping)
Block header
W type
L type
Socket
FCN-700
With M hook
With N hook
Header
Q type
Socket (crimping)
S type
Block header
1 row
FCN-720
Socket (crimping)
O type
Mini-socket
FCN-760
Card edge
Bump socket
FCN-700
With L hook
Header
P type
Socket
FCN-700
Socket
Socket
FCN-770
D type
Plug
Closed-end type
FCN-700
IDC plug

World-Class Components
Part of Tomorrow's
Technology

FUJITSU

Component Division Fujitsu America, Inc.
918 Sherwood Drive, Lake Bluff, IL 60044
(312) 295-2610 Telex: 206196 TWX: 910-651-2259

Fujitsu FCN-700 Series Flat-Cable Connectors

FUJITSU

		Electrical Characteristics				Wire Size			Materials		Plating		Post, mm (inch)			Number of Contacts										
		Current Rating	Voltage Rating	Insulation Resistance	Dielectric Withstanding Voltage	Wire-wrap	Crimp	IDC	Contacts	Insulators	Contacts	Terminal	Wire-wrap	Straight	Right-angle	10	14	16	20	24	26	30	34	40	50	60
Headers		3A DC	250V AC	10^3MΩ	500V AC	AWG #26~#30	–	–	Phosphor bronze	P.B.T.	Au	Sn-Pb	□0.64 (□.025)	□0.5 (□.020)	□0.5 (□.020)	●	●	●	●	–	●	●	●	●	●	●
Block Headers	O, L type	3A DC	250V AC	10^3MΩ	500V AC	AWG #26~#30	–	–	Phosphor bronze	P.B.T.	Au	Sn-Pb	□0.64 (□.025)	□0.5 (□.020)	□0.5 (□.020)	8~60 two pins each, Standard 10, 14, 16, 20, 26, 30, 34, 40, 50. 60										
	W type	3A DC	250V AC	10^3MΩ	500V AC	AWG #20~#30	–	–	Phosphor bronze	P.B.T.	Au	Sn-Pb	□0.64 (□.025)	□0.64 (□.025)	□0.64 (□.025)	6~72 two pins each, Standard 10, 14, 16, 20, 26, 30, 34, 40, 50 60										
	S type	3A DC	250V AC	10^3MΩ	500V AC	AWG #20~#30	–	–	Phosphor bronze	P.B.T.	Au	An-Pb	□0.64 (□.025)	□0.64 (□.025)	□0.64 (□.025)	3~36 one pin each, Standard 5, 10, 20, 25, 30, 36										
Mini Headers		3A DC	250V AC	10^3MΩ	500V AC	–	–	–	Phosphor bronze	P.B.T.	Au	Sn-Pb	–	□0.5 (□.020)	–	●	●	●	●	–	●	●	–	–	–	–
Socket Connectors		1A DC	250V AC	10^3MΩ	500V AC	–	–	AWG #28	Phosphor bronze	P.B.T.	Au	Au	–	–	–	●	●	●	●	–	●	●	●	●	●	●
Mini Socket Connectors		1A DC	250V AC	10^3MΩ	500V AC	–	–	AWG #28	Phorphor bronze	P.B.T.	Au	Au	–	–	–	●	●	●	●	–	●	●	●	●	●	●
Receptacle Connectors	2 row sockets	3A DC	250V AC	10^3MΩ	500V AC	–	AWG #24~#32	–	Phosphor bronze	66 Nylon	Au	Au	–	–	–	6~72 two pins each, Standard 10, 14, 16, 20, 26, 30, 34, 40, 50, 60										
	1 row sockets	3A DC	250V AC	10^3MΩ	500V AC	–	AWG #24~#32	–	Phosphor bronze	66 Nylon	Au	Au	–	–	–	3~36 one pin each, Standard 5, 10, 15, 20, 25, 30, 36										
P.C.B. Transition Connectors		1A DC	250V AC	10^3MΩ	500V AC	–	–	AWG #28	Phosphor bronze	P.B.T.	Au	Au	–	0.3x0.6 (.012x.024)	–	●	–	●	●	–	●	–	●	●	●	●
D.I.P. Connectors		1A DC	250V AC	10^3MΩ	500V AC	–	–	AWG #28	Phosphor bronze	P.B.T.	Au	Au	–	0.3x0.5 (.012x.020)	–	●	●	●	●	●	●	–	●	●	●	●
Mini D.I.P. Connectors		1A DC	250V AC	10^3MΩ	500V AC	–	–	AWG #28	Phosphor bronze	P.B.T.	Au	Au	–	0.3x0.5 (.012x.020)	–	●	●	●	●	●	●	–	●	●	●	●
Card Edge Connectors		1A DC	250V AC	10^3MΩ	500V AC	–	–	AWG #28	Phosphor bronze	P.B.T.	Au	Au	–	–	–	●	–	●	●	–	●	●	●	●	●	●

World-Class Components
Part of Tomorrow's
Technology

FUJITSU

Component Division Fujitsu America, Inc.
918 Sherwood Drive, Lake Bluff, IL 60044
(312) 295-2610 Telex: 206196 TWX: 910-651-2259

H&T COMPONENTS
IDC Connectors -

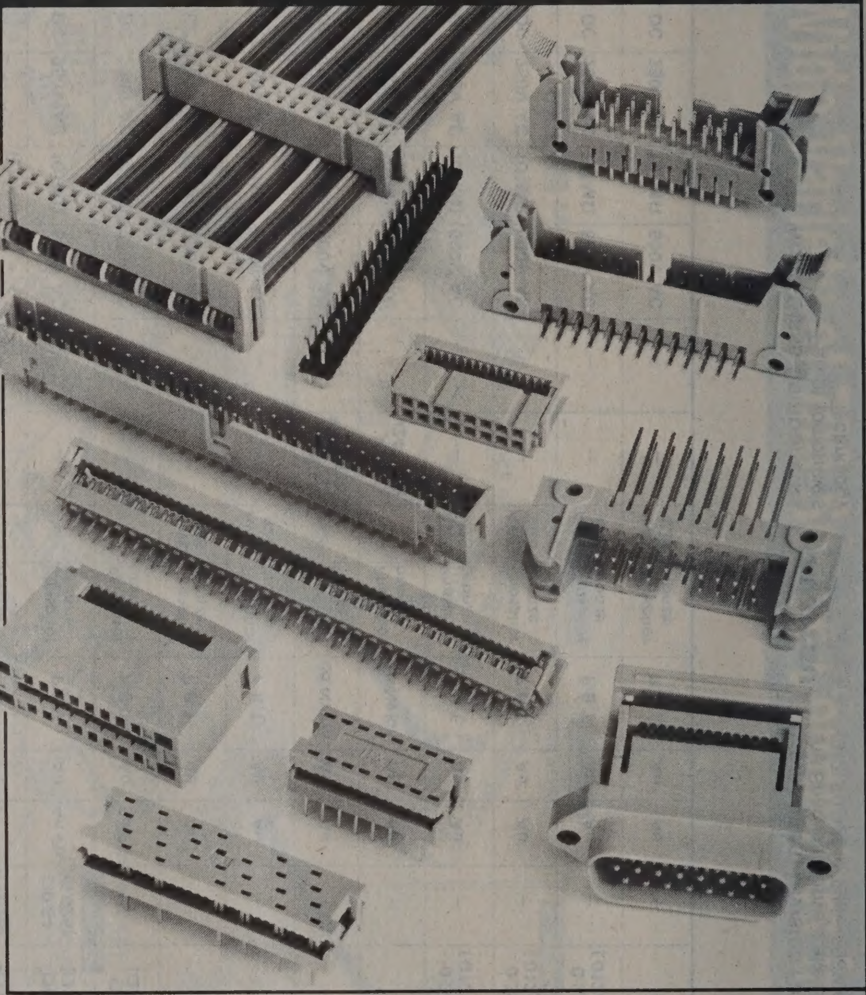
Your local H&T distributor stocks a broad line of MIL-C-83503 compatible insulation displacement connectors, manufactured in gray Valox,® for immediate delivery.

His prices are very competitive for IDC components that are completely intermateable and interchangeable with connectors that you are now using.

He can deliver complete, tested ribbon cable assemblies to your specifications, typically below your true cost.

H&T Components supports both you and your distributor through a nationwide network of manufacturers' representatives. They will gladly share their experience, give you applications assistance, and show you how IDC connectors can save you time and money. They will demonstrate or provide samples of these H&T products:

- **SOCKETS,** completely intermateable and interchangeable with other industry standard connectors, 10 to 60 contacts. Sockets have selectively gold plated dual beam contacts, mate reliably with .025" round or square posts or headers. Can be daisy chained.
- **HEADERS,** standard 3 or 4-wall, ***new*** low profile 4-wall box style. Right angle or straight, solder or wire wrap termination. Molded in polarization keys. Box style's low profile and high density saves height and board space. Low cost, low profile strip headers, 10 to 80 contacts, can be cut to any length.
- **PCB TRANSITION CONNECTORS,** connect ribbon cable permanently to PCB without stripping. Terminate before or after soldering to board. Standard 4-row 10 to 60 contacts. ***New*** 2-row (10 to 64 contacts) occupies 25% less board space than 4-row, and is cost saving replacement for standard IDC headers and sockets with .100" centers.
- **CARD EDGE CONNECTORS,** double sided, 10 to 60 contacts on 100" centers. Plain or with mounting ears. Separate polarization key.
- **DUAL-IN-LINE PLUGS,** 14, 16, 24, and 40 contacts. Mate with standard IC sockets to provide reliable, low cost interconnection.



- **D SUBMINIATURE CONNECTORS,** 9, 15, 25, and 37 contacts. Can be daisy chained. Mate with all industry standard D subminiature connectors. Backshells and locking hardware available.
- **RIBBON CABLE,** 10 to 60 conductors. UL Style No. 2651 and Style No. 2776. Plain, with single polarizing stripe, or fully color coded for breakout identification.
- **TOOLING,** hand termination tool, bench press, dies and tooling for H&T, 3M, Ansley, and other industry standard presses.

If you're not saving time and money yet with IDC connectors, CALL H&T AT (203) 794-1798 or write today for our 20 page catalog, list of stocking distributors, and the name of your local representative.

IN A HURRY? Contact distributor under our listing in the Manufacturers' Directory for a free sample and an immediate competitive price quote on an H&T connector interchangeable with the one you are now using.

See our full catalog in 1984-'85 EEM.

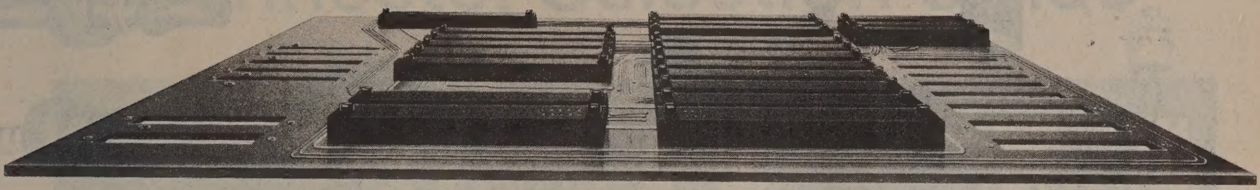
For immediate action, see our reply card in Vol. 4

H&T COMPONENTS INC.

87 Sand Pit Road, Danbury, CT 06810
Telephone 203-794-1798 Telex 643011

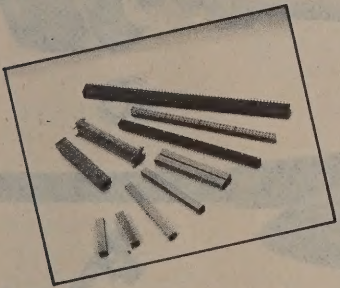
For More Information. Circle No. 96

THE BEST CONTACTS ACROSS THE BOARD...



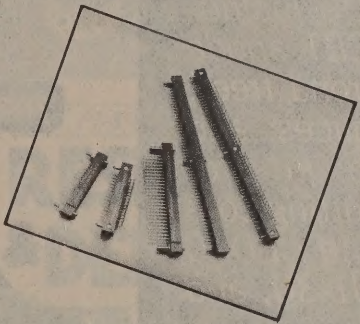
LOW INSERTION FORCE HYPERTACS®

Hypertronics' connectors feature Hypertac®, a design innovation that satisfies requirements previously considered impossible. The essence is a hyperboloid shape formed by multiple wires that stretch and wrap around the mating pin to create multiple contact paths.

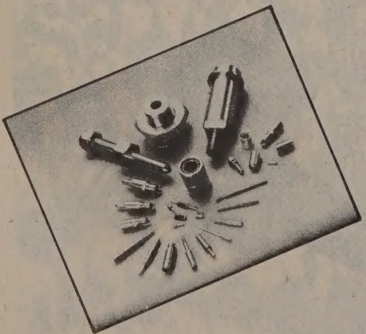


KG Series–Sub-Miniature Low Profile LIF/PCB Connectors• .100 x .100 grid from 22-90 positions• .240 height between parallel boards, sandwich style• Mother/daughter board, board to chassis and other applications• Inductance as low as 50% of comparable designs.

N Series–High Density LIF Mini-Modular Connectors • Design your own special connector from standard parts • 10 position–5 amp and 5 position – 9 amp modules • Up to 700 contacts on a .100 x .100 grid • Over 40,000 potential combinations for rack and panel, cable to chassis, and programming applications.



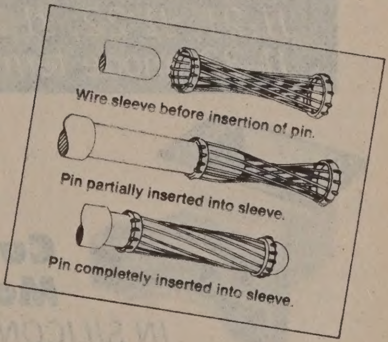
KA Series–Sub-Miniature LIF/PCB Connectors • The choice in demanding military and industrial applications • 17-320 position models with average contact insertion force of 1 ounce • Removable p.c., wire wrap, solder and crimp terminals • Integral guide and locking hardware.



Y Series– LIF Pins and Sockets • 2.5 to 200 amp standard pins and sockets • Customized p.c. or backplane mounting • Connect to cable or printed circuit boards.

All Hypertronics connectors utilize the Hyptertac® design, resulting in these unique characteristics:

- extremely low contact insertion/extraction force (as low as ½ ounce).
- electrical continuity under extremes of shock and vibration (tested below 10 n.s.).
- mechanical life exceeding 100,000 cycles with excellent electrical repeatability.


Wire sleeve before insertion of pin.
Pin partially inserted into sleeve.
Pin completely inserted into sleeve.

Customized designs featuring the Hypertac® contact are available from Special Products Division. For more information on these versatile connectors, call Toll-Free 1-800-225-9228 or write for a copy of our brochure, "New Horizons in Connectors."

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16 Brent Drive
Hudson, MA 01749
Telex: 95 1152
1-800-225-9228
Tel: (617) 568-0451
in MA & Canada

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A COMPLETE DESIGN-ENGINEERING AND MANUFACTURING
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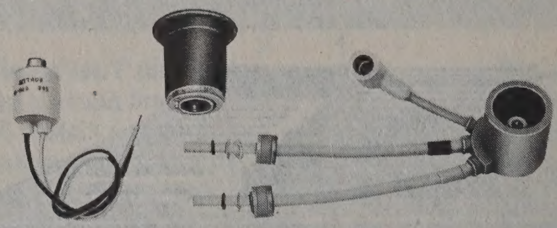
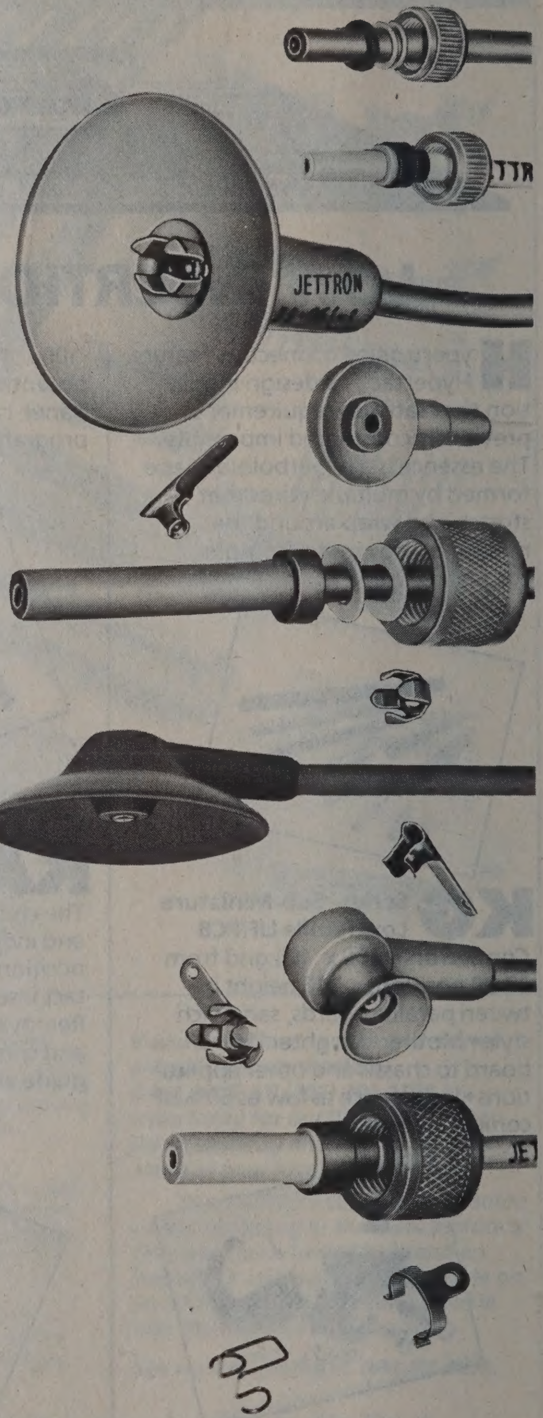


MAGNETRON CONNECTORS



JETTRON'S

Extensive line of high voltage connections to 50KVDC including molded silicone CRT anode leads (leakproof & corona free), in-line connectors, splices, and CRT anode connector kits for customer assembly. Potting contacts of BeCu for the JEDEC J1-21, J1-22, J1-25, J1-30, and J1-32 anode terminals.

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IN SILICONE RUBBER

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J1-25
CONNECTORS

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Telephone (201) 887-0571

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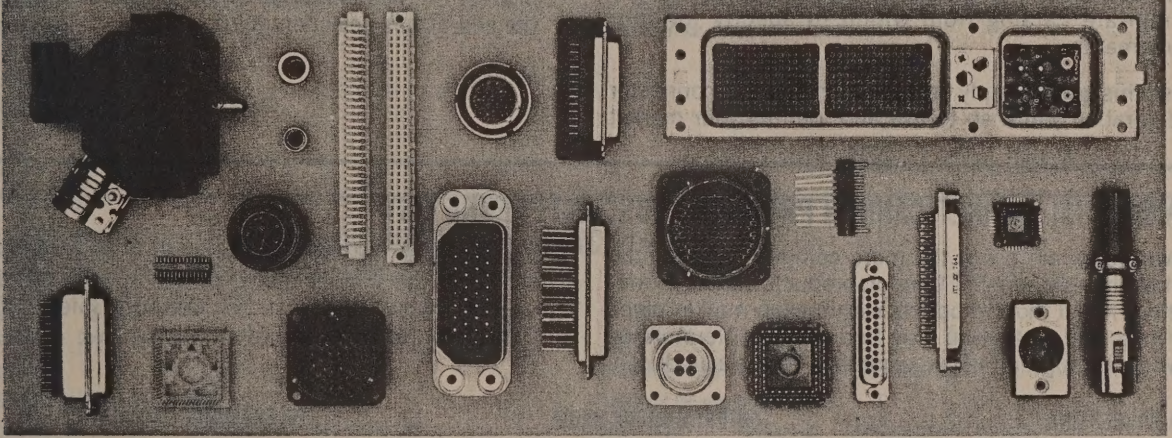
Cannon Worldwide
Connector Selection Guide



THE CANNON COMMITMENT

RESPONSE & DELIVERY

CANNON ITT
The Global Connection

INTRODUCTION

It's almost impossible to find electrical or electronic equipment anywhere in the world that doesn't involve the use of one or more ITT Cannon products. Our connectors are in place within electronic systems ranging from computers to cable television, telecommunications to transportation, vending machines to nuclear reactors, deep space to deep sea, in military aircraft to commercial aircraft.

This guide lists some of the more popular connector configurations, both standard and special and is designed to help you select the proper connector series and the appropriate catalog from which to specify for your requirements.

To use this guide simply determine the type of connector configuration you wish to use and identify your market application requirement. The Table of Contents lists the product by product configuration or special applications. A brief description and catalog reference, contact data, and broad application uses are shown so that you may better select the catalog (or catalogs) which you would like. We have also included a North American and European Military Specification/Cannon Product Cross Reference List and a Commercial Market Product Cross Reference List for your use. For catalog data please write to ITT Cannon, 666 E. Dyer Road, Santa Ana, California 92705-5684, telephone 714/964-8366. Or, contact your nearest ITT Cannon Sales Office or Distributor shown at the end of this selection guide.

COMMERCIAL MARKET/CANNON PRODUCT CROSS REFERENCE LIST

Shown below are six of the more common Commercial market places where ITT Cannon products can be found. We have listed those products within each market place and indicated where you may find product literature by showing the appropriate page number. Where a product is not included in the Connector Selection Guide, but shown in the market place, please consult the factory or contact your nearest ITT Cannon Sales Office or Distributor for technical information.

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CIRCULAR DIN	CONSULT FACTORY

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SRC	9
CM	CONSULT FACTORY
CIRCULAR DIN	CONSULT FACTORY
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CVA 6

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MILITARY SPECIFICATION/CANNON CROSS REFERENCE LIST

(contacts used in MIL spec. connectors are to the MIL-C-39029 specification)

Military Specification	Cannon Designator	Description	Page No.
NORTH AMERICA			
Subminiature Rectangular Connectors			
MIL-C-24308	D*, D*C/D*U, D*P, D*PF, D*SP, D*M, D*MA, D*MM, D*BMA, D*PF 2000 D SPEEDY D	Plastic and metal shell connectors.	4
	PD*N/PD*S		4
	D*H	Hermetically sealed connectors.	11
	D*J	Filtered connectors.	10
	MISC	EMI/RFI products.	10
Rack/Panel Connectors			
MIL-C-83733	DPK	Rack/panel connectors.	5
MIL-C-81659	DPXNA/NE	Single 2-, 3-, 4-gang rack/panel connectors.	5
Miniature Circular Connectors			
MIL-C-25955	KO	Miniature circular, general purpose.	8
MIL-C-26482	KPT/KPTM/ KPSE/KPTB	Miniature circular, general purpose.	8
	KPTH/PVA	Hermetic connectors.	11
	KTN/KTNM	Miniature circular, cupronickel.	8
	PV	Miniature circular connectors.	9
	PVJ	Filter connectors.	10
	PVW/PVX	Miniature circular connectors	9
MIL-C-38999	KJ/KJL/KJA	Subminiature circular connectors.	7
	KJLY/KJY/KJA	Hermetic connectors.	11
	KJJL/KJJ/TKJA	Filter connectors.	10
MIL-C-83723	CV	Standard circular connectors.	9
	CVA	Standard circular connectors.	6
	HTMF	Mini firewall connectors.	7
	PV	Miniature circular connectors.	9
	PVJ	Filter connectors.	10
	PVW/PVX	Miniature circular connectors.	9
NAS-1599	PVJ	Filter connectors.	10
	PVX	Hermetic versions.	9
NASA 40M39569	PVJ	Filter connectors.	10
Standard Circular Connectors			
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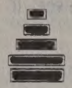
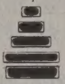
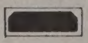
	CA-COM/ COM-B	Standard circular connectors.	6
	CA-KE	Firewall connectors.	6
	FRF/FVF/ FRA/FVA	Firewall connectors.	6
	GS	Hermetically sealed connectors.	11
	MR	Waterproof connectors.	7
	MSA/B/E/ F/R	General purpose connectors.	8
	MS-K	Firewall connectors.	6
	WFS	Front release, high temperature.	9
MIL-C-28840	KFS	Front release, high contact density.	7

Military Specification	Cannon Designator	Description	Page No.
EUROPEAN			
DEF 59-56 PATT 602 (UK) DEF 59-35 PATT 105 (UK) NFL 54125 (France) LN 29504 (Germany) NFC 93422 HE 301 (France)	PVW/PVX	Miniature circular connectors with hermetic versions.	9
VG 95 234	CA	Standard circular connectors.	6
	CGE	High voltage circular styles.	6
EL 2112 PATT 602	PVX	Miniature circular connectors with hermetic versions.	9
PAN 6432	PVW		
DIN 41612, VG 95 234, IEC, MIL-C-55302	G06/G60	PC Edgecard connectors, indirect, two piece.	14
DIN 41651, MIL-C-83503, BPO-SPEC. D 2632, UTE-C-93428	G80	Header (shrouded)	14

For immediate budgetary information contact your nearest Cannon Sales Office or Distributor (see Manufacturers' Directory).

ITT CANNON

RECTANGULAR/RACK AND PANEL CONNECTORS

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
D SUBMINIATURE SERIES **General commercial/industrial applications**  D* — original D, solder contacts D*C — general purpose economy version; rear release of crimp snap-in machined, stamped and formed contacts D*U — flame retardant D*C connector	**9-50 CONTACTS** Contact/Wire Size 20 #18-#32 AWG CRIMP TERMINATION	● Aircraft ● Missiles ● Test Equipment ● Ground Support Equipment ● Computer Peripheral Equipment ● Telecommunications ● Industrial Processing Controls ● Avionics ● Weapons/Navigation Systems ● Communications Systems ● Instrumentation ● Shipboard Radar Systems ● Data Processing ● Medical Electronics ● Entertainment Systems ● Torpedos ● Mobile Test Equipment ● Deep Space Probes ● Transportation ● Vending Machines	
insulation displacement D*SP — MAS/TER® D (Mass Terminated) flame retardant pin and socket connectors. SPEEDY-D — very low profile, low cost; termination to ribbon cable on .050" (1.27) centers.	**9-37 CONTACTS** Contact/Wire Size 20 #22-#28 AWG 20 #26-#28 AWG		
General military/aerospace applications  D*M — one piece insulator, solder contacts D*MA — rear release of crimp snap-in contacts D*MM/ D*MAM — same as D*M/D*MA except qualified to MIL-C-24308 D*BMA — feed-thru bulkhead	**9-78 CONTACTS** Contact/Wire Size 20 Coax. contacts available SOLDER OR CRIMP TERMINATION		
Printed circuit board applications **plastic housing** D*P — right angle connectors, flame retardent D*PF — straight, wire wrappable and 90° PCB contact connectors with one-piece flame retardant insulators PD*N/ PD*S — one-piece flame retardant reinforced thermoplastic insulators, straight and 90° contacts **D SUBMINIATURE CATALOG**	Contact/Wire Size 20 COMPLIANT PRESS FIT, WRAP POST, OR P.C. TERMINATION		
DESCRIPTION	**CONTACT DATA**	**APPLICATIONS**	**CATALOG**
DPD SERIES — general purpose single gang DPD — standard rack/panel connector with widest range of contact arrangements DPDMA — rear release of crimp snap-in contacts **— two gang DPD** DPD2 — two gang DPD DPD2MA — two gang DPD with rear release of crimp snap-in contacts ■	**2-128 CONTACTS (single gang)** **4-256 CONTACTS (two gang)** Contact/Wire Size 20 6 16 4 14 2 10 0 8 Coax. contacts available SOLDER OR CRIMP TERMINATION	● Military Aircraft ● Missiles ● Space Shuttle ● Electronic Instrumentation ● Flight Simulators ● In Board Computers ● Ground Support Systems ● Avionics	
DPGM/DPJM — general purpose, environmental DPGM — short shell, economical ring-type contact retention  DPJM — same as DPGM except shell is longer DPJMB — rear insertion/release of crimp snap-in contacts ■ **R/P CATALOG**	**12-98 CONTACTS** Contact/Wire Size 20 16 12 Coax. contacts available CRIMP TERMINATION		

□ Environmental version only ■ Environmental versions available, consult factory

ITT CANNON RECTANGULAR/RACK AND PANEL CONNECTORS

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
DPK — high performance, environmental, MIL-C-83733 Environmental sealing, thermal resistant connector with rear release of crimp snap-in contacts per PV/KJ circular series. ■	**18-185 CONTACTS** Contact/Wire Size 12 16 20 22 22D Coax. contacts available CRIMP TERMINATION	● Space Program Equipment ● Computer Periphery ● Environmental/Thermal Protection ● Black Box Instrumentation ● Military Aircraft ● Test Equipment ● Radar Systems ● Ground Support Equipment ● Test Equipment ● Power Circuits ● Communications Equipment ● Guidance Controls ● Early Warning Systems ● Missile Ground Support ● In-Flight Electronic Instrumentation ● Commercial Aircraft ● Retrofitting/repackaging with advantage of UF contacts ● Avionics	RACK AND PANEL CONNECTORS
DPX SERIES — small (rugged, general purpose, single gang **For commercial/industrial application** DPXA — single shell DPXAF — float mount DPXA DPXB — polarized ARINC shell DPXAL — large flange DPXLAF — float mount DPXL DPXAMA — LITTLE CAESAR® contact assembly DPXBMA — LITTLE CAESAR® contact assembly DPXBME — LITTLE CAESAR® contact assembly — environmental **For general military/aerospace application** DPXBNA — non-environmental, MIL-C-81659, type IV DPXBNE — environmental, MIL-C-81659, types II and III	**2-106 CONTACTS** Contact/Wire Size 22 20 16 2 6 4 Coax. contacts available SOLDER OR CRIMP TERMINATION		
DPX2 — two gang DPX DPX2 — two gang DPX DPX2A — ARINC A shell DPX2B — ARINC B shell DPX2MA — LITTLE CAESAR® contact assembly DPX2ME — LITTLE CAESAR® contact assembly — environmental DPX2NA — non-environmental, MIL-C-81659, type IV DPX2NE — environmental, MIL-C-81659, types II and III	**4-212 CONTACTS**		
DPX3 — three gang DPX DPX3 — three gang DPX DPX3MA — LITTLE CAESAR® contact assembly DPX3ME — LITTLE CAESAR® contact assembly — environmental DPX3NA — non-environmental, MIL-C-81659, type IV DPX3NE — environmental, MIL-C-81659, types II and III	**6-318 CONTACTS**		
DPX4 — four gang DPX DPX4 — four gang DPX DPX4MA — LITTLE CAESAR® contact assembly DPX4ME — LITTLE CAESAR® contact assembly — environmental DPX4NA — non-environmental, MIL-C-81659, type IV DPX4NE — environmental, MIL-C-81659, types II and III ■	**8-424 CONTACTS**		
BKA Series — ARINC 600 connectors High performance, environmental, non-environmental versions with low insertion force front and rear removable contacts. BKAD/E — rear release/rear removable crimp contacts BKAF — front release/front removable solder tail or wrap post size 22 contacts ■ **R/P CATALOG**	**3-150 CONTACTS** Contact/Wire Size 22 20 16 12 Coax contacts available SOLDER TAIL, CRIMP, or WRAP POST TERMINATION		

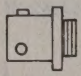
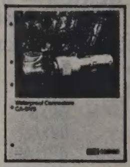
□ Environmental version only ■ Environmental versions available, consult factory

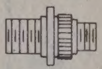
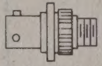
For immediate budgetary information contact your nearest Cannon Sales Office or Distributor (see Manufacturers' Directory).

ITT CANNON

CIRCULAR CONNECTORS

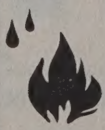
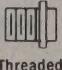
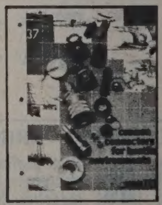
DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
CA BAYONET — rugged, bayonet connector series Bayonet Coupling Designed in accordance with European spec VG 95 234, interchangeable but not intermateable with MIL-C-5015; for use in heavy military equipment. **VG CATALOG**	**1-61 CONTACTS** Contact/Wire Size 16 12 8 4 0 CRIMP OR SOLDER TERMINATION	• Military Radios • Radar Systems • Heavy Military Equipment • Power Supplies • Communications and Ground Test Equipment • Earth Moving Equipment • Backstage Lighting Equipment • Mass Transit	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
CA-BVS — rugged, water-proof connectors  Bayonet Coupling Designed for the stringent requirements for mining equipment; contact arrangements to MIL-C-5015, VG 95 234; 360° HF shielding available. **GS-1E CATALOG**	**1-61 CONTACTS** Contact/Wire Size 16 12 8 4 0 CRIMP TERMINATION	• Underground Mining Installations • Heavy Duty Equipment	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
CA-COM/CA-COM-B standard circular connectors  Threaded Coupling CA-COM — threaded coupling CA-COM-B — bayonet coupling General purpose for commercial marketplace; interchangeable with corresponding MIL-C-5015 and VG 95234 types.  Bayonet Coupling ■ **CC CATALOG**	**2-48 CONTACTS** Contact/Wire Size 16 12 SOLDER OR CRIMP TERMINATION	• Industrial Machinery and Equipment	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
CVA — standard circular MIL-C-83723 (Series II) Threaded Coupling ☐ High performance, mates with MIL-C-5015 thread coupled connectors. Environmental and fluid resistant, rear release crimp snap-in contacts. **CVA/MIL-C-83723 CATALOG**	**1-48 CONTACTS** Contact/Wire Size 16 12 8 4 0 CRIMP TERMINATION	• Commercial/Military Aerospace • Test Equipment • Ground Support Equipment • Communications Equipment • Guidance Controls • Surface/Naval Vehicles • Black Box Instrumentation	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
CGE — high power connectors Bayonet Coupling Used to transmit high current at low voltage; meets mechanical requirements of VG 95234; operating temperature range −55 °C to +125 °C. ■ **HS CATALOG**	**1 CONTACT** Contact/Wire Size H2 H15 H5 H24 H9 Coax. contacts available CRIMP OR THREADED BOLT TERMINATION	• Heavy Vehicles Military/Commercial • Tanks • Any High Amperage Requirement	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
FIREWALL CONNECTORS  MS-K — 350°F (177°C), meets MIL-C-5015 fireproof test, crimp contacts CA-KE — 350°F (177°C), moisture-resistant, for sealable wires, meets MIL-C-5015 fireproof test or 350°F (177°C) continuous  Threaded Coupling FRF/FVF/FRA/FVA — firewall connector with front release crimp snap-in contacts; moisture sealed, exceeds MIL-C-5015 fireproof requirements; 400°F (204°C) continuous ■ **HEC CATALOG**	**1-47 CONTACTS** Contact/Wire Size 16 12 8 4 0 CRIMP TERMINATION	• Provides protection against extreme high temperatures, emergency fire retardant conditions, moisture, atmospheric conditions, resistant to fuels, cleaning agents, coolants, hydraulic fluids • Nuclear-Radiation Resistant • Aircraft Firewall	

☐ Environmental version only ■ Environmental versions available, consult factory

For More Information. Circle No. 99

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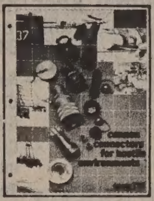
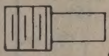
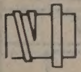
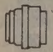
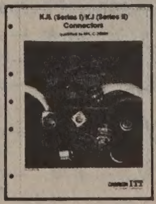
ITT CANNON

CIRCULAR CONNECTORS

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
HIGH TEMPERATURE connectors CA-HR — +371°F (+700°C), nuclear-radiation resistant Threaded Coupling	**1-73 CONTACTS** Contact/Wire Size 16 12 8 4 0 CRIMP OR WELD TERMINATIONS	• Provides protection against extreme high temperatures, emergency fire retardant conditions, moisture, atmospheric conditions, resistant to fuels, cleaning agents, coolants, hydraulic fluids • Nuclear-Radiation Resistant • Aircraft Firewall	
GEOPHYSICAL SERIES — hermaphroditic connectors  Threaded Coupling — Connectors designed for seismic applications in hostile environments. **HEC CATALOG**	**122, 176, 216 CONTACTS** Contact/Wire Size 20 18 SOLDER TERMINATION	• Oil Exploration	
DESCRIPTION	**CONTACT DATA**	**APPLICATIONS**	**CATALOG**
HIGH TEMPERATURE connectors HTMF — qualified to MIL-C-83723 Series III Class K and Class G. Temperature range from −85°F to +392°F (−65°C to +200°C). Meets U.S., NATO and British Govmnt. specifications Threaded Coupling **HTMF CATALOG**	**3-55 CONTACTS** Contact/Wire Size 12 16 20 Thermocouple contacts available CRIMP TERMINATION	• High Temperature Engines	
DESCRIPTION	**CONTACT DATA**	**APPLICATIONS**	**CATALOG**
K — standard lightweight, rugged general purpose  K — with special Acme thread coupling nut with internal threads RK — reverse coupling unit with external threads SK — "BEEP" telephone connectors Quick Coupling Acme Threads **K CATALOG**	**2-110 CONTACTS** Contact/Wire Size 20 16 14 10 8 6 4 Coax. contacts available SOLDER TERMINATION	• Aircraft Radios/Cameras • Instrument Panels • Black Boxes/"U" Boxes • TV Cameras • Transmitters • Communications and Radar Interconnects • CRT/Data Terminals • Automotive Instrument Sensors	
DESCRIPTION	**CONTACT DATA**	**APPLICATIONS**	**CATALOG**
KFS — standard circular, MIL-C-28840 KFS — front release contacts, high impact shock resistance for use with Navy Shipboard cable.  Threaded Coupling ☐ **28840 CATALOG**	**7-155 CONTACTS** Contact/Wire Size 20 CRIMP TERMINATION	• Navy Shipboard Cable • RFI/EMI and Hermetic • Filter	
DESCRIPTION	**CONTACT DATA**	**APPLICATIONS**	**CATALOG**
KJL/KJ/KJA — Series I, II and III subminiature high density, qualified to MIL-C-38999 Bayonet Coupling/ Threaded Coupling — KLJ Series I (Scoop Proof), KJ Series II (Low Profile). High performance, high density, lightweight, compact, environment-resistant connectors; rear release of crimp snap-in contacts; bayonet coupling. KJA Series III Scoop Proof self-locking threaded coupling for EMI/EMP shielding capability. ☐ **KJL/KJ CATALOG** **KJA CATALOG**	**3-128 CONTACTS** Contact/Wire Size 22M 22D 22 20 16 12 CRIMP TERMINATION	• Black Boxes • Electronic Instrumentation • Test Equipment • Ground Support Radar Systems • Space Shuttle • Guidance Controls • Military Spacecraft/Satellite Programs • Military/Commercial Aircraft • Military Missiles	

☐ Environmental version only ■ Environmental versions available, consult factory

For More Information. Circle No. 99

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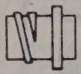
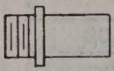
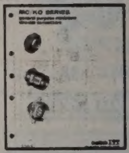
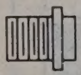
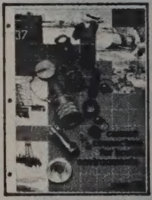
CIRCULAR CONNECTORS

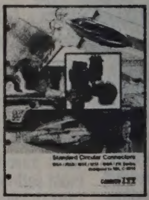
DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
KPT/KPTM/KPSE/KTN/KTNM — miniature general purpose, MIL-C-26482 Series I KPT — Solder contacts KPTM — Crimp montacts in DUAL-SHORE® insulator KPSE — Crimp contacts in integrally molded insulator KPTB — Thru-bulkhead receptacles KTN — Solder contacts, cupro-nickel hardware; corrosion-resistant KTNM — Crimp contacts, curpro-nickel hardware; corrosion-resistant Bayonet Coupling **KPT/KPTM/KPSE/KTN/KTNM CATALOG** ☐	**2-61 CONTACTS** Contact/Wire Size 20 16 12 SOLDER OR CRIMP TERMINATION	● Cable Assemblies ● Black Box Avionics ● Guidance Systems ● Control Systems ● Missile Instrumentation ● Word Processors ● Printers ● Cable Assemblies ● Chassis and Panel Mounting	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
KO — rugged lightweight Miniature environmental version of standard K connector with special Acme threads. Note: When potted they can meet MIL-C-25955.  Acme Threads **MC CATALOG** ☐	**3-50 CONTACTS** Contact/Wire Size 20 16 12 SOLDER TERMINATION	● Rapid Transit ● Recreation Vehicles ● Automotive Test Instrumentation ● Aircraft/Ground Support Equipment	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
LRN — connectors  Power connector for use on nuclear fueling machines; environmentally sealed and impervious to serious degradation from radiation. **HEC CATALOG**	**4-72 CONTACTS** Contact/Wire Size 16 12 4 SOLDER OR CRIMP TERMINATION	● Nuclear	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
MC — subminiature, sealed connectors Heavy duty, general-purpose, designed to withstand severe handling and a variety of environmental conditions. Acme Threads **MC CATALOG** ☐	**3-12 CONTACTS** Contact/Wire Size 20 SOLDER TERMINATION	● Military Instrument Panels ● Medical Instrumentation ● Air Traffic Control Ground Support ● Aircraft Communications Equipment	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
MR — standard weatherproof, submersible Rugged environmental MIL-C-5015 type; withstands severe conditions involving mud, ice, and water.  Submersible **HEC CATALOG** ☐	**1-56 CONTACTS** Contact/Wire Size 16 12 8 4 0 CRIMP OR SOLDER TERMINATION	● Rapid Transit ● Recreational Vehicles ● Missile Ground Support ● Radar Installations ● Heavy Construction Equipment ● Radio/TV Stations	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
MS — general purpose, MIL-C-5015 MS-A — solid shell MS-B — split shell MS-E — environmental, cable clamp MS-R — environmental, interfacial seal MSF — environmental, interfacial and periphery seal F-80 — crimp contact termination modification Threaded Coupling **MS CATALOG** Note: Catalog includes connectors for potting, bulkhead, quick disconnect and weatherproof applications. ■	**1-100 CONTACTS** Contact/Wire Size 16 12 8 4 0 SOLDER OR CRIMP TERMINATION High voltage Cartridges and Coax. Cartridges available	● Avionics ● Radar Systems ● Portable Power Generators ● Tanks, Trucks ● Farm Equipment ● Power Leads ● Electronic Scoreboards ● Traffic Signals ● Medical Equipment ● Computer Hardware	

☐ Environmental version only ■ Environmental versions available, consult factory

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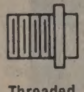
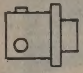
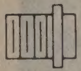
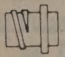
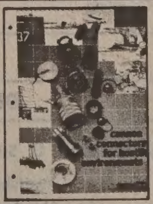
ITT CANNON CIRCULAR CONNECTORS

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
MS/CV 345*— MIL-C-5015G (NAVY) environmental, standard circular, crimp versions  Threaded Coupling The latest military design, high performance 5015 connectors with crimp removable contacts. Fully intermateable with existing MIL-C-5015 and threaded MIL-C-83723 (USAF) Series II connectors. ■ **MS/CV CATALOG**	**1-48 CONTACTS** Contact/Wire Size 16 12 8 4 0 CRIMP TERMINATION	• Mass Transit Systems • Military Space Programs • Black Box Instrumentation • Test Equipment • Radar Systems • Power Circuits • Ground Support Equipment	 STANDARD CIRCULAR HIGH ENVIRONMENTAL CONNECTORS

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
PV — miniature circular MIL-C-83723 (Series 1) MIL-26482 (Series 2) Bayonet Coupling Intermateable with MIL-C-26482 Series 1 bayonet coupled connectors. High performance, environmentally sealed; fluid resistant; rear release crimp snap-in contacts; eight shell sizes and 25 contact arrangements. ☐ **PV CATALOG**	**3-61 CONTACTS** Contact/Wire Size 20 16 12 CRIMP TERMINATION	• Missile On-Board Electronics Systems • Transportation Electronics • Military Armored Vehicles Electronics • CAB, Engine, Power Applications • Space Shuttle	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
PVW — miniature circular connectors Bayonet Coupling Lightweight version of PV Series, mates with M26482 and M83723 Series 1; temperature range −55 °C to +175 °C. ☐ **PVW CATALOG**	**3-61 CONTACTS** Contact/Wire Size 20 16 12 CRIMP TERMINATION	• Missiles • Aerospace Programs • Armored Vehicles • Black Box • Airbus/SST Concorde • Military Aircraft	 High performance miniature bayonet connectors
PVX — miniature circular connectors  Bayonet Coupling Same as PV Series except with 4 additional polarization positions (total 9 possibilities); temperature range −65 °C to +200 °C. ☐ **PVX CATALOG**			 High performance miniature bayonet connectors

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
SRC/SRCB/SRCN — miniature circular, rugged, lightweight, general-purpose connectors SRC — machined contacts (threaded coupling) SRCB — SRC with bayonet coupling SRCN — with stamped contacts (threaded coupling)  Threaded Coupling **SRC CATALOG**	**3-24 CONTACTS** Contact/Wire Size 20 16 SOLDER OR CRIMP TERMINATION	• Measurement and Test Equipment • Communications Systems • Medical Equipment • "Mini-cam" TV • Video Tape Recorders	 SRC/SRCN/SRCB

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
W SERIES — waterproof connectors  For extreme underwater geophysical applications, uses MIL-C-5015 contact arrangements, Acme thread coupling. **HEC CATALOG**	**1-48 CONTACTS** Contact/Wire Size 16 12 8 4 0 Coax. contacts available SOLDER TERMINATION	• Underwater Geophysical Exploration • Underground Drilling Equipment • Moisture-Resistant Outdoor Requirements	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
WFS — standard circular, designed to MIL-C-5015G-340* WFS — front release contacts, for use in commercial/industrial, military, mass transit, retrofit programs. **WFS CATALOG**	**7-104 CONTACTS** Contact/Wire Size 16-16 16-22 CRIMP TERMINATION	• Navy Shipboard Cable • Mass Transportation • Heavy Equipment • Space Programs	 STANDARD CIRCULAR CONNECTORS

☐ Environmental version only ■ Environmental versions available, consult factory

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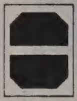
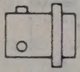
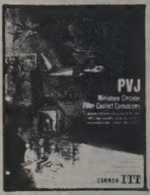
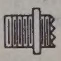
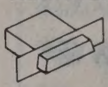
FILTER CONNECTORS

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
DPXJ  Rack/panel filter connectors in single, two, three or four gang shells interchangeable with standard DPX, DPXMA, DPXME and meets requirements of ARINC 404. Provide optimum attenuation of RFI/EMI. **FDPXJ CATALOG**	**CONTACTS** Contact/Wire Size 22 20 16 Coax. contacts available SOLDER TERMINATION Consult factory for availability of crimp filter contacts	● Electronic Countermeasures Equipment ● Communications Equipment ● Encoder/Decoder Equipment ● Radar Guidance Systems ● Instrumentation ● Navigational Equipment ● Deep Space Applications ● Military Aircraft ● Commercial Aircraft	 DPXJ/DPX'J
D*J Rectangular subminiature filter connectors intermateable with standard D subminiature and MIL-24308 types. Optimum RFI/EMI attenuation provided. **FDJ CATALOG**	**CONTACTS** Contact/Wire Size 20 Coax. contacts available SOLDER TERMINATION Consult factory for availability of crimp filter contacts		 D'J
PVJ  Bayonet Coupling Miniature circular filter connectors provide optimum attenuation of RFI/EMI. PJV equivalents to MIL-C-26482 and MIL-C-83723 types. Also available in hermetic. **FPVJ CATALOG**	**CONTACTS** Contact/Wire Size 20 16 SOLDER TERMINATION Consult factory for availability of crimp filter contacts		 PVJ
KJJ/KJJL Bayonet Coupling KJJ (low profile)/KJJL (scoop proof) miniature circular filter connectors combine functions of standard connector and a feed-thru filter into one complete package. Meet applicable portions of MIL-C-38999 Series I, II and III. Provides optimum RFI/EMI attenuation. Also available in hermetic. **FKJJ CATALOG**	**CONTACTS** Contact/Wire Size 22D 20 16 SOLDER TERMINATION Consult factory for availability of cirmp filter contacts		 KJJL (Series I) KJJ (Series II)

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
TKJ  Threaded Coupling A transverse monolith filter design incorporated into the KJJ (M38999) connector family.	**CONTACTS** Contact/Wire Size 22D 22M 22 20 16 12	● Missiles ● Military Communications ● Military Weapons System ● Radar Ground Control Equipment	 KJA MIL-C-38999

EMI/RFI PRODUCTS

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
SHIELDED D subminiature Available in kits or individual connectors to suit your EMI/RFI equipment requirements. Assures equipment compliance with FCC Docket 20780.	**CONTACTS** Contact/Wire Size 20 SOLDER OR CRIMP TERMINATION	● Computers ● Electronic Games ● Telecommunications ● Medical Electronics ● Computer Peripherals ● Black Box ● Business Machines ● Compact Packaging Requirements	 "SILENT SOLUTIONS"
TRANSVERSE MONOLITH D subminiature  Significantly reduces EMI/RFI emissions, assuring equipment compliance with FCC Docket 20780.	20 SOLDER POT, STRAIGHT AND RIGHT ANGLE PC, WIRE WRAPPABLE		

☐ Environmental version only ■ Environmental versions available, consult factory

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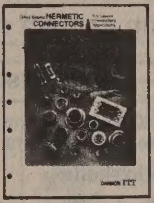
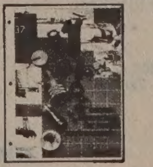
HERMETIC CONNECTORS

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
GS — standard circular MIL-C-5015 TBFH — through bulkhead fitting BFH — bulkhead fitting GS — glass seated Threaded Coupling	**1-54 CONTACTS** Contact/Wire Size 16 4 12 0 8 EYELET OR SOLDER POT TERMINATION	● Medical Equipment ● Relays ● Tachometers ● Directional Finders ● Aircraft Instrumentation ● Spacecraft/Satellite Systems ● Fuel Tanks ● Sensors ● Nuclear Instrumentation ● Transmitters ● TV Cameras ● Aircraft Ground Support Equipment ● Rapid Transit ● Recreational Vehicles ● Automotive Test Equipment ● Shipboard Instrumentation ● Communication Systems ● Submersible Vehicles ● Electronic Countermeasures ● Glove Boxes ● Construction and Oil Field Equipment ● Automotive Transmissions ● Mining Equipment	
***KH — standard circular, lightweight general purpose, quick disconnect** KH — Acme threaded coupling RKH — Reverse type coupling nut Quick Coupling	**2-57 CONTACTS** Contact/Wire Size 20 10 16 6 14 EYELET OR SOLDER POT TERMINATION		
KPT/PVA — miniature circular MIL-C-26482 (Series I and Series II) Connector for broad-base commercial, military, and industrial applications ranging from general purpose to space environments. Bayonet Coupling	**2-61 CONTACTS** Contact/Wire Size 20 16 12 EYELET OR SOLDER POT TERMINATION		
KJLY/KJY — miniature circular MIL-C-38999 (Series I and Series II) Lightweight, scoop-proof/low-profile, environment-resistant, engineered for high density circuitry applications. Bayonet Coupling	**3-128 CONTACTS** Contact/Wire Size 22 20 16 SOLDER OR CRIMP TERMINATION		
MC/KH — subminiature circular, general purpose Quick disconnect with Acme threads used for instrumental, machine tools, automotive, recreational vehicles and many military guidance and instrument applications. Acme Threads	**3-50 CONTACTS** Contact/Wire Size 20 16 12 SOLDER TERMINATION		
HYDROSPACE connectors — designed to withstand stringent environments encountered by submarines and other undersea vehicles MIL-C-24217 — hermetic seal capability of withstanding pressures up to 10,000 psi. MIL-C-22249 — features receptacles with feed through pin-pin contacts mated to low pressure (internal) plug and high pressure (hydrostatic) plug. MIL-C-22539 — similar to MIL-C-24217 connectors, accommodates different contact arrangements.	**3-208 CONTACTS** Contact/Wire Size 20 8 16 4 12 0 SOLDER, SET SCREW CRIMP TERMINATION		
D Subminiature for general military/aerospace application, qualified to MIL-C-24308 D*H — standard D subminiature D*TBH — through bulkhead **HCC CATALOG**	**9-50 CONTACTS** Contact/Wire Size 20 EYELET OR SOLDER POT TERMINATION (D*H) PIN-PIN (D*TBH)		

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
HIGH TEMPERATURE connectors HRM +315° (+600°F), nuclear radiation-resistant miniature circular connector Threaded Coupling **HEC CATALOG**	**1-73 CONTACTS** Contact/Wire Size 16 4 12 0 8 CRIMP OR WELD TERMINATIONS	● Temperature Sensing Detection Devices ● Radiation- and Temperature-Resistant Environmental Applications	

☐ Environmental version only ■ Environmental versions available, consult factory

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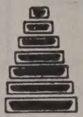
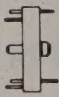
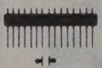
MICROMINIATURE CONNECTORS

THE MICRO CONTACT SERIES
3 amp contact rating

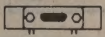
DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
RACK/PANEL, connectors **Micro-D connectors** **plastic shells**  .050" Centers MD — clip mounting, diallyl phthalate insulator MDA — clip mounting, polycarbonate insulator MDB — Screw mounting, diallyl phthalate insulator MDC — screw mounting, polycarbonate insulator MDN — clip mounting, nylon insulator MDNB — screw mounting, nylon insulator MDV — clip mounting, polyester insulator MDVB — screw mounting, polyester insulator **metal shells** MDM — screw mounting, aluminum die cast shell ■ **MMC CATALOG — Section I**	**9-100 CONTACTS** 3 Amps SOLID OR STRANDED LEADS SOLDER TERMINATION Coaxial contact layouts available	• Integrated Airborne Interconnection Systems • Mobile Military Radio • Military Aircraft • Commercial Aircraft • Analog/Digital Electronics • Navigational Systems • ECM Ground Support • Weapons/Guidance Systems Instrumentation • Flight Simulators • Entertainment Systems • Security Systems • Computer Mainframes • Computer Peripherals • Geophysical/Seismic Survey Equipment • Medical Instrumentation • Satellite Telemetry	
RECTANGULAR CONNECTORS **Center jack screw**  MJS — micro contact, interconnect pc boards, pc boards-to-harness, in-line wire interconnects **MMC CATALOG — Section I**	**10-66 CONTACTS** 3 Amps SOLID OR STRANDED LEADS		
CIRCULAR CONNECTORS Meet applicable performance requirements of MIL-C-38999, threaded or push/pull (quick connect/disconnect) coupling MIK — thermoplastic shell/insulator, threaded coupling, 7-55 contacts MIKM — metal shell, thermoplastic insulator, threaded coupling, 7-55-85 contacts MIKQ — metal shell, thermoplastic insulator, push/pull (quick disconnect) coupling, 7, 19, 37 contacts ■ **MMC CATALOG — Section I**	**7-85 CONTACTS** 3 Amps SOLID OR STRANDED LEADS		
STRIP CONNECTORS — 50-MIL strip For edge mounting on PC boards and encapsulation in modules.  .050" or .100" Centers MTB — diallyl phthalate (up to 81 contacts) MTV — polyester insulation, up to 120 contacts (special configurations are available; consult factory) **MMC CATALOG — Section I**	**UP TO 120 CONTACTS** 3 Amps SOLID OR STRANDED LEADS		

☐ Environmental version only ■ Environmental versions available, consult factory

ITT CANNON **MICROMINIATURE CONNECTORS**

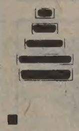
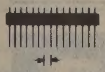
THE MICRO CONTACT SERIES (Continued)

3 amp contact rating

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
PRINTED CIRCUIT BOARD connectors  MDMPC —metal shell, high reliability, board-to-board, board-to-cable, cable-to-cable applications MEB —metal shell, mother board, daughter board 2-piece edgeboard connector system. DUAL-ROW —plastic version of MEB available in 74 contacts on .075″ centers **MMC CATALOG — Section I**	**9-100 CONTACTS** 3 Amps 90° OR STRAIGHT LEADS **128, 184 CONTACTS** 3 Amps SOLID OR STRANDED LEADS	● Flex Circuitry ● Flat Cable ● Industrial and Commercial Control Systems	

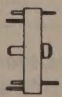
THE CENTI CONTACT SERIES

5 amps contact rating — 0.075″ (1.91) contact centers

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
2D — double density D  D subminiature shell and hardware; 19, 31, 52, 79 or 100 crimp removable contacts on .075″ centers. **MMC CATALOG — Section II**	**19-100 CONTACTS** 5 Amps Wire Size 22 thru 30 CRIMP TERMINATION	● Model Airplane Radio Control Equipment ● Calculators ● Communications and Audio Equipment ● Streamer Cables	
CENTI-LOC® connectors  .075″ or .100″ Centers Low cost, commercial strip connector available in "yardage" form for up to 53 crimp snap-in contacts on .075″ centers and up to 60 contacts on .100″ centers. **MMC CATALOG — Section II**	**1-60 CONTACTS** 5 Amps Contact/Wire Size 22 thru 30 (P.C. tails avail.)		

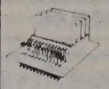
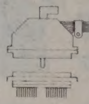
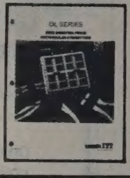
THE NANO CONTACT SERIES

1 amp contact rating

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
NANO connectors — strip 0.025″ Centers A high density connector using twist pins on .025″ centers. Available to various configurations including center jackscrew version. **MMC CATALOG — Section III**	**1-40 CONTACTS** 1 Amp SOLID OR STRANDED LEADS	● Medical Research Implementations ● Hearing Aid Harnessing ● Inertial Guidance Platform Harnessing	
RECTANGULAR CONNECTORS **Center jack screw**  NJS — Nano contact, interconnect pc boards, pc boards-to-harness, in-line wire interconnects. **MMC CATALOG — Section III**	**9-22 CONTACTS** 1 Amp SOLID OR STRANDED LEADS		

☐ Environmental version only ■ Environmental versions available, consult factory

ITT CANNON PRINTED CIRCUIT/INPUT-OUTPUT

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
ADAPTA-CON CONNECTORS  Low-force receptacle interconnections for P.C. and I/O applications, custom made to any size or configuration. **ACBP CATALOG**	**UBS UP TO 130 CONTACTS** **UBC UP TO 86 CONTACTS** Contact/Wire Size 18 thru 28 SOLDER, CRIMP TERMINATION	• PC Board Interconnections • Computer Peripheral Equipment • Automatic Test Equipment	
DL CONNECTORS  Low mating force, high performance, cam-actuated spring contacts on .100" centers. I/O, cord-to-cord, cord-to-panel applications. **DL CATALOG**	**UP TO 2496 CONTACTS** Contact/Wire Size 18 thru 30 CRIMP OR WIRE-WRAPPING TERMINATION	• Computer Main Frames • Computer Peripherals • Communications Systems • Ground Support Systems • Guidance/Control Systems	

ITT Cannon offers a broad range of edgecard (printed circuit) connectors. Available are modular printed circuit connectors accommodating from 2 to 200 contacts in gold, silver or tin plating. Contact spacing ranges from .100 inches to .200 inches. Commercial, military specification and DIN types are also available in a variety of mounting styles. The following generally describes several of ITT Cannon's direct and indirect discrete and backpanel types. Condensed technical data is provided in a selector chart below.

DESCRIPTION

PC CONNECTORS DIRECT (ONE PIECE)

Series	Number of Contacts	Contact Arrangement	Current Rating	Termination Styles
G03	5 to 89 10 to 178	Single read-out Dual read-out	3 A max.	Eyelet, Solder Tails, Wrap Posts
G05	2 to 100 4 to 200	Single read-out Dual read-out	4.5 A max.	Eyelet, Solder Tails, Wrap Posts
PB21	44, 56, 60, 68, 72, 80, 86, 88, 100	Dual read-out	3 A max.	Solder Tails, Wrap Posts
G08 (unshrouded)	8-70 (even increments, double row) 2-35 (single row)	Dual read-out	3 A max.	Solder Tails, Wrap Posts

PC CONNECTORS INDIRECT (TWO PIECE)

Series	Number of Contacts	Contact Arrangement	Current Rating	Termination Styles	
				Male Connector	Female Connector
G06 (DIN)	32, 64, 96	Two rows Three rows	2 A max.	Solder Tails, Straight and 90°	Solder Tails, Wrap Posts
G60 (Reverse DIN)	64, 96	Two rows Three rows	2 A max.	Solder Tails, Wrap Posts	Solder Tails, Straight and 90°
G06 (IDC)	64	Two rows Three rows	3 A max.	—	IDC Termination
G612* Compliant Pin	96	Three rows	2 A max.	Press-fit Wrap Posts	Solder Tails 90°
G60* Compliant Pin Press-fit	96	Three rows	2 A max.	Press-fit Wrap Posts	—
PB18	Modular Blocks, 2 rows of 10	Dual read-out	3 A ma.	Consult Factory	Solder Tails
PB23	Modular Blocks, 2 rows of 10	Dual read-out	3 A ma.	Consult Factory	Solder Tails
LIPS	Up to 150	Consult Factory	1 A max.	Consult Factory	Solder Tails
PICL	30, 40, 50, 60	Four rows	0.5 A	Solder Tails, Straight and 90°	Solder Tails, Straight and 90°

*G612 compliant pins are ordered separately.
G60 connectors are ordered with compliant pins installed.

IC SOCKETS

Series	Number of Contacts	Contact Arrangement	Current Rating	Termination Styles	
				Male Connector	Female Connector
DICF	14, 16, 18, 22, 24, 28, 40, 42	Dual-read-out	3 A max.	—	Solder Tails, Wrap Posts (14/16 contacts only)
DICA	14, 16, 18, 22, 24, 28, 40, 42	Two rows	1 A max.	—	Solder Tails

APPLICATIONS

- Missile Instrumentation Equipment
- Radar Early Warning Systems
- Dual Readout PC Applications
- Videotape Recorders
- Television Equipment
- Stereo Equipment
- Air Conditioners
- Computer/Micro Computer Equipment
- Automobile Dashboards
- Office Equipment
- Medical Equipment
- Tape Recorders
- Commercial/Industrial Electronic Equipment
- Computer Periphery
- Measuring Instruments
- Communications Equipment
- High Density PC Board Applications

CATALOG

PC Connectors G03/G05

DICF Series

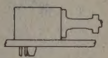
☐ Environmental version only ■ Environmental versions available, consult factory

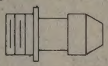
For immediate budgetary information contact your nearest Cannon Sales Office or Distributor (see Manufacturers' Directory).

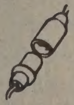
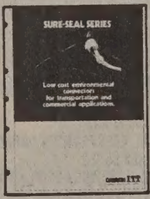
ITT CANNON SPECIAL APPLICATIONS

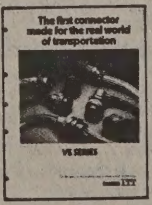
DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
AUDIO/ELECTRONIC CONNECTORS Used on microphones, audio/video, amplifiers, test instrumentation, computers and other low level circuit applications. **AUD CATALOG**	**2-8 CONTACTS** Contact/Wire Size 10 14 16 Coax. contacts available SOLDER OR CRIMP TERMINATION	• Microphones • Video Tape Recorders • Amplifiers • Medical Electronics • Computers • Audio/Video Systems	Audio Connectors

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
LEADLESS CHIP CARRIER PACKAGING Chip carrier sockets and pin frames designed to accept (JEDEC A, B and C) leadless chip carriers with PC boards. Pin patterns of .050" × .100" and .100" × .100". **LLCC CATALOG**	**68-196 CONTACTS** SOLDER (FLOW, DIP) WAVE	• Microprocessors • Digital Telephone Switching Equipment	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
FIBER OPTIC CONNECTORS FODC — Low cost fiber optic device connectors for PCB fiber optic applications.  **FODC CATALOG**	**Single Channel** (simplex) CRIMP TERMINATION	• Office Equipment • Computers • Local area network	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
FIBER OPTIC CONNECTORS  Multi-channel tactical communications connectors for fiber optics. **FOMC CATALOG**	2, 4, 8 Channels Epoxy, grind and polish of fiber Cable and cable strength member is crimp	• Tactical Radio C3 Systems • Ground Support Equipment • Avionics and Instrumentation • Flight Simulators • Communications	

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
SURE SEAL® CONNECTORS  High performance, low cost environmentally sealed connectors with rugged multiple moisture seals. Meets automotive/industrial standards including vibration, shock, temp. cycling, salt water spray and immersion, petroleum derivitives, and industrial gases. ☐ **SS CATALOG**	**1-10 CONTACTS** Contact/Wire Size #14 AWG #16 AWG #18 AWG CRIMP TERMINATION WITH OR WITHOUT INSULATION SUPPORT	• Missile Disconnect • Trucks • Off-Road Vehicles • Farm Machinery • Process Control Systems • Automotive/Mobile Units • Household Appliances • Solar Energy • Telephone Communication Lines	 SURE-SEAL SERIES Low cost environmental connectors for transportation and commercial applications. ITT

DESCRIPTION	CONTACT DATA	APPLICATIONS	CATALOG
VE CONNECTORS — heavy duty automotive /transportation General purpose connectors for industrial marketplace; quick harness termination; environmentally sealed. Super Ceasar™ contact assembly retention. ☐ **VE CATALOG**	**12-37 CONTACTS** Contact/Wire Size 16 12 8 4 Power and Signal Contacts CRIMP TERMINATION	• Digital Electronic Systems • Off-Road Vehicles • Engines • Generators • Transportation Electronics • Farm Machines • CAB, Signal and Chassis Power Systems	 The first connector made for the real world of transportation VE SERIES ITT

There are many other special products manufactured by ITT Cannon. For additional information please contact any of the offices listed on the following pages.

☐ Environmental version only ■ Environmental versions available, consult factory

For immediate budgetary information contact your nearest Cannon Sales Office or Distributor (see Manufacturers' Directory).

ITT CANNON SALES OFFICE/DISTRIBUTOR LOCATIONS

SALES OFFICES/REPRESENTATIVES

ITT Cannon Area Sales Offices or Representatives for CANNON® Connectors . . . Besides the local Area Sales Office telephone number we have added a new feature . . . an "umbrella" number . . . **(800) 845-7000.** This toll-free number can be called from anywhere in the U.S. and you will automatically reach your nearest Cannon Area Sales Office who will quickly direct you to your nearest Cannon branch office. These offices are staffed to provide you with fast Response and Delivery responses to your inquiries regarding our products and their application to your needs.

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ITT CANNON
Phone: 602/224-0944
TWX: 910-951-1325 • TELEX 66-7327

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ITT CANNON — Western Area Director — South
Phone: 714/964-7400
TWX: 910-596-2620 • TELEX 65-5358

CALIFORNIA 95008 — Campbell (San Jose)
ITT CANNON — Western Area Director — North
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BRANDEL-STEPHENS & COMPANY, INC.
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FLORIDA (Southern) 33441 — Deerfield Beach
BRANDEL-STEPHENS & COMPANY, INC.
Phone: 305/427-8558 • TELEX 51-9397

GEORGIA 30305 — Atlanta
BRANDEL-STEPHENS & COMPANY, INC.
Phone: 404/261-7579 • TELEX 54-9644

MASSACHUSETTS 01880 — Wakefield
ITT CANNON — Eastern Area Director — North
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MINNESOTA 55420 — Minneapolis
ITT CANNON — Central Area Director — North
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L-MAR ASSOCIATES
Phone: 607/257-5712

NEW YORK 13057 — East Syracuse
L-MAR ASSOCIATES
Phone: 315/437-7779

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OHIO 45429 — Kettering
ITT CANNON
Phone: 513/434-8181

PENNSYLVANIA 19422 — Blue Bell
ITT CANNON — Eastern Area Director — South
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PENNSYLVANIA 19047 — Trevose
P.S.A. INC.
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ITT CANNON — Central Area Director — South
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Phone: 206/454-3903

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ARIZONA 85034 — Phoenix
2801 E. Air Lane
Phone: 602/275-4792

CANADA: Whitby, Ontario — L1N 5V8
ITT CANNON CANADA
4 Cannon Court
Phone: 416/668-8881

INTERNATIONAL MANUFACTURING FACILITIES

AUSTRALIA: Moorabbin, Victoria — 3189
ITT CANNON (Australia)
Division of STC Cannon Components
P.O. Box 62, 248-254 Wickham Road
Phone: 61(3)555-1566 • TELEX 790-30877

ENGLAND: Basingstoke, Hants RG22 4BW
ITT CANNON (Great Britain) LTD.)
Jays Close, Viables Industrial Estate
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TELEX 851-858-105

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ITT CANNON FRANCE S.A.
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Phone: Toulouse 33(61)78.53.33
TELEX 842-51973

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CANNON JAPAN
3-27 Minami-Hashimoto 4-chrome
Sagamihara City
Phone: 81(3)344-6071 • TELEX 287-2223 CE JAE J

JAPAN: Tokyo — 150
JAPAN AVIATION ELECTRONICS INDUSTRY, LTD./Lic.
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WEST GERMANY: D-7056 Weinstadt
ITT CANNON GmbH
Poststrasse 75, P.O. Box 1120
Phone: 49(7151)604-0 • TELEX 724-343-0Ca-d

CAPS® DISTRIBUTORS

The Cannon Authorized Plug Specialist (CAPS) locations shown below are the major assembly locations for this network. Most of the major CAPS assembly locations are military-approved facilities with Quality Control standards and comparable to the ITT Cannon factory.

ARIZONA

TIME ELECTRONICS / ARIZONA, INC.
Tempe 85282
Phone: 602/967-2000 • TWX 910-950-0086

CALIFORNIA

HALL-MARK ELECTRONICS CORP.
San Jose 95131
Phone: 408/946-0900 • TWX 910-339-9505

RICHEY WESTERN ELECTRONICS, INC.
Sun Valley 91352
Phone: 213/875-2862, 768-3800
TWX 910-498-2205

RICHEY WESTERN ELECTRONICS, INC.
San Diego 92121
Phone: 619/271-4511

TIME ELECTRONICS WEST, INC.
Torrance 90501
Phone: 213/320-0880 • TWX 910-349-7536

TIME ELECTRONICS • NOR/CAL
Sunnyvale 94086
Phone: 408/734-9888 • Telex 17-2233

CANADA

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Whitby, Ontario L1N 5V8
Phone: 406/668-8881

COLORADO

ARROW ELECTRONICS, INC.
Denver 80222
Phone: 303/758-4585 • TWX 910-931-0440

FLORIDA

TIME ELECTRONICS-FLORIDA, INC.
Ft. Lauderdale 33309
Phone: 305/974-4800 • TWX 510-956-9408

GEORGIA

ELECTRO AIR CORP.
Atlanta 30325
Phone: 404/351-3545 • Telex 542127

ILLINOIS

HALL-MARK ELECTRONICS CORP.
Bensenville 60106
Phone: 312/860-3814 • TWX 910-651-0185

INDIANA

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South Bend 46628
Phone: 219/287-2911 • TWX 810-299-2583

MASSACHUSETTS

TIME ELECTRONICS / NEW ENGLAND
Woburn 01801
Phone: 617/935-8080 • TWX 710-393-0171

MISSOURI

TIME ELECTRONICS / MID-WEST
St. Louis 63011
Phone: 314/391-6444 • TWX 910-760-1893

NEW YORK

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Planview, L.I. 11803
Phone: 516/433-1700 • TWX 510-221-1896

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Buffalo 14202
Phone: 716/887-2800 • TWX 710-522-1692

NEW YORK (Cont.)

TIME ELECTRONIC SALES
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Telex 967827 or 143117

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HENWARR, INC.
Warminster 18974
Phone: 215/675-4104

PHILADELPHIA ELECTRONICS, INC.
Philadelphia 19107
Phone: 215/568-7400 • TWX 710-670-0852

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Broomall 19008 (Philadelphia)
Phone: 215/359-1200 • Telex 845317

TEXAS

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TWX 910-867-4721

HARRISON EQUIPMENT CO., INC.
Stafford 77477
Phone: 713/879-2600 • TWX 910-880-5153

WASHINGTON

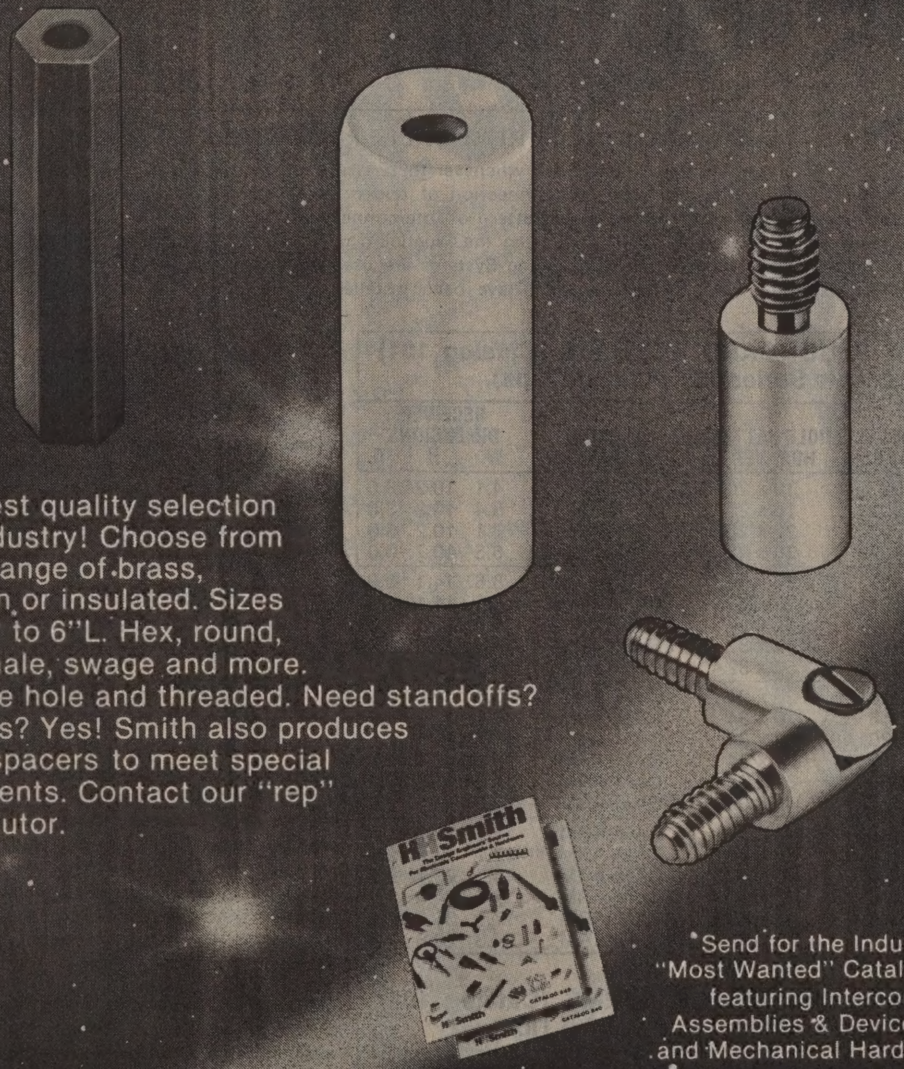
ALMAC ELECTRONICS
Bellevue 98007
Phone: 206/643-9992 • TWX 910-444-2067

For More Information. Circle No. 99

HHSmith

FUTURETECH™

Spacers and Standoffs



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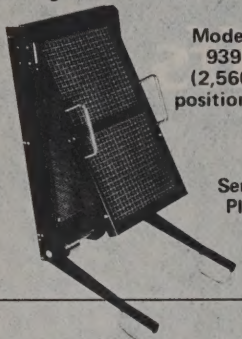
MAC PANEL

1958-1984 Our 26th Year PLUGBOARD PROGRAMMING SYSTEMS

SERIES 140 PLUGBOARD SYSTEMS

Extremely strong and compact systems with removable plugboards. Features cam-closing mechanism. Choice of taper pin or wrap terminations for connecting to external equipment. A complete line of Series 140 plugwires is offered. Catalog 102.



Model 939 (2,560 positions)

Series 140 Plugwire Tip

SERIES 157 PLUGBOARD SYSTEMS

Reliable economical program control. Taper pin or wrap terminations to external equipment. Removable plugboard patched with Series 157 plugwires. Catalog 101.

Model 922 (1,280 positions)

Series 157 Plugwire Tip

SERIES 157 FIXED SYSTEMS

Used where program change requirements do not dictate the use of removable plugboards. Systems from 200 to 1280 contact positions are offered from stock. Sizes up to 9,600 positions are made to order. Catalog 101.

Model 809 (816 positions)

IN-STOCK CONNECTORS & TOOLS

We maintain shelf stock on connectors, and crimping, insertion and extracting hand tools. Used for interconnecting the plugboard system to external equipment.

APPLICATIONS OF REMOVABLE PLUGBOARD SYSTEMS

MAC PANEL Plugboard Programming Systems are used whenever there is a need for frequent or fast changes in the functions performed by electrical equipment and circuits or in the interconnection of two or more machines and/or circuits. Removable Plugboards are prewired with plugwire assemblies to provide a given pattern of interconnection. Changes can be made either by changing the program wired in the removable Plugboard or by simply replacing the Plugboard in the Receiver with another pre-programmed Plugboard in a matter of seconds. **MAC PANEL** Plugboard Programming Systems are used as large connectors with up to 5,120 contact positions on standard models. Thousands of **MAC PANEL** systems have been installed in the United States and in over forty foreign countries since 1958.

SERIES 157 PLUGBOARD SYSTEMS (Catalog 101) (Accepts Series 157 Plugwire Tips)

CONTACT POSITIONS	MODEL NUMBER	HOLE PATTERN HOR.-VERT.	LOCKING MECHANISM	RECEIVER DIMENSIONS W	H	D
200	902	10 x 20	SPRING	4.1	10.2	3.0
320	903	16 x 20	SPRING	5.4	10.2	3.0
440	904	22 x 20	SPRING	7.1	10.2	3.0
440	905	20 x 22	SPRING	6.5	10.7	3.0
680	901	20 x 34	LEVER-ARM	8.6	14.1	6.0
748	906	22 x 34	LEVER-ARM	8.6	14.1	6.0
816	907	24 x 34	LEVER-ARM	9.6	14.1	6.0
1280	922	40 x 32	LEVER-ARM	13.4	13.6	6.0
1600	921	50 x 32	LEVER-ARM	16.3	13.6	6.0
480	916	20 x 24	CAM-ARM	8.1	9.3	2.2
680	918	20 x 34	CAM-ARM	8.1	12.1	2.2
748	920	22 x 34	CAM-ARM	8.1	12.1	2.2
816	919	24 x 34	CAM-ARM	9.3	12.1	2.2
1088	988	32 x 34	CAM-ARM	11.2	12.3	2.2
1280	924	40 x 32	CAM-ARM	13.0	11.8	2.2
1496	923	44 x 34	CAM-ARM	15.3	12.3	2.2
1632	925	48 x 34	CAM-ARM	17.7	12.3	2.2
2560	926	40 x 64	CAM-ARM	13.5	23.7	2.5
3264	927	48 x 68	CAM-ARM	17.5	24.0	2.5
4896	928	48 x 102	CAM-ARM	17.2	35.0	2.5
5120	929	80 x 64	CAM-ARM	24.3	23.6	2.5

SERIES 140 PLUGBOARD SYSTEMS (Catalog 102) (Accepts Series 140 Plugwire Tips)

CONTACT POSITIONS	MODEL NUMBER	HOLE PATTERN HOR.-VERT.	LOCKING MECHANISM	RECEIVER DIMENSIONS W	H	D
240	930	10 x 24	CAM-ARM	5.2	8.9	2.0
480	931	20 x 24	CAM-ARM	7.7	8.9	2.0
640	932	20 x 32	CAM-ARM	7.8	10.9	2.0
816	933	24 x 34	CAM-ARM	8.7	11.4	2.0
1280	934	40 x 32	CAM-ARM	13.1	10.9	2.0
1632	935	48 x 34	CAM-ARM	15.1	11.4	2.0
2560	939	40 x 64	CAM-ARM	13.5	21.9	2.5
3264	937	48 x 68	CAM-ARM	15.9	22.9	2.5
5120	938	64 x 80	CAM-ARM	20.1	25.6	2.5

GENERAL PRODUCT DESCRIPTION

Each system consists of a Receiver and one or more removable Plugboards. The Receiver is the frame and the engaging mechanism that accepts the removable Plugboard. Depending on the system there are from one to six molded black phenolic or blue diallyl phthalate panels in the Receiver and Plugboard frames. A molded panel will contain up to 1280 holes or contact positions. These panels are silk screened with a grid pattern that provides a unique alphanumeric address for each contact position in the system. Special customized printing in any number of colors can be provided on either the Plugboard or Receiver.

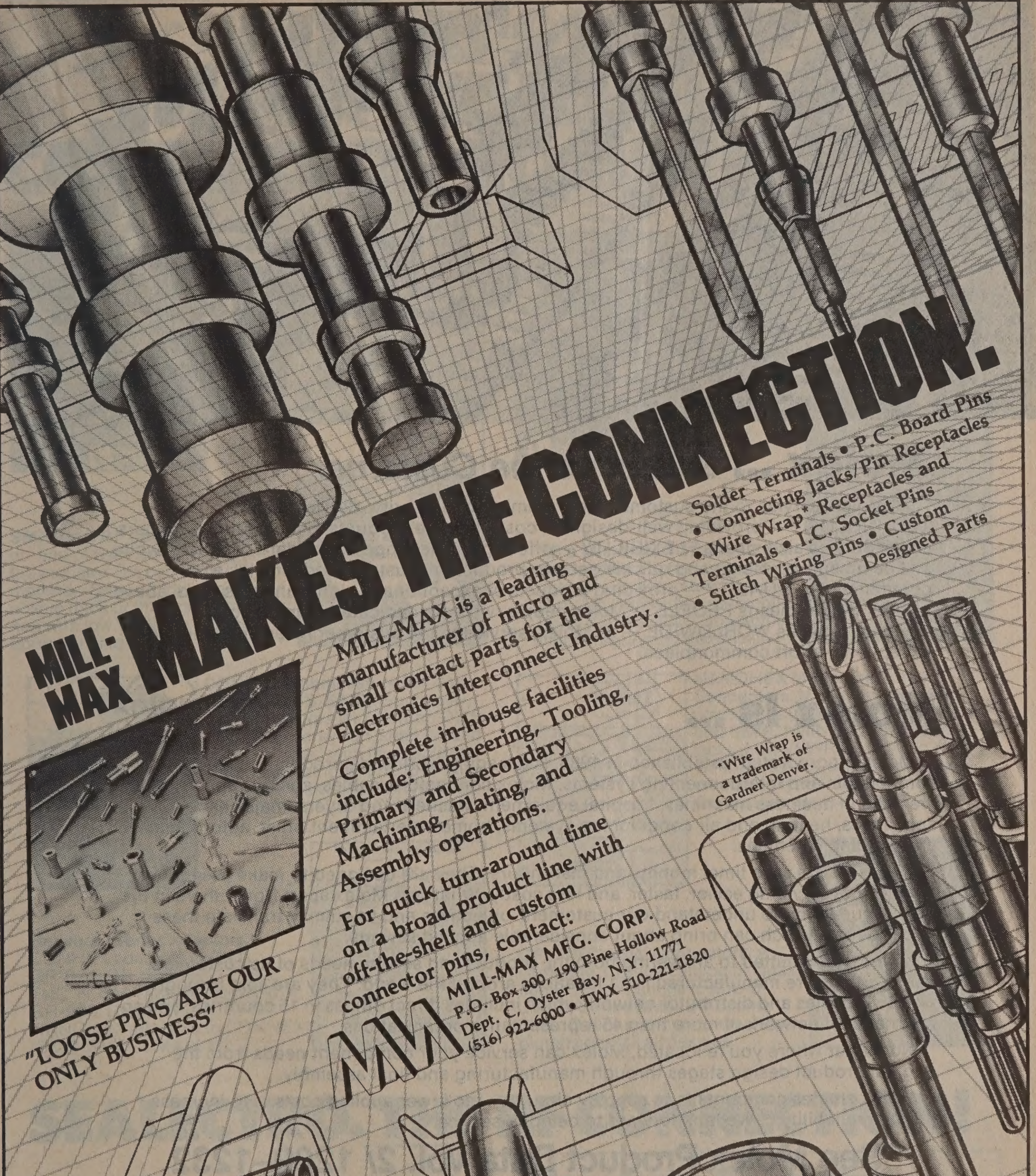
A contact spring is factory installed in each Receiver contact position. The front portion of these nickel or gold plated contact springs mates with nickel or gold plated plugwire tips inserted in the appropriate contact position of the Plugboard when the Plugboard is inserted in the Receiver. All Receivers are equipped with a mechanical interlock that assures proper mating of contact springs and plugwire tips. Each contact position can also be directly connected to the equipment from the rear of the Receiver by soldering, insertion of taper pins, or wire-wrapping. The desired method of connection must be determined prior to ordering so that the appropriate type of contact springs will be provided in the Receiver.

MAC PANEL maintains shelf stock on over 500 types of plugwire assemblies. These include single conductor and multi-conductor unshielded and shielded plugwires as well as crimpable and wire-wrapable plugwire tips.

MAC PANEL customer service personnel and design engineers invite your inquiries. We can promptly and economically design, build, and install a special custom system or plugwire if our standard product will not meet your requirements.

MAC PANEL COMPANY
P.O. Box 5027, High Point, N.C. 27262
Telephone (919) 884-8111 TWX 510-926-1542

For More Information. Circle No. 101



MILL-MAX MAKES THE CONNECTION.

Solder Terminals • P.C. Board Pins
• Connecting Jacks/Pin Receptacles
• Wire Wrap* Receptacles and
Terminals • I.C. Socket Pins
• Stitch Wiring Pins • Custom
Designed Parts

MILL-MAX is a leading manufacturer of micro and small contact parts for the Electronics Interconnect Industry.

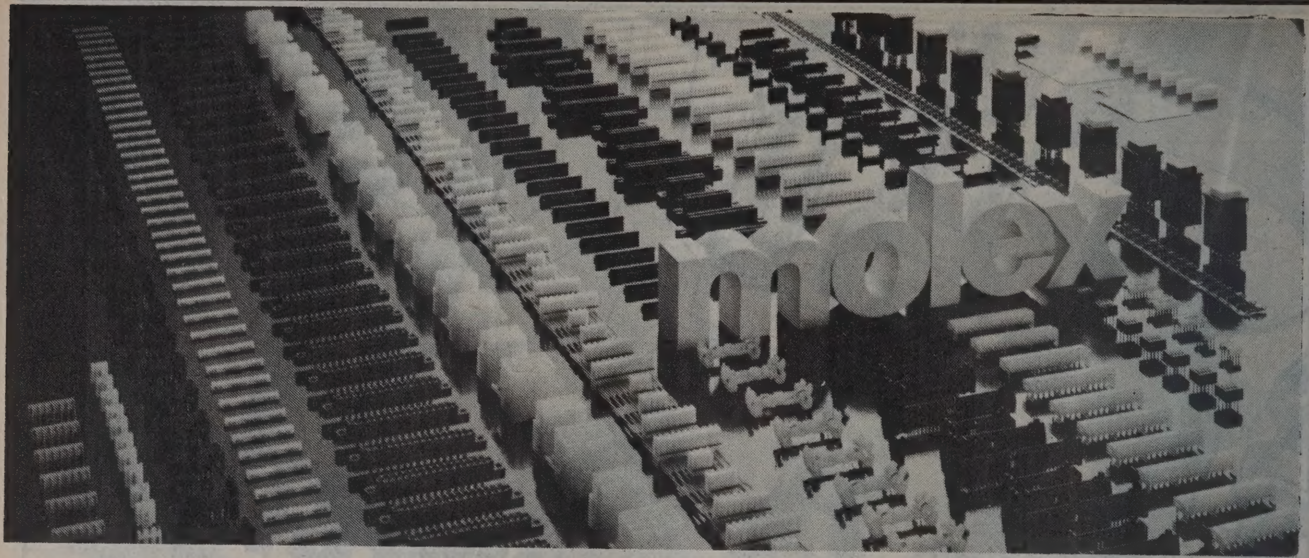
Complete in-house facilities include: Engineering, Tooling, Primary and Secondary Machining, Plating, and Assembly operations.

For quick turn-around time on a broad product line with off-the-shelf and custom connector pins, contact:

MILL-MAX MFG. CORP.
P.O. Box 300, 190 Pine Hollow Road
Dept. C, Oyster Bay, N.Y. 11771
(516) 922-6000 • TWX 510-221-1820

"LOOSE PINS ARE OUR ONLY BUSINESS"

*Wire Wrap is a trademark of Gardner Denver.



Molex ... *Service to the Customer*

At Molex, service to the customer is our number one priority. Service means TECHNOLOGY — providing well-designed, cost-effective products to lower our customers' costs. Service also means FLEXIBILITY — offering a wide range of standard products, while still being able to design and quickly get into production, custom products. It's a commitment to QUALITY — providing products of exceptionally high standards. And, above all else service means PEOPLE — Molex people, who are dedicated to meeting our customers' needs WORLDWIDE — At Molex, service to the customer means making the exceptional effort commonplace.

Molex Is ...

Molex Incorporated, established in 1938, is a leading worldwide producer of electrical components and interconnecting systems. Molex connectors, cables, sockets and switches are used in business machines, hospital equipment, washers and dryers, major kitchen appliances, heating and air conditioning systems, home entertainment units, automobiles and vending machines.

Our products save time, money, and man-hours. They are designed to make assembly, testing, and servicing easier, faster, and less costly. What sets Molex apart from others in the field is our ability to understand our customers' objectives and to quickly translate these into products which can bring about considerable applied savings.

Molex is committed to answering both the product and service needs of its customers. Our products are manufactured in 11 locations around the world. They are sold through a worldwide sales and distributor network which includes direct offices in 15 countries, and an international network of more than 45 representative organizations.

No matter where you're located, Molex can service your component needs from the original product design stages through manufacturing and final assembly.

Molex creates components to simplify circuitry ... to lower applied costs ... to increase product reliability ... We look forward to being of service.

*See Molex Product Data Vol. 2/ 1209–1232

*If your GOLD BOOK set does not include these pages, contact your nearest Molex sales office for a complete catalog.

Molex Incorporated
Costa Mesa, Ca. 92626
714/241-8588

Molex Incorporated
San Jose, Ca. 95131-2206
408/945-9060

Molex Incorporated
Englewood, Colo. 80111
303/779-8321

Molex Incorporated
Indianapolis, Ind. 46460
317-844-8986

Molex Incorporated
Louisville, Ky. 40223
404/396-6120/6121

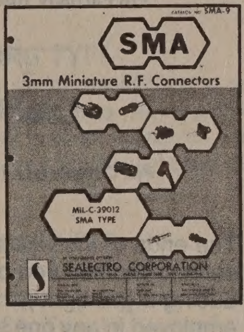
World Headquarters
Molex, Incorporated, 2222 Wellington Court, Lisle, Illinois 60532
Tel: 312-969-4550 TWX: 910-695-3229

For More Information. Circle No. 103

WORLD'S MOST COMPREHENSIVE CONNECTOR COMPENDIUM.

SOLDERLESS SMA
SEALECTRO SOLDERLESS SMA SEMI-RIGID CABLE CONNECTORS
SEALECTRO CORPORATION

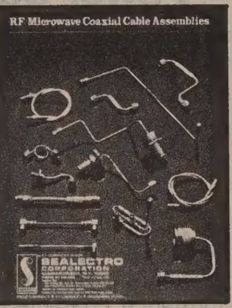
BRAND NEW! Solderless SMA Semi-Rigid Cable Connectors. A major breakthrough in semi-rigid SMA cable connectors...fully assembled without soldering! Fast, easy assembly without expensive tooling. Meets or exceeds electrical, cable retention and torque requirements of MIL-C-39012.


SMA-9
SMA
3mm Miniature R.F. Connectors
MIL-C-39012 SMA TYPE
SEALECTRO CORPORATION

SMA 3mm RF Connectors. Broadest line of SMA connector types in the industry. Six cable attachment methods. Semi-rigid designs available in thick or thin wall construction with low VSWR to 18 GHz, operational to 26 GHz.

HIGH FREQUENCY SLIDE-ON CONNECTORS
SMS
SIS
SMA PLUG
SEALECTRO

BRAND NEW! High Frequency Slide-On Connectors. New SMS connectors provide equally excellent VSWR up to and beyond 18 GHz with no degradation of reliability. Available in SMS, SSMS, SIS Intermediate, and SMA Slide-On Plugs.


RF Microwave Coaxial Cable Assemblies
SEALECTRO CORPORATION

RF & Microwave Coaxial Cable Assemblies. Complete technical data on pre-assembled flexible and semi-rigid cable assemblies to your specs, 100% guaranteed mechanically and electrically!

CONHEX
Subminiature R.F. Connectors
SEALECTRO CORPORATION

CONHEX Subminiature RF Connectors (SMB/SMC). Subminiature connectors for use from DC to 12.4 GHz. Screw-on, snap-on and slide-on types, with five cable attachment methods. For 50-ohm or 75-ohm impedance. Series SMB, series SMC per MIL-C-39012.

NANOHEX
Microminiature R.F. Connectors
SEALECTRO

NANOHEX Microminiature RF Connectors. Microminiature RF connectors (proposed types SSMB and SSMC) with 0.100 diameter jacks. Low VSWR from DC to 12.4 GHz. Screw-on, snap-on and slide-on mating types. Meet or exceed the requirements of MIL-C-39012.

Between Series Adaptors
CONHEX
SMA
KWK
NANOHEX
SEALECTRO CORPORATION

Between-Series Adaptors. CONHEX adaptors to SMA, GR-874, GR-900, APC-7, BNC, TNC, N. SMA adaptor to GR-874, GR-900, BNC, TNC, N, APC-7. NANOHEX adaptors to CONHEX (SMB/SMC), SMA, BNC.

QPL R.F. COAXIAL CONNECTORS
MIL-C-39012
SMA SMB SMC

QPL RF Coaxial Connectors. A complete 16 page catalog of Qualified Product Listings to MIL-C-39012, Series SMA, SMB, and SMC. Defines complete envelope dimensions for all designs.

SEALECTRO. THE RF CONNECTION!

FOR ULTRA RUSH SERVICE,
PHONE (914) 698-5600, EXT. 335
TWX: 310-425-501

® RF Components Division
SEALECTRO CORPORATION
Mamaroneck, NY 10543

New from Sealectro

K-Connectors* 46 GHz Coax! A complete line of precision K connectors with excellent performance to 46 GHz.

*K Connector is a registered TM of Wiltron.

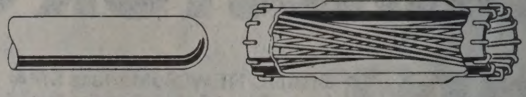
Commercial BNC's A new line of BNC connectors, including the popular crimp type cable plugs and bulkhead jack receptacles, for high volume commercial applications.

Coax DINserts 50 and 75 ohm matched impedance coaxial inserts for DIN 41612 connectors. These improved designs feature closed entry female contacts and overlapping dielectrics.

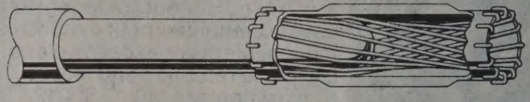
Hypertac® Connectors

The Ultimate Design for High Reliability.

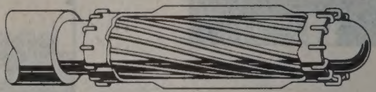
- 2-Piece P.C. Connectors
- MIL-C-55302 Approved
- Rack and Panel Connectors
- Modular Connectors
- Rectangular Connectors
- Power Connectors
- General Purpose Connectors
- ARINC 404 and 600 Series
- MIL-C-39029 Contacts



Wire Sleeve Before Insertion of Pin.



Pin Partially Inserted Into Sleeve.



Pin Completely Inserted Into Sleeve.

SI-TAC offers a complete line of connectors employing a socket design concept that results in connector performance characteristics previously considered impossible.

SI-TAC connector sockets consist of a hyperbolic-shaped socket sleeve formed by gold plated wires passing through a tubular wire-carrier at an angle to the axis of the carrier.

The ends of the wire are bent around the end of the carrier, and secured by the outer contact shank, producing a gas-tight joint. A minimum of five wires are employed in any one socket contact.

As the contact pin is inserted into the socket, each wire of the socket deflects (within it's elastic limit) simultaneously wrapping itself around the pin. Each socket wire thus forms a long, separate, helical contact-path along the pin.

HYPERTAC® CONTACT DESIGN FEATURES:

LOW CONTACT RESISTANCE: Circumfluent contact action generated by the wire carrier provides greater surface contact area and redundant electrical circuit paths.

LOW MATING FORCE: Tubular wire carrier socket design, eliminating the high normal forces required for conventional pin and socket integrity, reduces contact mating and demating forces while maintaining an excellent surface wiping action.

SUPERIOR ELECTRICAL INTEGRITY UNDER SHOCK AND VIBRATION: Multiple contact points and the compressive loads applied by the socket tubular wire carrier ensure greater electrical continuity regardless of direction, magnitude and frequency of the applied vibration.

DURABILITY, LONG LIFE, LOW RATE OF WEAR: Greater than 100,000 mating and demating cycles with minimal degradation of performance are typical.

RELIABILITY: The combination of the above features with years of field usage and history ensures the ultimate in contact integrity.

CONTACT SIZE: Available from size 22 AWG signal contacts to 4/0 AWG power contact.

CURRENT RATINGS: Off-the-shelf designs are available with ratings from 1 ampere to 250 ampere.

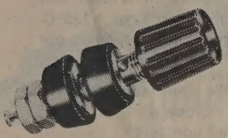
SI INDUSTRIES INC.

Building 207, 15251 Roosevelt Blvd., Clearwater, Florida 33520
Telephone (813) 536-5933 Telex 808730

For More Information. Circle No. 105

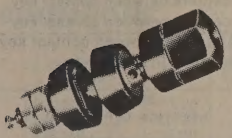
5-way® BINDING POSTS

5 WAYS TO CONNECT ● GOLD-PLATED BRASS PARTS ● RANGE OF COLORS



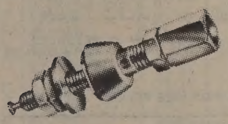
FLUTED NUT TYPES

Plastic parts of standard (not miniature) size types molded of Lexan polycarbonate resin; brass parts are gold-plated. Rated for 30 amperes, 1000 volts working.



HEX NUT TYPES

Rated for 30 amperes, 1000 volts working. Brass parts gold-plated; plastic parts are of nylon compounded to meet military specifications MIL-P-20693A, Type IV.



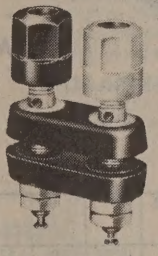
GROUNDING TYPE

For making rapid connections to ground. Made of finely machined brass nickel-plated and polished. Panel grounding collar frozen to shaft has "D" type shoulder for locking in keyed panel hole.

MINIATURE TYPES

Fluted nut design. Rated for 15 amperes, 1000 volts working. Nylon parts meet military specification MIL-P-20693A, Type IV. Limited clearances between insulated and current-carrying parts on BP21 types minimize possibility of accidental contact.

DOUBLE ASSEMBLY TYPES

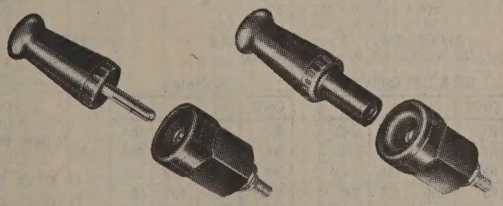


For instrument and equipment panels requiring binding posts mounted on ¾" centers. Rated for a current capacity of 30 amperes and a working voltage of 1000 volts. Brass parts are gold-plated; panel insulators in black only. Self-contained assembly makes mounting more accurate, faster and easier than two individual binding posts and gives maximum strength where connections are frequently made.

STYLE	TYPE
Fluted Nut – Standard	DF31*
Hex Nut – Standard	DF30*
Grounding – All Metal	GP30NC
Fluted Nut – Miniature	DF21*
Fluted Nut – Mini Ltd. Clear.	BP21*
DOUBLE ASSEMBLY TYPE	
Black & Red Hex Nut	DF30-2-BRC

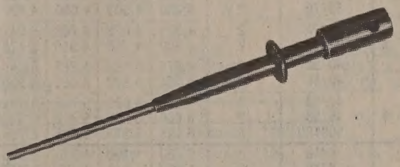
*Indicate color desired: red, white, blue, black, yellow or green.

SUPERCON®
ELECTRICAL CONNECTORS



Nylon plastic parts; gold-plated brass current-carrying parts. Wiring connections to the same plug can be either soldered or solderless. Plug cable-fastening screws permit a wide range of cable sizes. Plug grips are of a simple, two-piece threaded construction for quick assembly. All receptacle plastic parts are molded of the same color to permit more rapid and accurate circuit identification front and back of panel when installed. The 25, 50 and 100 ampere types are listed by Underwriters' Laboratories, Inc. In red, black, white, blue, green or yellow.

5-WAY™
TEST PROBES



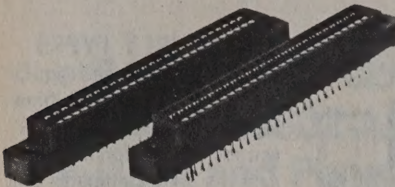
For test connections to PC boards and other electronic components. Design allows connections by hooking onto component leads or by plugging into Superior Electric 207146-001-JB terminals or others having 0.080" diameter receptacles. For plug-in, conductor holds firmly to inside of receptacle under spring tension. When used for hook-on, probe clamps to component lead or wire wrapping pin with approximately 16 oz. force. Conductor beryllium copper tempered to spring hardness. Insulating parts durable nylon plastic capable of withstanding 250°F without deforming. Available in red, black, white, blue, green or yellow.

THE SUPERIOR ELECTRIC COMPANY

383G Middle St., Bristol, CT 06010/Telephone: (203) 582-9561/Telex: 962-446

Sullins ELECTRONICS CORP. / EDGECARD CONNECTORS

EZ SERIES—LOW PROFILE DIP SOLDER/ EYELET



FEATURES

- Insulation Resistance: 5,000 Megohms
- Solvent Resistance: Perchloroethylene Freon 113, Freon 11, Trichloroethylene
- Operating Voltage (At sea level): 600 VDC, 800 VDC, 1800 VDC, for contact centers of .100, .125, .156, respectively
- Current Rating: 3 amperes
- Voltage Drop: 30 MV at rated current
- Contact Resistance: 10 milliohms maximum
- Operating Temperature: −65°C to +125°C
- Board Insertion Force: 16 ozs maximum per contact pair using .062 steel test blade
- Board Withdrawal Force: 1 oz minimum per contact pair using .054 steel test blade
- Accommodates .062 PC board
- Bifurcated full bellows contacts

MATERIALS

- Insulator: Glass filled thermoplastic polyester (Blue Valox*) or polyphenylene sulfide (green Ryton*)
- Contacts: Copper alloy contacts with gold over nickel plating on contact surface; tin/lead or gold over nickel on the tail

* (Trademarks: General Electric Valox, Philips 66 Ryton)

POLARIZATION KEYS

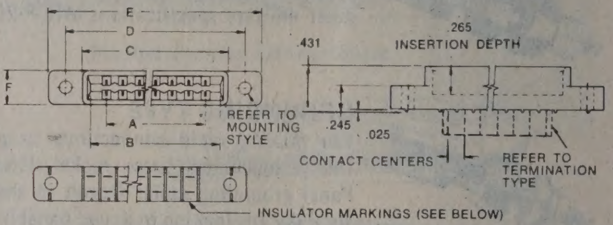
- P/N PLA-K1 for .100 centers between contact key
- P/N PLA-K1 for .125 centers between contact key
- P/N PLM-K1 for .156 centers between contact key
- P/N PLM-K2 for .156 centers in position key

DIMENSIONS

	Part Number†	Number of Contacts	Contact ID TYPE	A	B	C	D	E	F	G
.100 CONTACT CENTERS	EZC06D _ _	6/12	1	0.500	0.700	0.875	1.175	1.475	.330	.100
	EZC08D _ _	8/16	1	0.700	0.900	1.075	1.375	1.675	.330	.100
	EZC10D _ _	10/20	1	0.900	1.100	1.275	1.575	1.875	.330	.100
	EZC12D _ _‡	12/24	1	1.100	1.300	1.475	1.775	2.075	.330	.100
	EZC13D _ _	13/26	1	1.200	1.400	1.575	1.875	2.175	.330	.100
	EZC15D _ _	15/30	1	1.400	1.600	1.775	2.075	2.375	.330	.100
	EZC18D _ _	18/36	1	1.700	1.900	2.075	2.375	2.675	.330	.100
	EZC19D _ _	19/38	1	1.800	2.000	2.175	2.475	2.775	.330	.100
	EZC20D _ _	20/40	1	1.900	2.100	2.275	2.575	2.875	.330	.100
	EZC22D _ _	22/44	1	2.100	2.300	2.475	2.775	3.075	.330	.100
	EZC25D _ _	25/50	1	2.400	2.600	2.775	3.075	3.375	.330	.100
	EZC26D _ _	26/52	1	2.500	2.700	2.875	3.175	3.475	.330	.100
	EZC28D _ _	28/56	1	2.700	2.900	3.075	3.375	3.675	.330	.100
	EZC30D _ _	30/60	1	2.900	3.100	3.275	3.575	3.875	.330	.100
	EZC31D _ _‡	31/62	1	3.000	3.200	3.375	3.675	3.975	.330	.100
	EZC35D _ _	35/70	1	3.400	3.600	3.775	4.075	4.375	.400	.100
	EZC36D _ _	36/72	1	3.500	3.700	3.875	4.175	4.475	.400	.100
	EZC40D _ _	40/80	1	3.900	4.100	4.275	4.575	4.875	.400	.100
	EZC43D _ _	43/86	1	4.200	4.400	4.575	4.875	5.175	.400	.100
	EZC44D _ _	44/88	1	4.300	4.500	4.675	4.975	5.275	.400	.100
	EZC49D _ _‡	49/98	1	4.800	5.000	5.175	5.475	5.775	.400	.100
	EZC50D _ _	50/100	1	4.900	5.100	5.275	5.575	5.875	.400	.100
	EZC60D _ _	60/120	1	5.900	6.100	6.275	6.575	6.875	.400	.100
.125 CONTACT CENTERS	EZA06D _ _‡	6/12	2	0.625	0.875	1.035	1.295	1.575	.330	.125
	EZA10D _ _	10/20	2	1.125	1.375	1.535	1.795	2.075	.330	.125
	EZA14D _ _‡	14/28	2	1.625	1.875	2.035	2.295	2.575	.330	.125
	EZA15D _ _	15/30	2	1.750	2.000	2.160	2.420	2.700	.330	.125
	EZA18D _ _	18/36	2	2.125	2.375	2.535	2.795	3.075	.330	.125
	EZA22D _ _	22/44	2	2.625	2.875	3.035	3.295	3.575	.330	.125
	EZA28D _ _	28/56	2	3.375	3.625	3.785	4.045	4.325	.330	.125
	EZA30D _ _	30/60	2	3.625	3.875	4.035	4.295	4.575	.330	.125
	EZA31D _ _	31/62	2	3.750	4.000	4.160	4.420	4.700	.330	.125
	EZA35D _ _	35/70	2	4.250	4.500	4.660	4.920	5.200	.330	.125
	EZA36D _ _	36/72	2	4.375	4.625	4.785	5.045	5.325	.330	.125
	EZA37D _ _‡	37/74	2	4.500	4.750	4.910	5.170	5.450	.330	.125
	EZA40D _ _	40/80	2	4.875	5.125	5.285	5.545	5.825	.370	.125
	EZA43D _ _	43/86	2	5.250	5.500	5.660	5.920	6.200	.370	.125
	EZA44D _ _	44/88	2	5.375	5.625	5.785	6.045	6.325	.370	.125
	EZA49D _ _‡	49/98	2	6.000	6.250	6.410	6.670	6.950	.370	.125
	EZA50D _ _	50/100	2	6.125	6.375	6.535	6.795	7.075	.370	.125
.156 CONTACT CENTERS	EZM06D _ _	6/12	3	0.780	1.100	1.220	1.533	1.783	.325	.156
	EZM08D _ _	8/16	3	1.092	1.412	1.532	1.845	2.095	.325	.156
	EZM10D _ _	10/20	3	1.404	1.724	1.844	2.157	2.407	.325	.156
	EZM11D _ _	11/22	3	1.560	1.880	2.000	2.313	2.563	.325	.156
	EZM12D _ _	12/24	3	1.716	2.036	2.156	2.469	2.719	.325	.156
	EZM15D _ _	15/30	3	2.184	2.504	2.624	2.937	3.187	.325	.156
	EZM18D _ _	18/36	3	2.652	2.972	3.092	3.405	3.655	.325	.156
	EZM22D _ _	22/44	3	3.276	3.596	3.716	4.029	4.280	.325	.156
	EZM24D _ _	24/48	3	3.588	3.908	4.028	4.341	4.591	.325	.156
	EZM25D _ _	25/50	3	3.744	4.064	4.184	4.497	4.747	.325	.156
	EZM28D _ _	28/56	4	4.212	4.532	4.652	4.964	5.215	.438	.156
	EZM36D _ _	36/72	4	5.460	5.780	5.906	6.219	6.463	.438	.156
	EZM43D _ _	43/86	4	6.552	6.872	7.000	7.302	7.555	.500	.156

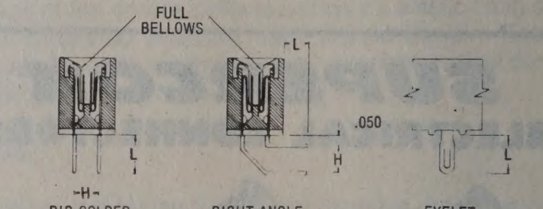
† For complete part number, add termination type and mounting style from PART NUMBER CODING (e.g.: EZC22DRTH).

‡ Consult Factory for availability.



CONTACT ID TYPE	INSULATOR MARKINGS LETTERS G, I, 0 & Q NOT USED
1	B 1 2 .... 23 24 .... 45 46 .... B A 1 2 .... 23 24 .... 45 46 .... A
2	1 2 .... 23 24 .... 45 46 .... A B .... a b .... AA BB ....
3	1 2 .... 23 24 .... 45 46 .... A B .... AA BB .... a b ....
4	1 2 .... 23 24 .... 45 46 .... A B .... A B .... a b ....

TERMINATION TYPE



DIP SOLDER
(RT, RK, RY, RX, RU, RJ)

RIGHT ANGLE
(RA)

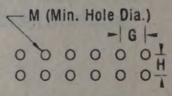
EYELET
(RE)

.100 & .125 Centers

CODE	H	L	M
RT	.140	.200	.043
RY	.140	.425	.043
RX	.200	.185	.043
RJ	.250	.165	.043
RA	.156	.125	.043
RE	.140	.225	N/A

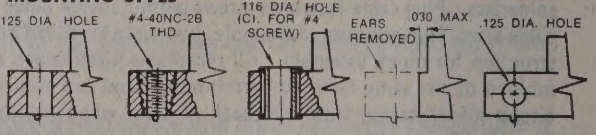
.156 Centers

CODE	H	L	M
RT	.140	.137	.051
RK	.140	.225	.051
RY	.140	.422	.051
RX	.200	.137	.051
RU	.200	.225	.051
RA	.156	.125	.051
RE	.140	.225	N/A



PCB LAYOUT

MOUNTING STYLE



CLEARANCE HOLE (H)

THREADED INSERT (I)

FLOATING BOBBIN (F)

NO MOUNTING EARS (N)

SIDE MOUNTING (S)

PART NUMBER CODING

EXAMPLE: E Z C 22 D RT H

MATERIALS
E = Valox/Copper Alloy (Standard)
R = Ryton/Copper Alloy (Special)
H = Valox/Beryllium Copper (Special)
A = Ryton/Beryllium Copper (Special)

PLATING

Contact Surface	Termination
Z = .000010 Gold	.000100 Tin/Lead
X = .000030 Gold	.000100 Tin/Lead
G = .000010 Gold	.000005 Gold
Y = .000030 Gold	.000005 Gold

MOUNTING (SEE ABOVE) — H, I, F, N, or S

TERMINATION TYPE (SEE TABLE)
RA, RE, RT, RK, RY, RX, RU, or RJ

READOUT — D = Dual

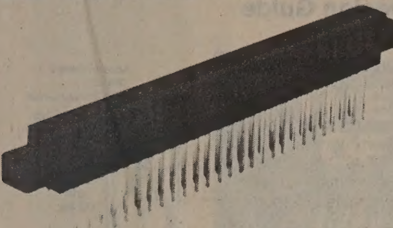
NUMBER OF POSITION — 06 thru 60

CONTACT CENTERS — C = .100, A = .125, M = .156

SULLINS ELECTRONICS CORPORATION / P.O. Box 189', San Marcos, CA 92069 / (619) 744-0125 / TWX 910-322-1472

Sullins ELECTRONICS CORP. / EDGECARD CONNECTORS

EZ SERIES—HIGH PROFILE DIP SOLDER/WIRE WRAP*



FEATURES

- Insulation Resistance: 5,000 Megohms
- Solvent Resistance: Perchloroethylene Freon 113, Freon 11, Trichloroethylene
- Operating Voltage (At sea level): 600 VDC, 800 VDC, 1800 VDC, for contact centers of .100, .125, .156, respectively
- Current Rating: 3 amperes

MATERIALS

- Insulator: Glass filled thermoplastic polyester (Blue Valox)
- Contacts: Copper alloy contacts with gold or tin/lead over nickel plating

* Trademark of Gardner Denver

- Voltage Drop: 30 MV at rated current
- Contact Resistance: 10 milliohms maximum
- Operating Temperature: −65°C to +125°C
- Board Insertion Force: 16 ozs maximum per contact pair using .062 steel test blade
- Board Withdrawal Force: 1 oz minimum per contact pair using .054 steel test blade
- Accommodates .062 PC board
- Bifurcated bellows contacts

POLARIZATION KEYS

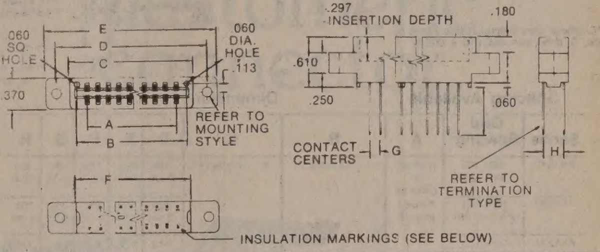
- P/N PLC-K1 (Order separately) for between contact polarization

DIMENSIONS

	Part Number*	No. of Contacts	Contact ID Type	A	B	C	D	E	F	G	H
.100 CONTACT CENTERS	EZC 10D _ _	10/20	5	0.900	1.000	1.260	1.575	1.835	1.150	.100	.200
	EZC 12D _ _	12/24	5	1.100	1.300	1.460	1.775	2.035	1.350	.100	.200
	EZC 15D _ _	15/30	5	1.400	1.600	1.760	2.075	2.335	1.650	.100	.200
	EZC 18D _ _	18/36	5	1.700	1.900	2.060	2.375	2.635	1.950	.100	.200
	EZC 20D _ _	20/40	5	1.900	2.100	2.260	2.575	2.835	2.150	.100	.200
	EZC 22D _ _	22/44	5	2.100	2.300	2.460	2.775	3.035	2.350	.100	.200
	EZC 25D _ _	25/50	5	2.400	2.600	2.760	3.075	3.335	2.650	.100	.200
	EZC 28D _ _	28/56	5	2.700	2.900	3.060	3.375	3.635	2.950	.100	.200
	EZC 30D _ _	30/60	5	2.900	3.100	3.260	3.575	3.835	3.150	.100	.200
	EZC 31D _ _	31/62	5	3.000	3.200	3.360	3.675	3.935	3.250	.100	.200
	EZC 35D _ _	35/70	5	3.400	3.600	3.760	4.075	4.335	3.650	.100	.200
	EZC 36D _ _	36/72	5	3.500	3.700	3.860	4.175	4.435	3.750	.100	.200
	EZC 40D _ _	40/80	5	3.900	4.100	4.260	4.575	4.835	4.150	.100	.200
	EZC 43D _ _	43/86	5	4.200	4.400	4.560	4.875	5.135	4.450	.100	.200
	EZC 44D _ _	44/88	5	4.300	4.500	4.660	4.975	5.235	4.550	.100	.200
	EZC 49D _ _	49/98	5	4.800	5.000	5.160	5.475	5.735	5.050	.100	.200
	EZC 50D _ _	50/100	5	4.900	5.100	5.260	5.575	5.835	5.150	.100	.200
	EZC 55D _ _**	55/110	5	5.400	5.600	5.760	6.075	6.335	5.650	.100	.200
	EZC 60D _ _	60/120	5	5.900	6.100	6.260	6.575	6.835	6.150	.100	.200
	EZC 61D _ _	61/122	5	6.000	6.200	6.360	6.675	6.935	6.250	.100	.200
	EZC 65D _ _	65/130	5	6.400	6.600	6.760	7.075	7.335	6.650	.100	.200
	EZC 70D _ _	70/140	5	6.900	7.100	7.260	7.575	7.835	7.150	.100	.200
.125 CONTACT CENTERS	EZA 06D _ _**	6/12	5	0.625	0.875	1.035	1.295	1.555	0.875	.125	.250
	EZA 10D _ _	10/20	5	1.125	1.375	1.535	1.795	2.055	1.375	.125	.250
	EZA 14D _ _**	14/28	5	1.625	1.875	2.035	2.295	2.555	1.875	.125	.250
	EZA 15D _ _	15/30	5	1.750	2.000	2.160	2.420	2.680	2.000	.125	.250
	EZA 18D _ _	18/36	5	2.125	2.375	2.535	2.795	3.055	2.375	.125	.250
	EZA 22D _ _	22/44	5	2.625	2.875	3.035	3.295	3.555	2.875	.125	.250
	EZA 24D _ _**	24/48	5	2.875	3.125	3.285	3.545	3.805	3.125	.125	.250
	EZA 28D _ _	28/56	5	3.375	3.625	3.785	4.045	4.305	3.625	.125	.250
	EZA 30D _ _	30/60	5	3.625	3.875	4.035	4.295	4.555	3.875	.125	.250
	EZA 31D _ _	31/62	5	3.750	4.000	4.160	4.420	4.680	4.000	.125	.250
	EZA 32D _ _	32/64	5	3.875	4.125	4.285	4.545	4.805	4.125	.125	.250
	EZA 35D _ _	35/70	5	4.250	4.500	4.660	4.920	5.180	4.500	.125	.250
	EZA 36D _ _	36/72	5	4.375	4.625	4.785	5.045	5.305	4.625	.125	.250
	EZA 40D _ _	40/80	5	4.875	5.125	5.285	5.545	5.805	5.125	.125	.250
	EZA 43D _ _	43/86	5	5.250	5.500	5.660	5.920	6.180	5.500	.125	.250
	EZA 44D _ _	44/88	5	5.375	5.625	5.785	6.045	6.305	5.625	.125	.250
	EZA 49D _ _	49/98	5	6.000	6.250	6.410	6.670	6.930	6.250	.125	.250
	EZA 50D _ _	50/100	5	6.125	6.375	6.535	6.795	7.055	6.375	.125	.250
.156 CONTACT CENTERS	EZM06D _ _	6/12	6	0.780	1.102	1.221	1.534	1.784	1.030	.156	.200
	EZM08D _ _**	8/16	6	1.092	1.414	1.533	1.846	2.096	1.342	.156	.200
	EZM10D _ _	10/20	6	1.404	1.726	1.845	2.158	2.408	1.654	.156	.200
	EZM12D _ _	12/24	6	1.716	2.038	2.157	2.470	2.720	1.966	.156	.200
	EZM15D _ _	15/30	6	2.184	2.506	2.625	2.938	3.188	2.434	.156	.200
	EZM18D _ _	18/36	6	2.652	2.974	3.093	3.406	3.656	2.902	.156	.200
	EZM20D _ _**	20/40	6	2.964	3.286	3.405	3.718	3.968	3.214	.156	.200
	EZM22D _ _	22/44	6	3.276	3.598	3.717	4.030	4.330	3.526	.156	.200
	EZM24D _ _	24/48	6	3.588	3.910	4.029	4.342	4.642	3.838	.156	.200
	EZM25D _ _	25/50	6	3.744	4.066	4.185	4.498	4.748	3.994	.156	.200
	EZM28D _ _	28/56	7	4.212	4.534	4.653	4.966	5.216	4.462	.156	.200
	EZM30D _ _	30/60	6	4.524	4.846	4.965	5.278	5.528	4.774	.156	.200
	EZM31D _ _	31/62	7	4.680	5.002	5.121	5.434	5.684	4.930	.156	.200
	EZM36D _ _	36/72	8	5.460	5.782	5.901	6.214	6.464	5.710	.156	.200
	EZM40D _ _	40/80	8	6.084	6.406	6.525	6.838	7.088	6.334	.156	.200
	EZM43D _ _	43/86	8	6.552	6.874	6.993	7.306	7.556	6.802	.156	.200

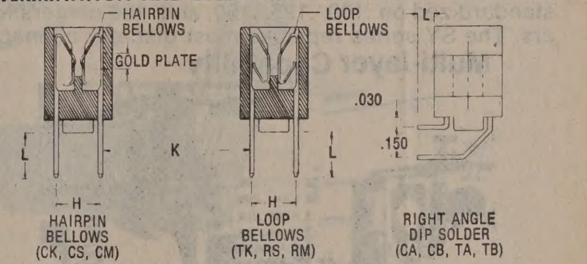
* For complete part number, add termination type and mounting style from PART NUMBER CODING (e.g.: EZA40DRMH).

** Consult factory for availability.



CONTACT ID TYPE	INSULATOR MARKINGS LETTERS G, I, O & Q NOT USED
5	1 3 .... 45 47 .... 89 91 .... 2 4 .... 46 48 .... 90 92 ....
6	1 2 .... 23 24 .... 45 46 .... A B .... $\underline{A}$ $\underline{B}$ .... a b ....
7	1 2 .... 23 24 .... 45 46 .... A B .... $\overline{A}$ $\overline{B}$ .... a b ....
8	A B .... $\underline{A}$ $\underline{B}$ .... a b .... 1 2 .... 23 24 .... 45 46 ....

TERMINATION AND BELLOWS TYPE

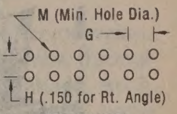


HAIRPIN BELLOWS (CK, CS, CM)

LOOP BELLOWS (TK, RS, RM)

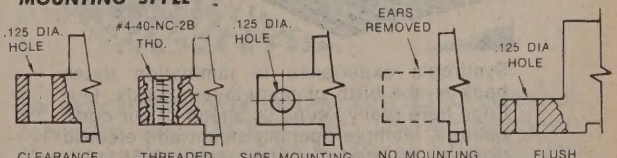
RIGHT ANGLE DIP SOLDER (CA, CB, TA, TB)

HAIRPIN	LOOP	TERMINATION	K	L	M
CK	TK	Dip Solder	.026 Round	.190	.030
CS	RS	Dip Solder	.025 Square	.190	.040
CM	RM	Wire Wrap	.025 Square	.560	.040
CA	TA	Right Angle	.025 Square	.100	.043
CB	TB	Right Angle	.025 Square	.180	.043



PCB LAYOUT

MOUNTING STYLE



CLEARANCE HOLE (H)

THREADED INSERT (I)

SIDE MOUNTING HOLE (S)

NO MOUNTING EARS (N)

FLUSH MOUNTING (D) W/INSERT (T)

PART NUMBER CODING

EXAMPLE: E Z C 22 D CS H

MATERIALS
E = Valox/Copper Alloy

PLATING

Contact Surface	Termination
Z = .000010 Gold	.000100 Tin/Lead
X = .000030 Gold	.000100 Tin/Lead
G = .000010 Gold	.000005 Gold
Y = .000030 Gold	.000005 Gold

CONTACT CENTERS
C = .100, A = .125, M = .156

MOUNTING (SEE ABOVE) — H, I, S, N, D, or T

TERMINATION TYPE (SEE TABLE)

Hairpin Bellows	Loop Bellows
CS = .025 x .025 dip solder	RS = .025 x .025 dip solder
CK = .026 round dip solder	TK = .026 round dip solder
CM = .025 x .025 wire wrap	RM = .025 x .025 wire wrap
CA = right angle dip solder	TA = right angle dip solder
CB = right angle dip solder	TB = right angle dip solder

READOUT — D = Dual

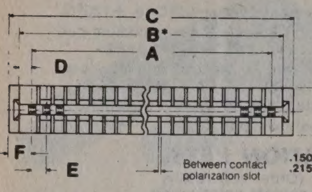
NUMBER OF POSITION — 06 thru 70

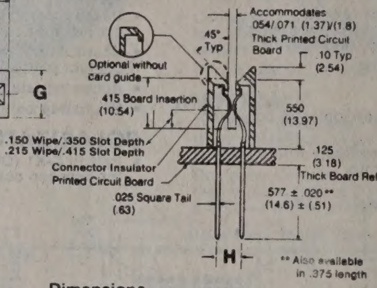
SULLINS ELECTRONICS CORPORATION / P.O. Box 189 , San Marcos, CA 92069 / (619) 744-0125 / TWX 910-322-1472

Pressfit Backpanels and Multi-Layer Boards . . . .

For Connectors with .350 in. and .415 in. slot depth

PK Series


C
B*
A
D
G
F
E
Between contact polarization slot


Accommodates 054/ 071 (1.37)/(1.8) Thick Printed Circuit Board
45° Typ
Optional without card guide
.10 Typ (2.54)
415 Board Insertion (10.54)
550 (13.97)
.150 Wipe/.350 Slot Depth
.215 Wipe/.415 Slot Depth
Connector Insulator
Printed Circuit Board
.125 (3.18) Thick Board Ref
.025 Square Tail (.63)
577 ± .020** (14.6) ± (.51)
H

** Also available in .375 length

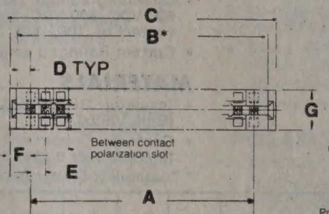
*Customer card mating edge length to be the "B" dimension less .010 ± .005 in

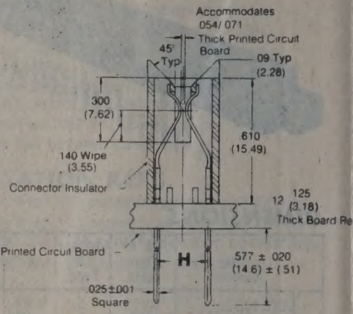
Spacing Available		Dimensions								
Series	Grid Spacing	A	B	C	D	E	F	G	H
PK1010	100x 100 (2.54)x (2.54)	Number of contacts minus 1 times E	A · (2 times D)	A · (2 times F)	100 (2.54)	100 (2.54)	180 (4.57)	.382 (9.7)	100 (2.54)
PK1020	100x 200 (2.54)x(5.08)				100 (2.54)	100 (2.54)	180 (4.57)	382 (9.7)	200 (5.08)
PK1212	125x 125 (3.18)x(3.18)				115 (2.92)	125 (3.18)	180 (4.57)	354 (8.99)	125 (3.18)
PK1225	125x 250 (3.18)x(6.35)				125 (3.18)	125 (3.18)	180 (4.57)	354 (8.99)	250 (6.35)
PK1562	156x 200 (3.96)x(5.08)				156 (3.96)	156 (3.96)	218 (5.54)	324 (8.2)	200 (5.08)
PK1515	150x 150 (3.8)x(3.8)				145 (3.68)	150 (3.8)	210 (5.3)	354 (8.99)	150 (3.8)

Press-fit Connector Design Guide

For Connectors with .300 in. Slot Depth

SY Series


C
B*
D TYP
G
F
E
Between contact polarization slot
A


Accommodates 054/ 071 Thick Printed Circuit Board
45° Typ
09 Typ (2.28)
300 (7.62)
610 (15.49)
140 Wipe (3.55)
Connector Insulator
12 125 (3.18) Thick Board Re
Printed Circuit Board
H
577 ± 020 (14.6) ± (.51)
.025±.001 Square

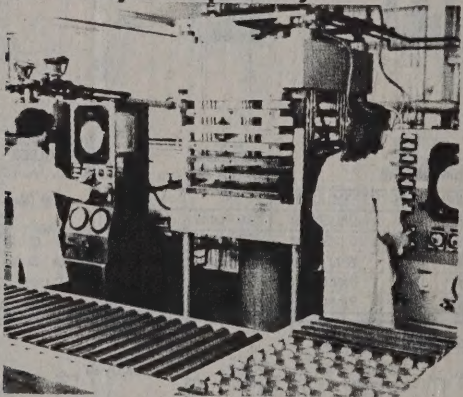
*Customer card mating edge length to be the "B" dimension less .010 ± .005 in

Spacing Available		Dimensions								
Series	Grid Spacing	A	B	C	D	E	F	G	H
SY1020	100x 200 (2.54)x(5.08)	Number of contacts minus 1 times E	A · (2 times D)	A · (2 times F)	100 (2.54)	100 (2.54)	180 (4.57)	370 (9.39)	200 (5.08)
SY1225	125x 250 (3.18)x(6.35)				125 (3.18)	125 (3.18)	180 (4.57)	370 (9.39)	250 (6.35)

PCB Connector Backpanel Systems

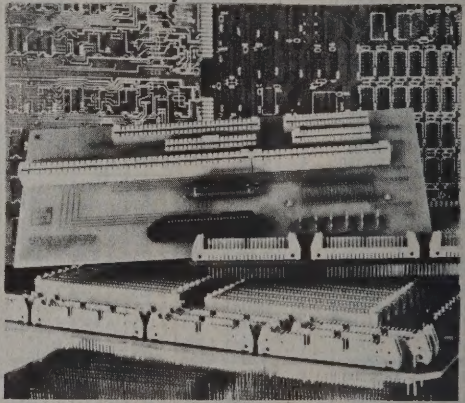
The solderless press-fit connector concept, first produced in 1970, offers an extremely reliable, low cost method of interconnection in electronic packaging. Press-fit is widely used in backpanel applications by manufacturers of main frame computer, peripheral and tele-communications equipment. The PK Series of press-fit contacts is standardized on .100, .125, .150, and .156 centers for ease of interchangeability with other backpanel manufacturers. The SY series replaces most discrete connectors.

Multi-layer Capability



Symtron's experience in lamination dates back to the birth of multi-layer boards. Our Edge here really keeps us ahead of our competitors. Multiple opening steam and electric presses are used. Qualified to MIL-P-55110C.

Pressfit Capabilities



Along with the Standard Product Lines, Symtron offers Pressfit Terminal Blocks, subminiature D connectors, Vertical Headers, DIN, and Telephone Connectors.

Symtron Corporation
2415 East Charleston Road
Mountain View, CA 94043
Telephone: (415) 965-4500
TWX: 910-379-5002

Symtron Corporation
4140 Billy Mitchell Dr.
Addison, Texas 75001
(214) 233-8991
TWX: 910-860-5283

Southwest Regional Office
Telephone: (213) 961-4536

Rocky Mountain Office
Telephone (303) 642-7656

Arizona Regional Office
(602) 978-6595

East Coast Regional Office
Telephone: (603) 431-6296

Mid-West Regional Office
(612) 934-8318

Symtron Corporation

The Leading Edge in Printed Circuit and Backpanel Technology

SEE IMMEDIATE ACTION CARD VOL. 4

For More Information. Circle No. 108

Unless it's from TECKNIT,® it's not really a ZEBRA® elastomeric connector.

THE DAY OF THE
BY TECKNIT
ZEBRA® TIME
LCD Microsystems, Inc. Clock
Beckman Instruments, Inc Tech 300 DMM
Microvision
BOWLING
Milton Bradley MB Communications Microvision Game
Texas Instruments, Inc. TI-1750 Calculator

The Day of the ZEBRA® elastomeric connector is here and the reasons are clear. Only the ZEBRA elastomeric connector provides a simple, cost effective connection between the contact pads of printed circuit boards and liquid crystal displays (LCD's).

The ZEBRA elastomeric connector is constructed of alternating layers of conductive and nonconductive silicone rubber, permitting high density interface connections as close as 0.010" centerline-to-centerline. You also get nonabrasive contacts and superior shock and vibration protection. The seal is gas-tight making it resistant to humid and harsh environments.

The Day of the ZEBRA elastomeric connector means convenience during manufacturing and assembly through its ease of installation and reduction in breakage. Applications are almost endless — clocks, calculators, home appliances, test instruments and auto engine read-outs, to name just a few.

For more information on the Day of the ZEBRA elastomeric connector, write TECKNIT, Inc., 129 Dermody Street, Cranford, New Jersey 07016. Phone (201) 272-5500, TWX (710) 996-5951, TELEX 685-3079:TCKNT.

TECKNIT® *a TWP company*

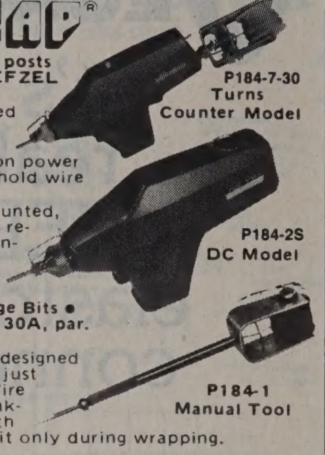
® REGISTERED TRADEMARK OF TECKNIT, INC.

For More Information. Circle No. 109

WIRE WRAPPING TOOLS, P.C. CARDS, TERMINALS, VECTORBORD®

SLIT-N-WRAP®

wiring tools — wire for .025" sq. posts P184 SERIES FOR 28 GAGE TEFZEL INSULATED WIRE



- 300' & 50' wire spools mounted with tension regulators to reduce wire breakage.
- Removable wire-grip housing on power tools eliminates need to hand-hold wire end at start of wrap.
- Replaceable bits, set-screw mounted, simplify maintenance & insure reliability, reduce costs and downtime.

No Stripping • No Precutting • No Premeasuring • No Loading • Daisy Chain Wraps • Quick Change Bits • Reliable Wraps Meet MIL-STD 1130A, par. 5.6 • U. S. & Foreign Patents

The patented tool has a specially designed tip which slits the wire insulation just before it is wrapped on a post. Wire feeds from a spool on the tool making "daisy chain" connections with single level wraps. Insulation is slit only during wrapping.

MANUAL SLIT-N-WRAP TOOLS

P184-1. Supplied with two 50' spools of 28 ga. Tefzel wire, tension regulator wire spool bracket, wrap bit No. 02, P183 cutoff and forming tool.

P184-6. Same as P184-1 except supplied with two 75' spools of 30 ga. Tefzel wire and No. 04 wrap bit.

TURNS COUNTER 110V AC SLIT-N-WRAP TOOLS

P184-7-28. Electronic 7-turn counter, also adjustable to 3, 5, 9 turns or continuous run, assures uniform number of turns for each pull of trigger. Supplied with 300' spool of Tefzel 28 ga. wire with tension regulator wire spool bracket, wrap bit No. 02, P183 cutoff and forming tool, external power transformer with cord. 2-piece wrap bit shaft with stationary wire grip avoids need to hold wire end at start of wrap.

P184-7-30. Same as P184-7-28 except supplied with No. 04 bit and 200' spool of 20 ga. Tefzel wire.

CONTINUOUS RUN SLIT-N-WRAP POWER TOOLS

P184-3S. 110V AC with external power transformer and cord, P183 cutoff and forming tool Order bits, wire spools and wire bracket separately (see table below).

P184-2S. DC with nickel/cadmium battery, AC recharging unit, P183 cutting and forming Tool. Order bits, wire spools and bracket separately (see table below).

ALL SLIT-N-WRAP TOOLS CAN BE USED WITH ALL SLIT-N-WRAP & CONVENTIONAL WRAP BITS AND WIRE TYPES LISTED BELOW.

Set-Screw Mounted Wrapping Bits for Easy Low Cost Replacement. For Use With All Slit-N-Wrap Tools

Part No.	Type	For Use With Wire AWG	Wiring Method
01	Polyurethane	28	Slit-N-Wrap
02	Tefzel	28	Slit-N-Wrap
03	Kynar	26-30	Conventional Wrap
04	Tefzel	30	Slit-N-Wrap

WIRE FOR SLIT-N-WRAP METHOD

Tefzel Insulated Silver Plated Wire
FOR USE WITH 02 BIT

Part No.	AWG	Color	Feet Per Spool
W28-6A	28	Green	50
W28-6B	29	Red	50
W28-6D	28	Blue	50
W28-6E	28	White	50
W28-6F	28	Yellow	50
W28-6H	28	Black	50
W28-6AS	28	Green	300
W28-6BS	28	Red	300
W28-6DS	28	Blue	300
W28-6ES	28	White	300
W28-6FS	28	Yellow	300

FOR USE WITH 04 BIT

Part No.	AWG	Color	Feet Per Spool
W30-6E	30	White	200
W30-6D	30	Blue	200
W30-6J	30	Orange	200
W30-6F	30	Yellow	200
W30-6ET75	30	White	75
W30-6DT75	30	Blue	75
W30-6JT75	30	Orange	75
W30-6FT	30	Yellow	75

Polyurethane-Nylon Insulated Wire For Use With No. 01 Bit.

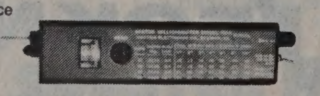
Part No.	AWG	Color	Feet Per Spool
W28-2-A	28	Green	100'
W28-2-B	28	Red	100'
W28-2-C	28	Clear	100'
W28-2-D	28	Blue	100'

Wire For Conventional Wire Wrapping Method Kynar Insulated Wire, Silver Plated, Solid Conductor, Easy Stripping, For Use With 03 Bit.

Part No.	AWG	Color	Feet Per Spool
2323A28-4	28	White	50
W30-5A	30	Green	75
W30-5AS	30	Green	300
W30-5B	30	Red	75
W30-5BS	30	Red	300
W30-5E	30	White	75
W30-5ES	30	White	300
W30-5F	30	Yellow	75
W30-5FS	30	Yellow	300

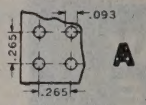
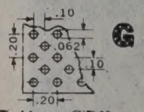
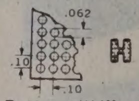
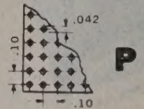
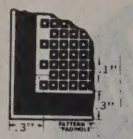
P210 MILLIOHM PROBE

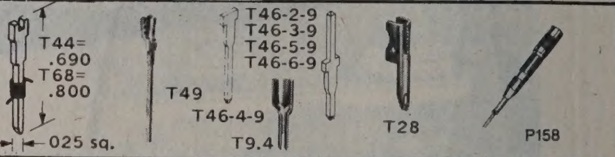
P210 – For use in verifying wrap connection from post to post. Determines wrap resistance in milliohms (0–30, 0–300 and 0–3000) in accordance with MIL-STD 1130B. Hand held, battery operated convenience (9V battery). Many other uses: verifying power and ground lines in automotive, marine and avionics.



P210

VECTORBORD® — MICROVECTORBORD®

Pattern	Material	Catalog Number	Length Inches	Width Inches	Thick. Inches
 Pattern "A"	phenolic	32AA18	8.51	4.80	3/32
		64AA18	16.99	4.80	3/32
	epoxy glass comp.	32A18WE	8.51	4.80	1/16
		64A18WE	16.99	4.80	1/16
 Pattern "G"	epoxy paper	85G24EP	16.99	4.80	1/16
	epoxy glass comp.	42G24WE	8.51	4.80	1/16
		85G24WE	16.99	4.80	1/16
		85G42WE	16.99	8.51	1/16
 Pattern "H"	epoxy glass	85H48WE	8.50	4.80	1/16
		85H85WE	8.51	8.51	1/16
		170H48WE	16.99	4.80	1/16
		170H48-032	16.99	4.80	1/32
		170H85WE	16.99	8.51	1/16
 Pattern "P"	Note 1: boards with "WE" in part no. are epoxy glass; boards without "WE" are epoxy glass comp.	29P29	3.00	3.00	1/16
		44P29	4.50	3.00	1/16
		44P44	4.50	4.50	1/16
		59P44-032	6.00	4.50	1/32
		64P44-032	6.50	4.50	1/32
		64P44	6.50	4.50	1/16
		64P44WE	6.50	4.50	1/16
		84P44	8.50	4.50	1/16
		84P44WE	8.50	4.50	1/16
		169P44	17.00	4.50	1/16
		164P44WE	17.00	4.50	1/16
		169P59-032	17.00	6.00	1/32
		169P59-047	17.00	6.00	3/64
		169P79	17.00	8.00	1/16
		169P84	17.00	8.50	1/16
		169P84WE	17.00	8.50	1/16
		169P99	10.00	17.00	1/16
		349P84	36.00	8.50	1/16
	copper clad; see Note 1 above	169P44C1	17.00	4.50	1/16
		169P44C2	17.00	4.50	1/16
		169P44WEC1	17.00	4.50	1/16
		169P59C1	17.00	6.00	1/32
		169P84C1	17.00	8.50	1/16
		169P84WEC1	17.00	8.50	1/16
 Pattern "P" PAD/HOLE **Following pad-per-hole Vectorbord** has P pattern holes with etched, tinned 2 oz. copper pads on both sides around ea. hole.	epoxy paper	64P44EP	6.50	4.50	1/16
		84P44EP	8.50	4.50	1/16
		169P44EP	17.00	4.50	1/16
		169P47EP	17.00	4.80	1/16
		169P84EP	17.00	8.50	1/16
	epoxy paper Cu 1	64P44EPC1	6.50	4.50	1/16
		169P44EPC1	17.00	4.50	1/16
		64P44EPC2	6.50	4.50	1/16
		169P44EPC2	17.00	4.50	1/16
	phenolic	64P44XXXP	6.50	4.50	1/16
		169P44XXXP	17.00	4.50	1/16
		169P59XXXP	17.00	6.00	1/16
	ep. gl. comp. Pad/Hole	45P80-1	8.08	4.50	1/16
		106P106-1	10.60	10.60	1/16



TERMINAL DIMENSIONS AND INSTALLING TOOLS

Part No. Tin Plated	Length Below 1/16" Board	Height Above Board	Hand Tool	P158 Tool w/Die Point
T9.4	.219	.190	P122B	——
T28	.175	.200	P91A	——
T42-1	.107	.281	P149A	——
T46-2-9	.300	.360	P133B	D7-4
T46-3-9	.520	.460		D7-4
T46-4-9	.300	.040	or	D7-4
T46-5-9	.24	.280		D7-4
T46-6-9	.32	.360	P205	D7-4
T49	.560	.210	P156	D8
T49-1	.388	.21	P156	D8
T44	.477	.120	A13	D11
T68	.790	.172	A13-1	D17
T68A	.540	.172	A13-1	D17

WRAPPABLE & SOLDERABLE TERMINALS & PINS

T44/T68 Mini-Wrap for 0.042″ Holes – Low profile wire wrappable terminals have slotted upper end for soldered wires. Ideal for miniature assemblies.

T49 Trifurcated Klip-Wrap – Unique three-fingered clip on upper end makes this a time-saving terminal for production or experimental uses. Spring clip holds leads from 0.018″ to 0.025″, 0.032″ or 0.040″ until soldered.

T46 Series Press-In Wrap Posts have rectangular base with stepped shank for better holding in 0.042″ holes.

T42-1 Miniaturized Compact Push-in fits 0.042″ dia. holes such as in "P" pattern Micro-Vectorbord and can be mounted on 0.1″ centers side-to-side. Tintillate plated. Ideal for IC work because leads can be laid in slots or pass through terminal vertically.

T28 – Compact push-in terminals fit 0.062″ dia. holes in printed circuit boards and Vectorbord. Patterns B, F, G, and H. Tintillate plated copper alloy.

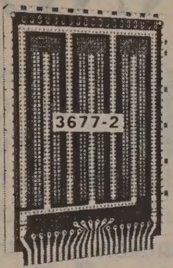
T9.4 – Push-in type fits 0.093″ dia. holes in printed circuit boards or Vectorbord "A" and "AA" patterns. Serrated teeth hold leads 0.032″ to 0.040″ in slots until soldered. Supplied with tintillate plating for easy soldering.

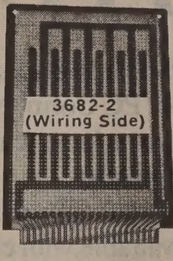
P158 Spring Impact Tool accepts screw-in terminal die points listed above. When depressed, tool delivers sharp impact force to drive terminals into circuit board holes.

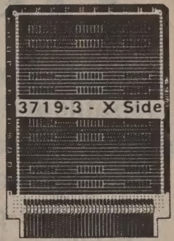
VECTOR ELECTRONIC COMPANY, 12460 Gladstone Avenue, P.O. Box 4336, Sylmar, CA 91342-0336 Phone (818) 365-9661

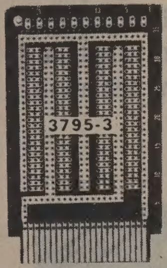
PLUGBORDS • P. C. CONNECTORS • EXTENDER CARDS •

Vector

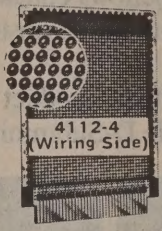


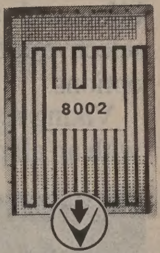






4066-4
(Wiring Side)





BARE BOARDS • BOARDS FOR WIRE WRAPPING • BOARDS FOR SOLDERING

UNIVERSAL PLUGBORDS

Use for prototype, test, and short run plug-in circuits. All boards are 1/16" thick and have an overall grid of 0.042" holes on 0.1" centers (pattern "P"). All etched circuitry above contact area is tinned for easy soldering. Boards are available with varied contact arrangements and mating connectors are listed. Back-to-back contacts terminate in independent hole pads. Layout paper furnished with all boards.

PLUGBORD SPECIFICATIONS

Flame Retardant Epoxy Glass Composite.

Copper Cladding: 2 oz. (.0027" thick) 1 or 2 sides. Solder coated except contacts.

Contacts: Nickel plated and gold flashed.

CARD EXTENDERS SPECIFICATIONS

Flame retardant epoxy glass composite. Nickel/gold plug tips. High quality top connector installed.

ORDERING INFORMATION

Part No.	Size	Contacts		Max. No. 16-pin DIPs Accom.	Circuitry Description	Mating Connectors		Mating Extenders
		No.	Spacing			Solder Tail	Wrap Tail	
3662	4.5 x 6.5	44	.156	50	Contacts only.	R644	R644-3	3690
3662-2	4.5 x 9.6	44	.156	90		R644	R644-3	3690
3662-5	4.5 x 4.5	44	.156	40		R644	R644-3	3690
3662-9	4.5 x 6.5	44	.156	50	Same as 3662 but with plated thru holes.	R644	R644-3	3690
3662A6	4.5 x 6.5	44	.156	54	Ground plane, component side.	R644	R644-3	3690
3673	7.98 x 9.6	80	.125	152	Contacts only.	R680-2	R680	3690-14
3677	4.5 x 9.6	44	.156	21	3-hole pad groups for component mounting and interconnection. Interleaved ground & voltage buses.	R644	R644-3	3690
3677-2	4.5 x 5.5	44	.156	12		R644	R644-3	3690
3677-6	4.5 x 8.1	none	none	21	Sim. to 3677, but without contacts.	none	none	none
3682	4.5 x 9.6	44	.156	48	For wire wrapping. Interleaved ground & voltage buses. 3682-4 has ground plane on component side.	R644	R644-3	3690
3682-2	4.5 x 6.5	44	.156	24		R644	R644-3	3690
3682-4	4.5 x 6.5	44	.156	24		R644	R644-3	3690
3719-1	4.5 x 6.5	72	.100	60	Contacts only.	R636-2	R636-1	3690-2
3719-2	4.5 x 6.5	72	.100	12	Horizontal etched conductor lines.	R636-2	R636-1	3690-2
3719-3	4.5 x 6.5	72	.100	12	Horizontal etched conductors one side, vertical other side, broken for 14-pin DIP only.	R636-2	R636-1	3690-2
3719-4	4.5 x 9.6	72	.100	90	Contacts only.	R636-2	R636-1	3690-2
3719-5	4.5 x 4.5	72	.100	30	Contacts only.	R636-2	R636-1	3690-2
3719-6	4.5 x 6.5	72	.100	48	Contacts only and plated thru holes.	R636-2	R636-1	3690-2
3795	2.73 x 4.5	44	.100	16	Contacts only.	———	R644-2	3690-8
3795-1	2.73 x 4.5	44	.100	4	Interleaved power & ground buses and 3-hole solder pads.	———	R644-2	3690-8
3797	2.73 x 4.5	30	.156	16	Contacts only.	R630	R630-1	3690-10
3797-2	2.73 x 4.5	30	.156	4	Power & ground buses and 3-hole solder pads.	R630	R630-1	3690-10
4050-1	4.5 x 6.5	44	.156	12	Horizontal etched conductor lines one side, vertical other side broken for 14-pin DIP mounting.	R644	R644-3	3690
4050-2	4.5 x 6.5	44	.156	12		R644	R644-3	3690
4066-4	4.5 x 6.5	72	.100	34	Interleaved power & ground buses plus "free" space for large components. Ground plane on component side.	R636-2	R636-1	3690-2
4066-5	4.5 x 4.5	72	.100	18		R636-2	R636-1	3690-2
4112	4.5 x 9.6	44	.156	40	3-hole pads plus interleaved zig-zag voltage bus, overall ground plane other side.	R644	R644-3	3690
4112-4	4.5 x 6.5	44	.156	25		R644	R644-3	3690
4112-5	4.5 x 4.5	44	.156	15		R644	R644-3	3690
4493	4.5 x 6.5	72	.100	42	2 regulator positions, 1 prewired to powers input, ground plane, other position uncommitted. Full ground plane network 1 side, other side interdigital.	R636-2	R636-1	3690-2
4493-1	4.5 x 9.6	72	.100	63		R636-2	R636-1	3690-2
4494	4.5 x 6.5	44	.156	42		R644	R644-3	3690
8001	4.5 x 6.5			20	3-hole pads, 2 buses, solder or wrap.	These circbords are Vector's popular Plugbord patterns without the expensive plug section. I/O area for mounting any type board connector.		
8002	4.5 x 6.5			35	2 buses - best for wire wrapping.			
8003	4.5 x 6.5			60	Pad-per-hole board.			
8004	4.5 x 6.5			40	Clearance ground plane.			

Many Other Standard Models Availabl? — Fast Production of Custom Models. See Sec. 1700, P. for Card Racks and Enclosures.

VECTOR ELECTRONIC COMPANY, 12460 Gladstone Avenue, P.O. Box 4336, Sylmar, CA 91342-0336 Phone (818) 365-9661

For More Information. Circle No. 110

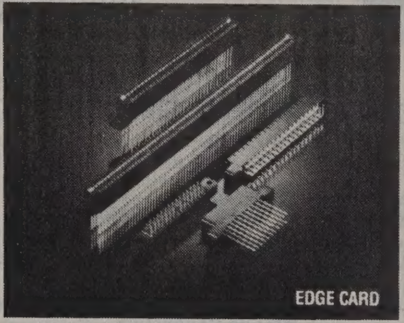
VIKING PC CONNECTORS

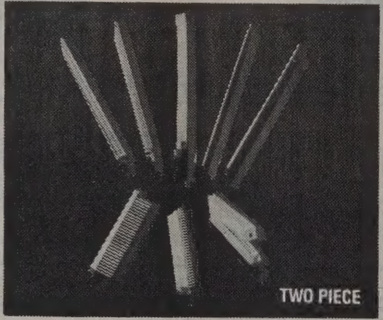
Viking Connectors Co. offers a high quality, versatile and affordable line of PC Connectors.

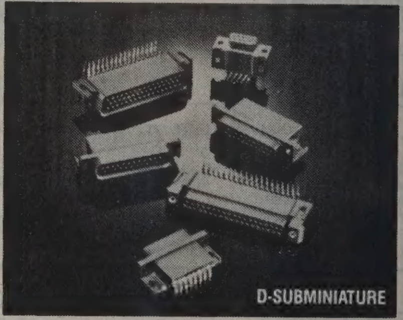
The standard products, shown here, can be modified to meet a variety of needs.

The one-piece PC Connector gives high reliability at low cost and is available with either bifurcated, semi-bellows or bellows contacts in selective or full gold plating with various insulator options.

Viking recently expanded their product line with an all plastic Right Angle D-Subminiature and the VSBX Series two-piece PC Connector system. The VSBX Connector system was initially developed by Viking as a unique solution to a need for a low cost method of stacking two PC boards. Now the product line has been expanded and is suitable for both parallel as well as perpendicular applications. Both the D-Subminiature and the VSBX Connectors are ideal for computer, peripheral, telecommunications, instrumentation and industrial control usage.







EDGE CARD

CONTACT CENTERS	TYPE	CONTACT POSITIONS
.050	Micro Miniature, Dip Solder, Short Dip Solder.	6/12 thru 66/132
.100 x .150	Dip Solder, (Short, Medium, Right-Angle), Pierced.	6/12 thru 50/100
.100 x .200	Wire Wrap*, Flow Solder; .025 (.63 mm) Sq.; .026 (.66 mm) Dia.	15/30 thru 70/140
.125 x .145	Dip Solder (Short, Medium), Pierced.	6/12 thru 50/100
.125	Dip Solder, Pierced. (Single read-out.)	28
.125 x .250	Wire Wrap*, Flow Solder; .025 (.63 mm) Sq.; .026 (.66 mm) Dia.	6/12 thru 50/100
.150 x .200	Dip Solder, Right-Angle Dip Solder, Pierced.	56/112, 105/210
.150 x .200	Wire Wrap*, .045 (1.14 mm) Sq.	6/12 thru 50/100
.156	Dip Solder, (Short, Medium, Right-Angle), Pierced. (Single read-out.)	6/12 thru 36/72
.156 x .145	Dip Solder, (Short, Medium), Pierced.	6/12 thru 43/86
.156 x .200	Wire Wrap*, Flow Solder; .025 (.63 mm) Sq.; .026 (.66 mm) Dia.	18/36 thru 43/86
.156 x .200	Wire Wrap*, .062 x .031 (1.57 mm x 0.78 mm).	6/12 thru 50/100

TWO PIECE

CONTACT CENTERS	TYPE	CONTACT POSITIONS
.100 x .100	Dip Solder, Sq. Wire Wrap*.	18/36, 22/44 bridge. (VSBX I)
.100 x .100	Dip Solder, Right-Angle Dip Solder, Wire Wrap*	22/44, 28/56, 50/100 (VSBX II)
.100 x .100	Wire Wrap*.	64 or 82 (ODIN)
.100 x .100	Wire Wrap*.	120 (NORDIC)
.100 x .100	Wire Wrap*, Right-Angle Dip Solder.	32/64/96 (EURO-DIN)

D-SUBMINIATURE

	TYPE	CONTACT POSITIONS
	All Plastic, Right-Angle PC Mount D-Subminiature.	9, 15, 25, 37, 50 (both plug & receptacle)

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CRITON VIKING

Criton Technologies
Electronics and
Defense Group

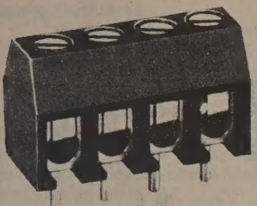
Viking Connectors, Co.
21001 Nordhoff Street
P.O. Box 2379
Chatsworth, CA 91311
(818) 341-4330
TWX: 910-494-2094

Viking Connectors (UK) Ltd.
Barton Industrial Estate
Faldo Road, Barton-le-Clay
Bedfordshire MK45 4RS, England
Phone: Luton (0582) 882345
Telex: 825377 Viking G

For More Information. Circle No. 111

WECO

SCREW CONNECTORS FOR PRINTED CIRCUITS



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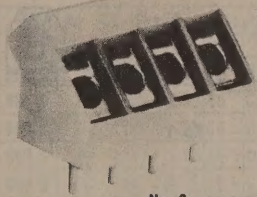

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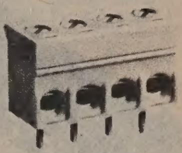

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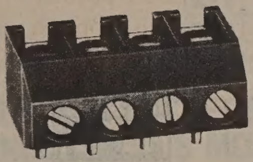

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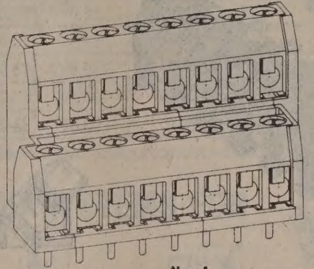


No. 4

Type	No. of circuits	Length		Height		Width		Wire Entrance relative to PCB:			Center-to-Center		UL recognized for:			Design similar to figure No.:
		mm	in	mm	in	mm	in	horizontal	45° angled	vertical	mm	in	Voltage	Amperage	AWG	
95 GDS	2-27*	135	5.32	10	0.39	8	0.31	X			5	0.197	150	15	14-22	1
95 SGDS	2-27*	135	5.32	8	0.31	10	0.39			X	5	0.197	150	15	14-22	2
95 G/DS	2-14	135	5.32	10	0.39	8	0.31	X			10	0.394	300	15	14-22	1
95SG/DS	2-14	135	5.32	8	0.31	10	0.39			X	10	0.394	300	15	14-22	2
970 DS	2-31	156	6.14	13	0.51	9	0.35	X			5	0.197	150	15	14-22	1
971 DS	2-31	156	6.14	9	0.35	13	0.51			X	5	0.197	150	15	14-22	2
972 DS	2-16	156	6.14	13	0.51	9	0.35	X			10	0.394	300	15	14-22	1
973 DS	2-16	156	6.14	9	0.35	13	0.51			X	10	0.394	300	15	14-22	2
940 DS	2-32*	162.6	6.40	11.5	0.45	8	0.31	X			5.08	0.200	150	15	14-22	1
941 DS	2-32*	162.6	6.40	8	0.31	11.5	0.45			X	5.08	0.200	150	15	14-22	2
942 DS	2-16	162.6	6.40	11.5	0.45	8	0.31	X			10.16	0.400	300	15	14-22	1
943 DS	2-16	162.6	6.40	8	0.31	11.5	0.45			X	10.16	0.400	300	15	14-22	2
960 DS	2-32	163.5	6.44	13.5	0.53	9	0.35	X			5.08	0.200	150	15	14-22	1
961 DS	2-32	163.5	6.44	9	0.35	13.5	0.53			X	5.08	0.200	150	15	14-22	2
962 DS	2-16	163.5	6.44	13.5	0.53	9	0.35	X			10.16	0.400	300	15	14-22	1
963 DS	2-16	163.5	6.44	9	0.35	13.5	0.53			X	10.16	0.400	300	15	14-22	2
974 DS	2-26*	130	5.12	12	0.47	12.5	0.49		X		5	0.197	150	15	14-22	3
975 DS	2-13*	130	5.12	12	0.47	12.5	0.49		X		10	0.394	300	15	14-22	3
977 OPDS	2-19	141	5.55	13	0.51	9	0.35	X			7.5	0.295	300	15	14-22	1
976 DS	2-3	20	0.79	12	0.47	12.5	0.49		X		7.5	0.295	300	15	14-22	3
977 DS†	2-3	21	0.83	13	0.51	9.5	0.37	X			7.5	0.295	300	15	14-22	1
977 SGDS	2-3	21	0.83	9.5	0.37	13	0.51			X	7.5	0.295				2
910 DS	2-12	118	4.65	14	0.55	9	0.35	X			10	0.394	300	25	18-10	1
990 DS	2-28*	140	5.51	11.3	0.45	9	0.35	X			5	0.197	250	15	14-22	5
97 EDS	2-62	192.5	7.58	27	1.06	20.2	0.80	X			5	0.197	250	15	14-22	4

"Tiered Terminal": Two rows of type 970 DS are offset by half of the pitch. Produces an effective pitch of 2.5 mm/0.098 in.

*: Terminal strips can be butted side by side to form any requested pole configuration without losing center-to-center spacing.
Length measurement indicated refers to strip with maximal available number of circuits: 95 GDS-27 has 27 circuits and a length of 135mm/5.32in.
†: Each circuit is equipped with a test hole.

Terminal body accommodating 10-16 AWG: available for types: 970 DS, 972 DS, 960 DS, 962 DS, 97 EDS, 977 DS, 977 OPDS. It allows the connection of several conductors.

Extra features: Screen print labelling, labelling strips. Blocks can be supplied without wireguards (DS). Most types can be supplied with solder pins exceeding their standard length and up to 70mm/2.75in.

WECO Electrical Connectors Inc.
Headquarters Montreal:
P.O. Box 84, Ste. Anne de Bellevue, P.Q.
Canada H9X 3L4
Phone: (514) 457-3648
Telex: 05-821840 WECO CDA BDRF

Moulding: Glass fibre reinforced Polyamide 6.6
Permissible temperature loading: short-time 200°C/392°F
continuous 100-120°C/212-248°F
Cold resistant down to: −50°C/−58°F

Terminal Body: Tin-plated Brass

Soldering Pin: Tin-plated copper, suitable for soldering

Wire Guard: Bright tin bronze

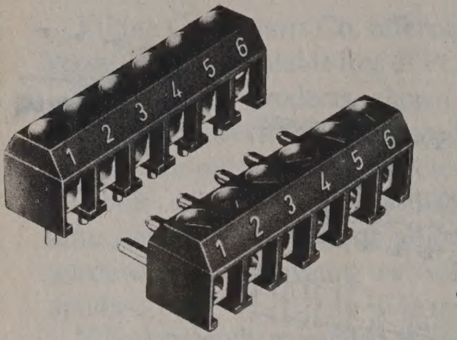
Screw: Zinc-plated steel, yellow chromated

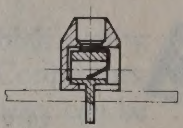
HOW TO ORDER: Indicate Type and No. of Circuits, e.g.: 95 GDS-12 is type 95 GDS with 12 circuits.

WECO Electrical Connectors Inc.
US-Warehouse:
Trimex Building
RT. 11
Mooers, NY 12958

WECO

PLUG AND SOCKET SCREW-CONNECTOR SYSTEMS FOR PRINTED CIRCUIT BOARDS





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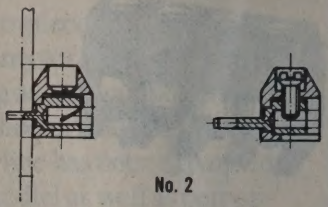

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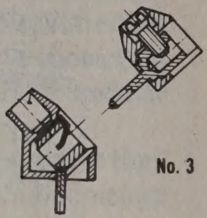

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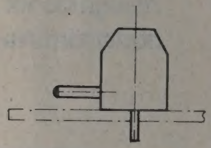

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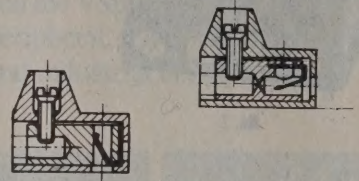

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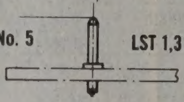


LST 1,3 × 6,5

Types		No. of circuits	Length		Height		Width		Wire Entrance relative to PCB:			Plug-in direction relative to PCB			Center-to Center spacing		UL recognized for:			Design similar to figure No.:
Male	Female		mm	in	mm	in	mm	in	vertical	horizontal	45°	horizontal	vertical	45°	mm	in	Volt	Ampere	AWG	
95 SVDS with	**95 FB°**	2-27* 2-27*	135 135	5.31 5.31	10 10	0.39 0.39	8 8	0.31 0.31		X		X			5 5	0.197 0.197	250	6	16-22	1
95 SVDS with	**95 SGFB°**	2-27* 2-27*	135 135	5.31 5.31	10 8	0.39 0.31	8 10	0.31 0.39	X				X		5 5	0.197 0.197	250	6	16-22	2
97 SVDS with	**97 FB°**	2-31 2-31	156 156	6.14 6.14	13 13	0.51 0.51	9 9	0.35 0.35		X		X			5 5	0.197 0.197	250	6	14-22	1
97 SVDS with	**971 FB°**	2-31 2-31	156 156	6.14 6.14	13 9	0.51 0.35	9 13	0.35 0.51	X				X		5 5	0.197 0.197	250	6	14-22	2
95 SVG° with	**97 FBSDS**	2-27* 2-24*	135 120	5.31 4.72	10 13	0.39 0.51	8 15.5	0.31 0.61		X		X			5 5	0.197 0.197	250	6	14-22	4
LST 1.3 × 6.5° with	**97 FBWDS**	Single solder pin. Can also be ordered mounted on a strip. 2-24*	120	4.72	13	0.51	15.5	0.61		X			X		5	0.197	250	6	14-22	5
LST 1.3 × 6.5° with	**97 FBSDS**	Single solder pin. Can also be ordered mounted on a strip. 2-24*	120	4.72	15.5	0.61	13	0.51	X				X		5	0.197	250	6	14-22	5
95 SVDS with	**974 FB°**	2-27* 2-26*	135 130	5.31 5.12	complete ensemble: 16.5	0.65	15.5	0.60			X			X	5 5	0.197 0.197	300	6	14-22	3

°: soldered onto PC-board, the counterpart is removable.
*: terminal block can be butted side by side to form any requested pole configuration without losing center-to-center spacing.

Based on the standard program of screw-connectors for printed circuits a line of more than 20 different Plug and Socket Systems are available. A stainless steel spring provides the contact pressure to ensure a reliable connection not only to the male terminal, but also to other components. All systems offered provide for a quick connect and disconnect of wiring to PCB.

There are many advantages and benefits to using these components:

- Subassemblies manufactured at different places are equipped with either the male or female terminal of the selected WECO plug and socket screw-connector system. At the time the final assembly is to be finished one has only to plug the male into the female connector. No more wiring is necessary.
- Peripheral appliances can be connected to the main PC-board avoiding any risk of changing wires by mistake.
- For service purposes a PC-board can easily be disconnected. The plug-connector may then be used for testing the PC-board.
- The plug-connector also connects onto the PC-board, when direct wiring into a screw-connector is difficult because of limited space.
- Service-ability.

Spacing other than 5mm/0.197in: 5.08mm/0.200in available for types: 95 SVDS, 95 FB, 95 SGFB, 97 SVDS, 97 FB, 971 FB.
7.5mm/0.295in available for types:
97 SVDS/97 FB and 97 SVDS/971 FB
10mm/0.394in available for all listed types.

WECO Electrical Connectors Inc.
Headquarters Montreal:
P.O. Box 84, Ste. Anne de Bellevue, P.Q.
Canada H9X 3L4
Phone: (514) 457-3648
Telex: 05-821840 WECO CDA BDRF

Moulding: Glassfibre reinforced Polyamide 6.6
Permissible temperature loading: short time: 200°C/392°F
continuous: 100-120°C/212-248°F
Cold resistant down to: − 50°C/ − 58°F

Terminal Body: Nickel-plated brass
Spring: Stainless steel strip
Plug: Tin-plated brass
Soldering Pin: Tin-plated copper, suitable for soldering
Single soldering pin LST 1.3 × 6.5: Silver-plated brass
Wire guard: Bright tin bronze
Screw: Zinc-plated steel, yellow chromated.

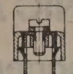
Extra features: Screen print labelling; labelling strips; Blocks can be supplied without wire guard (DS); some types are available with projecting ribs at wire entrance to increase air gaps and creepage distance. Carrying plates are available to additionally interlock each assembly, to increase creepage distance to panel and provide absolute sure connection in vibration treated environment.

How to order: Please indicate type and no. of circuits, e.g.: 95 SVDS-05 and 95 FB-05. This is the pluggable arrangement of type 95 SVDS and 95 FB, with each 5 circuits per strip.

WECO Electrical Connectors Inc.
US-Warehouse:
Trimex Building
RT. 11
Mooers, NY 12958

For More Information. Circle No. 112

WECO SINGLE ROW SCREW BARRIER TERMINAL STRIPS FOR PRINTED CIRCUITS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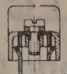
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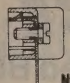
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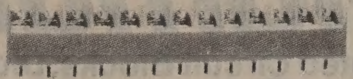


Moulding: Polyamide 6.6
Permissible temperature loading:
short-time: 140-160°C/284-320°F
continuous: 80-100°C/176-212°F
Cold resistant down to: −40°C/−40°F

Terminal body: tin-plated brass, suitable for soldering.

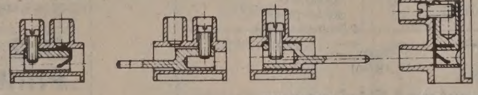
Screw and wire clamp: zinc-plated steel, yellow chromated.

Extra features: Screen print labelling. Types 980, 982 and 983 can be supplied with quick-connect tabs for up to six terminations per pole. All PCB executions mentioned can be supplied for panel mounting.

Type	No. of circuits	Length		Height		Width		Center to Center spacing		UL recognized for:			Design similar to figure No.:
		mm	in	mm	in	mm	in	mm	in	Voltage	Amperage	AWG	
980 S	26	166.3	6.55	15	0.59	14	0.55	6.35	1/4	250	7	18-22	2
980 D	26	166.3	6.55	15	0.59	14	0.55	6.35	1/4	250	7	18-22	1
980 W	26	166.3	6.55	14	0.55	15	0.59	6.35	1/4	250	7	18-22	3
982 S	26	247.7	9.75	16.5	0.65	16	0.63	9.52	3/8	300	20	12-20	2
982 D	26	247.7	9.75	16.5	0.65	16	0.63	9.52	3/8	300	20	12-20	1
983 S	26	260.0	10.24	16.5	0.65	16	0.63	10.00	0.394	300	20	12-20	2
983 D	26	260.0	10.24	16.5	0.65	16	0.63	10.00	0.394	300	20	12-20	1

*These blocks can be butted side by side to form any requested number of circuits without losing center to center spacing.

WECO PLUG AND SOCKET SCREW-CONNECTOR SYSTEMS FOR PANEL/CHASSIS MOUNTING


322 SVW
323 FBW

Types		No. of Circuits	Length		Height		Width		Contact pressure provided through:		UL recognized for:		
Male	Female		mm	in	mm	in	mm	in	Steel spring	Slotted Plug and Socket	Voltage	Amperage	AWG
302 SV	**302 FB**	2-12	94	3.74	15	0.59	16	0.63	X		250	6	14-20
302 STS	**302 STB**	2-12	94	3.74	15	0.59	16	0.63		X	250	6	14-20
322 SV	**323 FB**	2-12	117	4.61	16	0.63	14/21	0.55/0.83	X		250	10	12-18
322 SVW	**323 FBW**	2-12	117	4.61	16	0.63	14/21	0.55/0.83	X		250	10	12-18
(Male block plugs in from top. All other combinations plug together horizontally [relative to panel] as shown above)													
324 STFS	**324 STFB**	2-12	135	5.32	18.5	0.73	22	0.87		X	250*	25	10-18

*600V with insulating base

Where service-ability is a must.

Plug and Socket Connectors are particularly suitable for installations where simple circuit closing and opening is required.

By pre-wiring various equipment sections, it is possible to use Plug and Socket Connectors to provide a quick and reliable connection during final assembly. Therefore wire confusion is avoided. Blocks can be coded (color coding, labelling, etc.) to ensure proper connection. For greater safety the male block can be equipped with an extra long grounding plug.

Some of these assemblies are available for printed circuit application.

Standard strip has 12 circuits and can easily be cut to required number of poles or ordered as required. A mounting hole is provided between each circuit. The terminal screws are backed up and ready for wiring. The dead front design is for safety and avoids short circuitry.

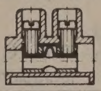
Moulding: Flexible natural Polyamide
Terminal body: Nickel-plated brass
Spring: Stainless steel strip
Wire guard: Bright tin bronze
Screw: Zinc-plated steel, yellow chromated

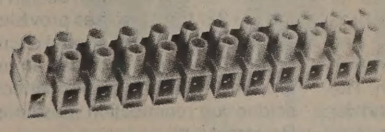
Permissible temperature loading:
short-time: 140-160°C/284-320°F
continuous: 80-100°C/176-212°F
cold resistant down to: −40°C/−40°F

Extra features: Screw connections can be equipped with wire guard (DS) on request, to protect the conductors against damage through the screw. Marking strips; labels; mouldings can be supplied made of PVC or Polyethylene.

How to order: Please indicate type and no. of circuits, e.g.: 302 SV-05 and 302 FB-05. These are the types 302 SV and 302 FB ea. with 5 circuits.

WECO SOCKET TERMINAL STRIPS FOR PANEL/CHASSIS MOUNTING





Type	No. of circuits	Length		Height		Width		UL recognized for:		
		mm	in	mm	in	mm	in	Voltage	Amperage	AWG
302 HDS	1-12	94	3.74	15	0.59	16	0.63	250	20	12-20
323 HDS	1-12	117	4.61	16	0.63	21	0.83	250	20	10-20
324 HDS	1-12	135	5.32	18.5	0.73	22	0.87	250	35	8-14
324 FU HDS	1-12	135	5.32	21.3	0.84	22	0.87	600	40	8-14
326 HDS	1-12	171	6.73	22.5	0.89	30	1.18	300	55	8-14
327 HDS	1-12	171	6.73	25	0.98	30	1.18	300	65	6-14
327 FU HDS	1-12	171	6.73	28.5	1.12	30	1.18	600	65	6-14

Moulding: Flexible natural Polyamide
Permissible temperature loading:
short-time: 140-160°C/284-320°F
continuous: 80-100°C/176-212°F
Cold resistant down to −40°C/−40°F
Terminal body: Nickel-plated brass
Wire guard (HDS): stainless steel strip
Screw: zinc-plated steel, yellow chromated.

The terminal strips are used for connecting standard or solid wire directly to each contact. Standard strip has 12 circuits and can easily be cut to required number of poles or ordered as required. A mounting hole is provided between each circuit. The terminal screws are backed up and ready for wiring. The dead-front design is for safety and avoids short circuits. Each circuit has a wire guard (HDS), a thin memorizing steel plate placed between screw and wire. This avoids any wire damage. The screws are protected against working lose and cannot be lost.

Extra features: Marking strips, labels, strips can be supplied without wireguards. Strips can be made of PVC or Polyethylene. Several blocks can be supplied where each circuit is equipped with a screw/solder lug connection.

HOW TO ORDER: Please indicate Type and No. of circuits, e.g.: 302 HDS-12 is terminal block type 302 HDS with 12 circuits.

WECO Electrical Connectors Inc.
Headquarters Montreal:
P.O. Box 84, Ste. Anne de Bellevue, P.Q.
Canada H9X 3L4
Phone: (514) 457-3648
Telex: 05-821840 WECO CDA BDRF

WECO Electrical Connectors Inc.
US-Warehouse:
Trimex Building
RT. 11
Mooers, NY 12958

Weidmüller

TERMINALS FOR ELECTRONIC APPLICATIONS

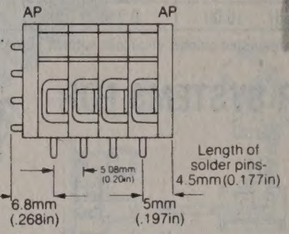
Printed Circuit Blocks, Diode-Fitted Blocks and Component Holders

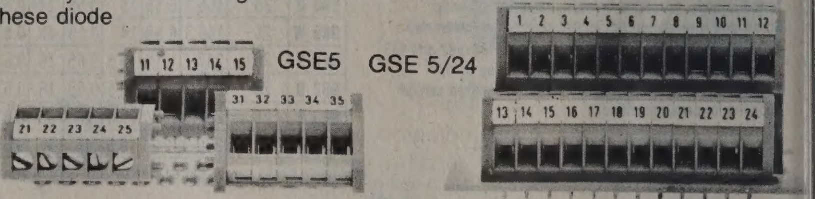
Weidmuller offers a wide range of small dimension modular blocks and multi-way strips which use a screw clamp for external connection. In addition, we also provide a wide selection of rail-mounted blocks fitted with diodes, and component holders which may be complemented with circuit conditioning components. These diode terminal blocks and holders can be assembled on STANDARD TS32 ASSEMBLY RAIL along with feed-through test, and fuse te minal blocks.

UL Recognized/CSA Certified

GSE Series for Printed Circuit Blocks

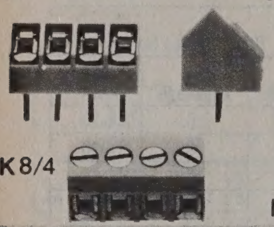
The single GSE modular block is interlocked with adjacent blocks by 5 spigots so that assemblies of up to 24 ways can be made with centers of 0.20 in (5.08 mm). Depending on the preferred mounting to the printed circuit GSE terminal blocks are supplied in three versions, horizontal, vertical or 45° angle. All Polyamid 6.6.

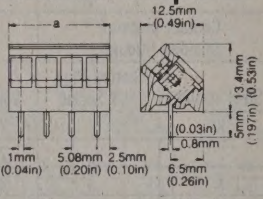




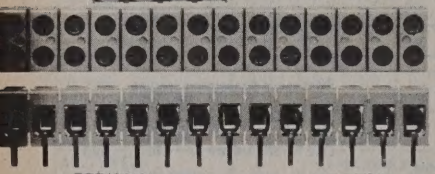
TERMINAL TYPE	CAT. NO.	RATING V.	RATING AMPS.	AWG SIZE NO.
GSE5 Horizontal	5561.6	300	10	22-12
GSE5 Vertical	5563.6	300	10	22-12
GSE5 45 Angle	5562.6	300	10	22-12

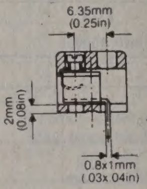
MK Series Multi-Way Terminal Strips


MK 8/4



MK10/14

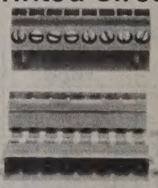


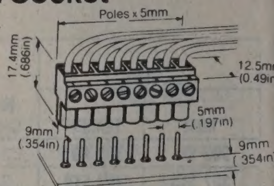


TERMINAL TYPE	CAT. NO.	RATING V.	RATING AMPS.	AWG SIZE NO.
MK 8/2	3320.6	50	15	22-14
MK 8/3	3078.6	50	15	22-14
MK 8/4	3077.6	50	15	22-14
MK 8/10	3026.6	50	15	22-14
2 to 10 way				
MK 10/14	3702.6	150	10	22-12

All Polyamid 6.6

BL2...15/SL2...15 Series 2 to 15 Way Printed Circuit Plug and Socket





This plug and socket series is available in 5 mm and 5.08 mm centers that are mounted horizontal or vertical to the P.C. board. For an alternative connection, the BL socket can be connected to the P.C. board by means of a 0.63 in. (1.6 mm) round pin. Pins are suited to P.C. board up to 2 mm (0.78 in.) thick. The catalog numbers for this series reflect the 5.08 mm centers.

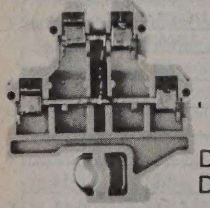
RATING VOLTS	AMPS	AWG SIZE NO.
300	8	22-14

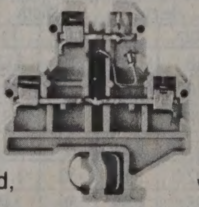
TERMINAL TYPE	CAT. NO.	TERMINAL TYPE	CAT. NO. (Vertical)	CAT. NO. (Horizonta
BL2	5104.6	SL2	1113.6	1126.6
BL3	5527.6	SL3	1112.6	1125.6
BL4	5528.6	SL4	1111.6	1124.6
BL5	5109.6	SL5	1110.6	1123.6
BL6	5529.6	SL6	1109.6	1122.6
BL7	5530.6	SL7	1108.6	1121.6
BL8	5392.6	SL8	1107.6	1120.6
BL9	1270.6	SL9	1106.6	1119.6
BL10	5131.6	SL10	1105.6	1118.6
BL11	1271.6	SL11	1104.6	1117.6
BL12	5164.6	SL12	1103.6	1116.6
BL13	1272.6	SL13	1102.6	1115.6
BL14	1275.6	SL14	1101.6	1114.6
BL15	5097.6	SL15	6922.6	6923.6

Polyamid 6.6

Diode Terminals For use with standard TS32 assembly rail

The DK4D Series offers a wide range of fittlings: Diode fitted; LED and Series Resistor fitted; LED, Series Resistor and Diode fitted, and with Neon Indicator and Series Resistor. Polyamid.


DK4D with Diode Fitted,


DK4D with LED,

TERMINAL TYPE	CAT. NO.	RATING V.	RATING AMPS.	AWG SIZE NO.	DIMENSIONS (Inches) L.	H.	W.
DK4D	4840.6	300	10	22-16	1.97	2.22	0.236
Diode and 4 yokes fitted							
DK4D	4953.6	24V D.C. MAX	10	22-16	1.97	2.22	0.236
LED and Series Resistor: Top bar positive							
DK4D	4744.6	24V D.C. MAX	10	22-16	1.97	2.22	0.236
LED and Series Resistor: Top bar negative							
DK4D	4954.6	24V A.C. MAX	10	22-16	1.97	2.22	0.236
LED and 3 screw clamps.							
DK4D	6328.6	48V A.C. MAX	10	22-16	1.97	2.22	0.236
LED and 3 screw clamps							
DK4	5095.6	220V	10	22-16	1.97	2.22	0.236
Neon indicator and 4 screw clamps							
DK4	5695.6	110V	10	22-16	1.97	2.22	0.236
Neon indicator and 4 screw clamps.							

Component Holders For use with standard TS32 assembly rail

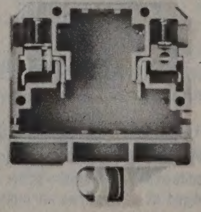
These component holders consist of a molded housing which can be fitted with a variety of screw clamps and solder lugs or quick-connect tabs.

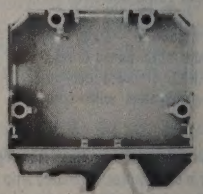
EG 32/1

The EG 32/1 series provides for inclusion of components such as diodes, surge supressors, and resistor/capacitor networks which can be soldered into position. The molding also has a provision for mounting an indicator lamp, toggle, or potentionmeter.
Polyamid 6.6.

EG 32/2

The EG 32/2 is similar in design to the EG 32/1 but also has provision for mounting a small printed circuit board. This series provides an extensive choice of quick-connect/solder lug connection positions. Polyamid 6.6.



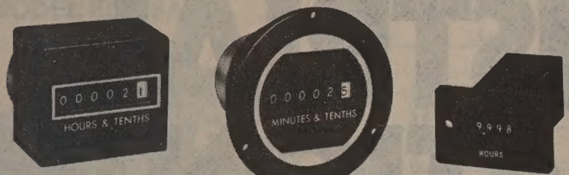


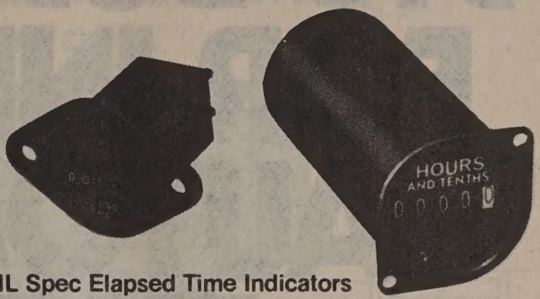
TERMINAL TYPE	CAT. NO.	RATING V.	RATING AMPS.	AWG SIZE NO.	DIMENSIONS (Inches) L.	W.	H.
EG 32/1	4535.6	300	10	20-12	2.28	0.709	2.66
EG 32/2	5088.6	300	10	20-12	2.28	0.709	2.66

WEIDMULLER TERMINATIONS, INC. 821 SOUTHLAKE BLVD. RICHMOND, VIRGINIA 23235 U.S.A.

For More Information. Circle No. 113

Indicators





Commercial Elapsed Time Indicators

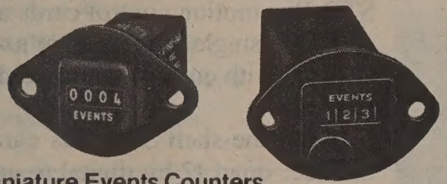
Maintain record of equipment on/off time and provide utilization time information for maintenance, billing, etc. Many different models and mounts. Up to 6 digit readouts.

Type	Series No.	Operating V ac	Styles
Standard Commercial	K42200	6-230, 50 or 60 Hz	Round and rectangular
Microminiature Commercial	K49200	115 60 or 400 Hz	End or side readout

MIL Spec Elapsed Time Indicators

Meet MIL-M-7793 environmental requirements. In either subminiature (5-digit) or microminiature (4-digit) sizes. White numerals on black, "tenths" digit red on white. Hermetically sealed.

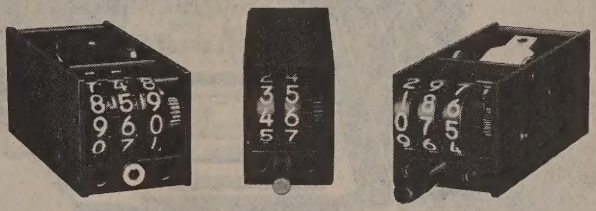
Type	Series No.	Operating Voltage
Subminiature	K4200	28V dc
	K23200	115V ac, 60 Hz
	K25200	115V ac, 400 Hz
Microminiature	K19200 (Square) K19220 (Round)	24 or 120V ac 400 Hz
	K19760 (Square) K19780 (Round)	28V dc



Microminiature Events Counters

Meet MIL-M-7793 environmental requirements. Up to 6 digit display, depending on model. Non-resettable and resettable types. Many standard mountings.

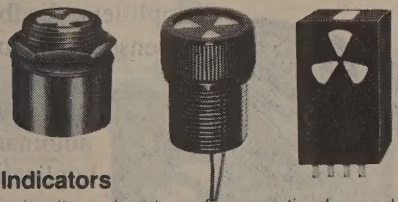
Type	Digits	Series No.		
		28V dc	115V 60 Hz	115V 400 Hz
Non-resettable	4	K19502	K19511	K19501
	5	K19504	K19513	K19503
	6	K19506	K19515	K19505
Resettable	3	LM19502	LM19511	LM19501
	4	LM19504	LM19513	LM19503



Subtractive and Additive Events Counters

Two- and three-digit military grade counters. Meet MIL-STD-202C. Maximum count rate 1000 pulses per minute. Additive (count up) and subtractive (countdown) models. Presettable. Operates on 21-29 Vdc pulses.

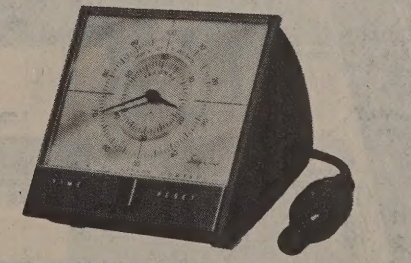
Type	Digits	Serial No.	Operating Voltage
Subtractive	2	K-4702-P1	21-29V dc
	3	K-4701-P1	
	3	K-4703-P1	
Additive	2	K-4702-P2	
	3	K-4701-P2	
	3	K-4703-P2	



Fault Indicators

Monitor circuits and systems for operation beyond design parameters. Contrasting flag indicates fault condition. Magnetically latched until manually or electrically reset. Units with internal switches for remote signalling.

Type	Series	MIL Ref.	Vdc	Operating Time
Round-Manual Reset. Internal Sw.	A21682	MIL-I-83287	0-30	50ms
Round-Electric Reset	K21600	MIL-M-83287	17-29	50ms
Round-Manual Reset	L21603/01	MIL-M-83287	3-30	50ms
Round-Electric Reset	L21603/02	MIL-M-83287	10-30	50ms
Rectangular-Electric Reset	K21500	MIL-E-5400J	17-29	50ms



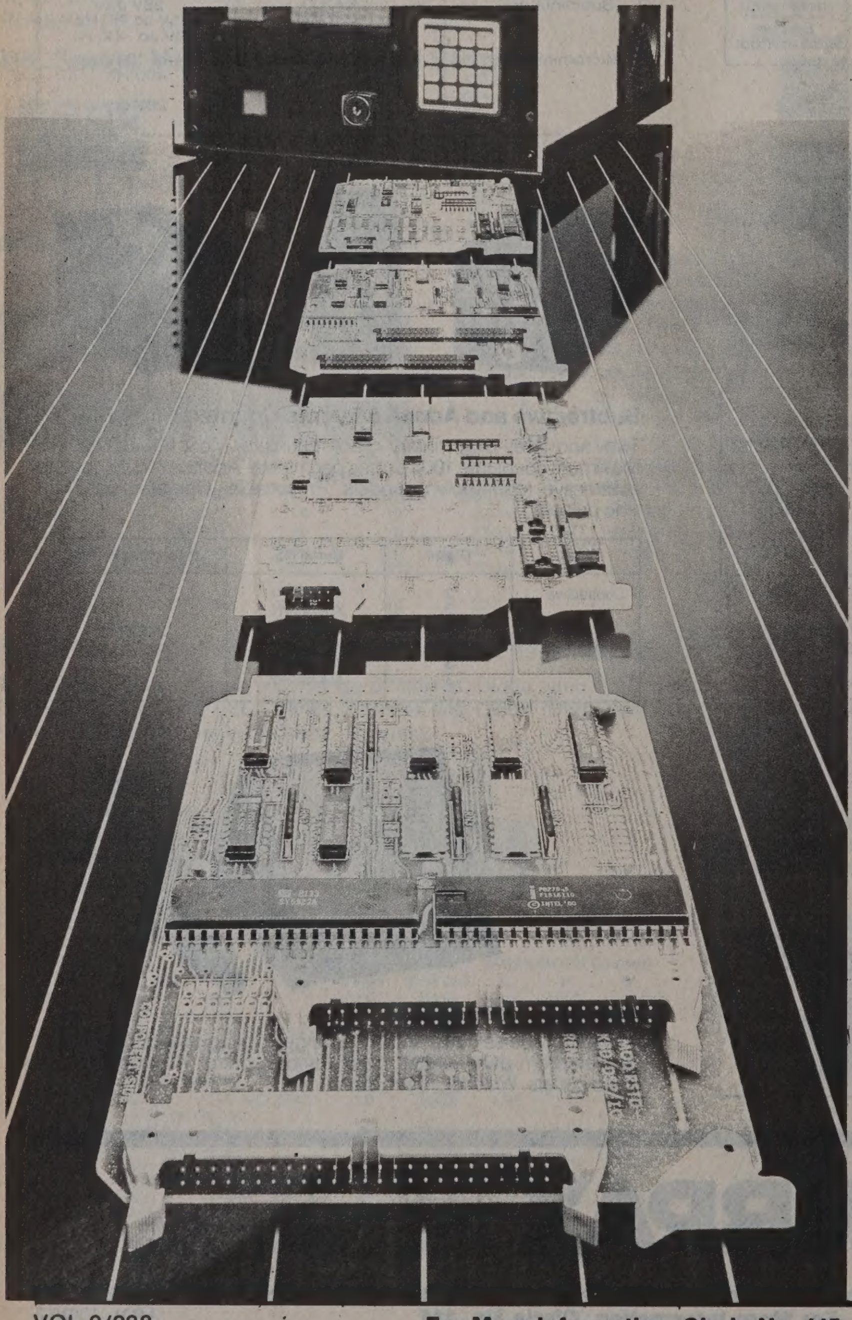
Laboratory Stop Clocks

Provide a wide selection of timing ranges, voltages and mountings. Operate from panel switch or by remote control. All models have timed outlets. Write for information.

AIRPAX®

A North American Philips Company
Cheshire Division
Cheshire Ind. Park, Cheshire, CT USA 06410
Telephone: (203) 272-0301

STD BUS MODULES FOR INDUSTRIAL AUTOMATION BY RENCO.



Renco, the Optical Encoder Company, offers the automation and robotics engineer a wide selection of STD Bus motion control cards and complete single and multiple axis servo systems with custom, hand-held control terminals.

Off-the-shelf STD Bus cards include: quad 12 bit digital to analog converters; quad encoder interface; general purpose intelligent peripheral controller; intelligent servo-control module for single or multi-axis systems; system communicator module with IEEE-488, RS-232 and 16 bit parallel I/O ; and keyboard, display, parallel I/O interface.

Industrial Control Systems: Renco and Electro-Craft provide motors, amplifiers, feedback sensors and control systems for your industrial automation applications — automatic slide drives, laboratory micro-positioners, machine monitors, production test equipment, punch press control, point-to-point robotic systems and more.

INDUSTRIAL ENCODER
RENCO CORP.

Renco Corporation,
26 Coromar Drive, Goleta, CA 93117,
(805) 968-1525, TWX 910-334-1180.

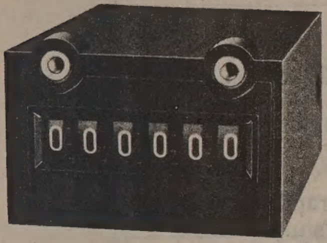
RENCO
Division of Electro-Craft Corporation
Industrial Automation Group

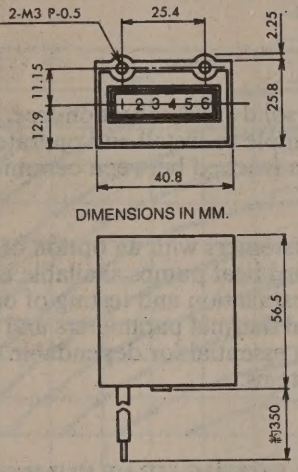
For More Information. Circle No. 115

SHINMEI ELECTRIC CO., LTD.

ELECTRO MAGNETIC COUNTERS

MODEL ECT-6A



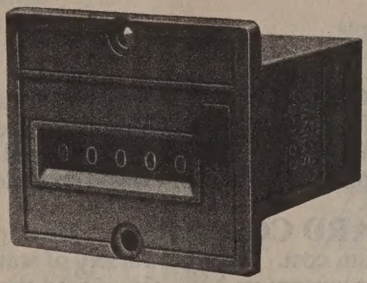


DIMENSIONS IN MM.

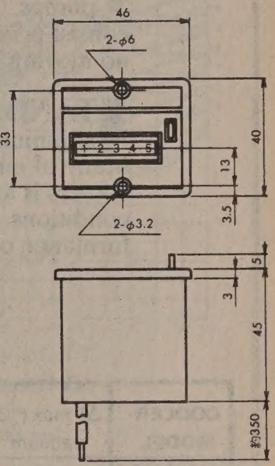
THIS MODEL IS OPERATED BY AN ELECTRO-MAGNET:

- * 1 Count/Pulse
- * DC 12V. 24V. AC 100V.
  Max. 10 counts per second
- * 6 Digits (Non-Resettable)
- * High Reliability and Long Life
- * High Impact Plastic Case

MODEL ECR-5A



DIMENSIONS IN MM.



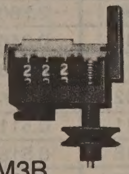
- * 1 Count/Pulse
- * Push Button Reset
- * 5 Digits
- * DC 12V. 24V. AC 100V.
  Max. 10 counts per second
  Returnable to zero instantly.
- * High Reliability and Long Life
- * High Impact Plastic Case

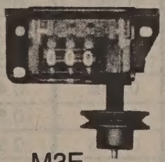
SPECIAL COUNTERS

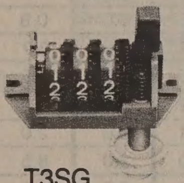
• CONTACT SATORI ELECTRIC FOR ADDITIONAL INFORMATION

MTI-I

M3K


M3B


M3E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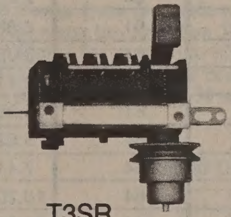
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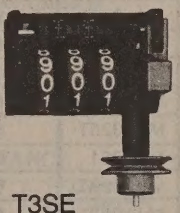
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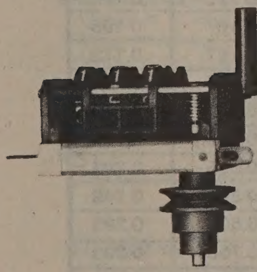
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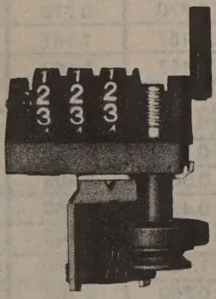
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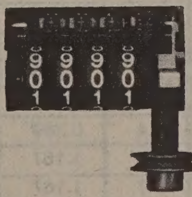
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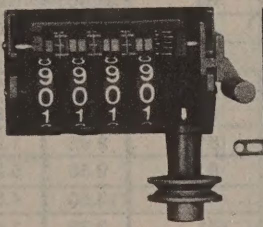
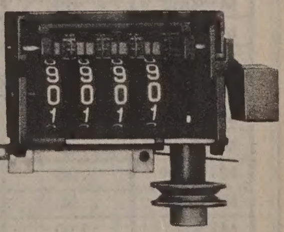

T4E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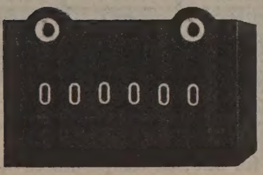
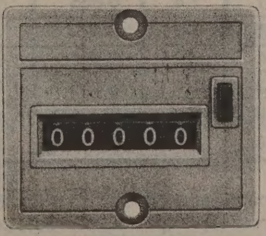
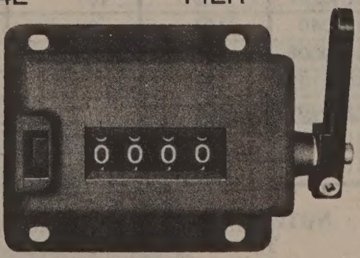

ECT-6A


ECR-5A


RT-401

IMPORTED AND MARKETED BY:

SATORI ELECTRIC (AMERICA) INC.
23717 Hawthorne Blvd., Suite 201
Torrance, CA 90505

Tel. (213) 378-9478
Telex. 182536 SATORITRNC
FAX. (213) 375-8565

MARLOW INDUSTRIES

SOLID STATE RELIABILITY

THERMOELECTRIC COOLERS are solid-state, vibration-free, noise-free heat pumps. They are modular devices, so are simple to install and operate. Since they consist primarily of thermoelectric material sandwiched between ceramic plates and have no moving parts, they are inherently reliable.

STANDARD COOLERS provide our customers with an option of rapid delivery at a minimum cost. The wide variety of standard heat pumps available is shown below. Many of our customers have discovered that installation and testing of one of our standard coolers is an effective means of defining critical thermal parameters and desired operating conditions. This feed-back information is often essential for dependable cost versus performance optimization of complex thermal systems.

STANDARD THERMOELECTRIC HEAT PUMPS

COOLER MODEL	ΔT max (°C) vacuum	ΔT max (°C) dry N_2	Q max (watts)	I max (amps)	V max (volts)	Base Ceramic		Top Ceramic		Cooler Height (inches)
						Width (inches)	Length (inches)	Width (inches)	Length (inches)	
MI1010T	67	61	0.52	1.0	0.8	0.156	0.156	0.156	0.156	0.095
MI1020T	68	64	1.01	2.0	0.8	0.156	0.156	0.156	0.156	0.085
MI1011T	67	61	1.26	1.0	2.0	0.260	0.260	0.260	0.260	0.095
MI1012T	67	61	2.29	1.0	3.7	0.346	0.346	0.346	0.346	0.095
MI1021T	68	64	2.45	2.0	2.0	0.260	0.260	0.260	0.260	0.085
MI1015T	67	61	2.88	1.0	4.7	0.346	0.432	0.346	0.432	0.095
MI1060	68	64	3.05	6.0	0.8	0.380	0.380	0.380	0.380	0.172
MI1022T	68	64	4.47	2.0	3.7	0.346	0.346	0.346	0.346	0.085
MI1013T	67	61	5.25	1.0	8.5	0.518	0.518	0.518	0.518	0.095
MI1025T	68	64	5.62	2.0	4.7	0.346	0.432	0.346	0.432	0.085
MI1061	68	64	7.41	6.0	2.0	0.511	0.511	0.511	0.511	0.172
MI1023T	68	64	10.20	2.0	8.5	0.518	0.518	0.518	0.518	0.085
MI1062	68	64	15.30	6.0	4.2	0.570	1.167	0.570	1.167	0.172
MI1064	68	64	15.30	6.0	4.2	0.770	0.770	0.770	0.770	0.172
MI1120	68	64	27.40	12.1	3.7	1.167	1.167	1.167	1.167	0.195
MI1063	68	64	31.00	6.0	8.5	1.167	1.167	1.167	1.167	0.172
MI1069	68	64	55.40	6.0	15.2	1.500	1.500	1.500	1.500	0.172
MI2020T	95	88	0.35	1.7	0.9	0.156	0.156	0.100	0.100	0.149
MI2021T	90	84	1.04	1.5	2.1	0.260	0.260	0.156	0.156	0.149
MI2060	95	87	1.22	5.8	0.9	0.380	0.380	0.205	0.205	0.293
MI2012T	86	81	2.62	1.2	5.4	0.389	0.432	0.260	0.346	0.149
MI2064	98	91	9.50	5.2	8.6	1.167	1.167	0.500	0.500	0.293
MI2063	90	83	13.50	4.5	8.7	1.167	1.167	0.750	0.750	0.293
MI3021T	110	101	0.38	1.4	2.1	0.260	0.260	0.100	0.100	0.212
MI3026T	109	101	0.72	1.4	3.6	0.346	0.346	0.160	0.174	0.234
MI3040	107	98	6.29	4.7	7.4	0.855	1.113	0.339	0.511	0.430
MI4000T	106	—	0.46	0.6	6.9	0.520	0.678	0.160	0.314	0.345
MI4012T	111	—	0.85	1.1	6.9	0.520	0.678	0.160	0.314	0.345
MI4040	118	—	3.01	4.3	7.1	0.855	1.113	0.253	0.425	0.561
MI6020	132	—	0.33	1.9	6.5	0.855	1.113	0.205	0.205	1.012
MI6030	132	—	0.66	3.8	6.5	0.855	1.113	0.205	0.205	0.802

NOTE: The above chart is based on a hot side temperature of 27 °C. It can be used as-is for hot side temperatures of $T_h = 15\ ^\circ C$ to $40\ ^\circ C$ with less than 10% errors. To improve accuracy, convert the respective maximum values per the following formulas:

$\Delta T\text{max} \ @ \ T_h = \Delta T\text{max} \cdot [1 + .0056 \cdot (T_h - 27\ ^\circ C)]$

$Q\text{max} \ @ \ T_h = Q\text{max} \cdot [1 + .0042 \cdot (T_h - 27\ ^\circ C)]$

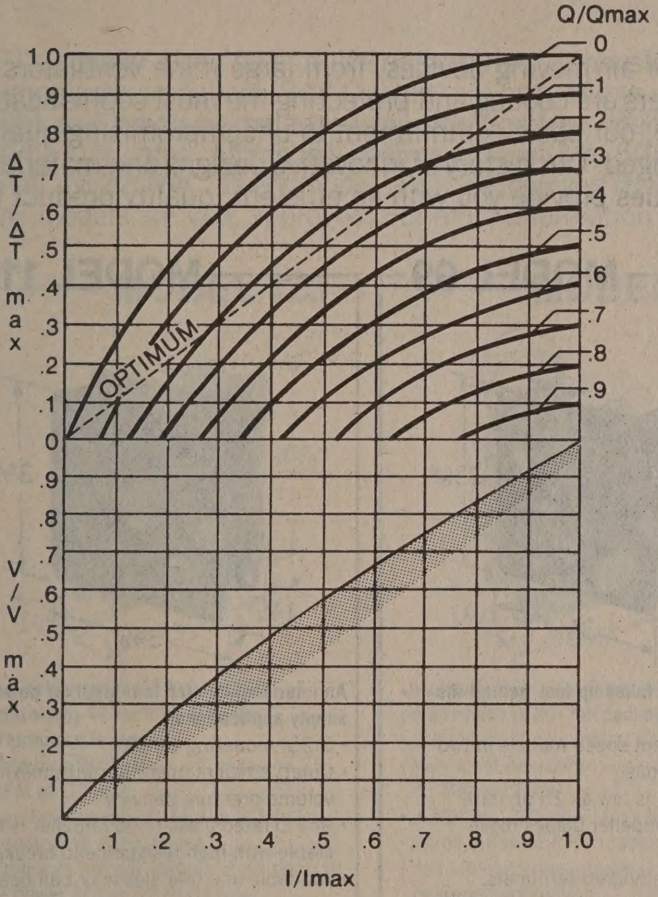
$V\text{max} \ @ \ T_h = V\text{max} \cdot [1 + .0047 \cdot (T_h - 27\ ^\circ C)]$

$I\text{max} \ @ \ T_h = I\text{max}$ Constant

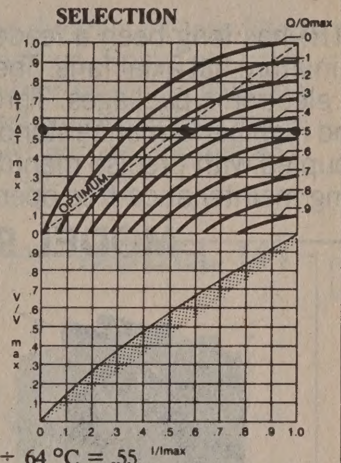
For More Information. Circle No. 117

HIGH PERFORMANCE COOLERS

HOW TO USE CHART



SELECTION



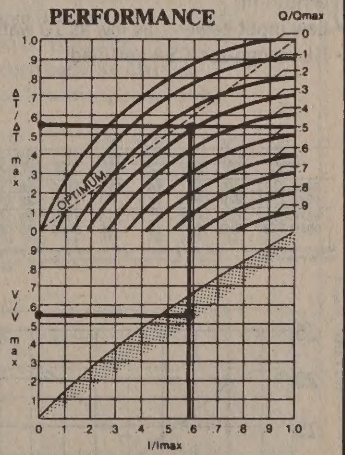
EXAMPLE Select a cooler to pump 9 watts at a cold side temperature of -8°C from a hot side of 27 °C. Ambient is dry nitrogen.

SELECTION

1. **Select number of stages and calculate ΔT/ ΔTmax.** The example ΔT is 35 °C and, by observing the table, can be achieved with a single stage cooler:
   ΔT/ ΔTmax = 35 °C ÷ 64 °C = .55
2. **Draw the corresponding horizontal line on the upper graph.**
3. **Read Q/Qmax for the optimum and maximum cooling cases.**
   Optimum Q/Qmax = .25
   Maximum Q/Qmax = .45
4. **Calculate Qmax:**
   Optimum Qmax = 9 watts ÷ .25 = 36 watts
   Maximum Qmax = 9 watts ÷ .34 = 20 watts
5. **Select a cooler from the table** whose Qmax is greater than 20 watts but less than 36 watts, favoring the optimum Qmax for maximum efficiency or maximum Qmax for potentially lower cost:
   Select MI 1063 with Qmax = 31 watts

PERFORMANCE

1. **Record the maximum values for the selected cooler:** MI 1063
   Qmax = 31 watts
   Imax = 6.0 Amps
   Vmax = 8.5 Volts
2. **Calculate Q/Qmax and plot corresponding vertical line** from the intersection of this Q/Qmax and the original horizontal line:
   Q/Qmax = 9 watts ÷ 31 watts = .29
3. **Read I/Imax and calculate I:**
   I/Imax = .59
   I = 6 amps * .59 = 3.5 amps
4. **Plot horizontal line** in the lower graph from the intersection of the vertical line and the curve. Note: Use the solid curve for ΔT's near ΔTmax and shaded area for lower ΔT's.
5. **Read V/Vmax and calculate V:**
   V/Vmax = .56
   V = 8.5 volts * .56 = 4.8 volts



SUMMARY

The **MI 1063** was selected and can produce the thermal performance given in the example with an applied power of **3.5 amps @ 4.8 volts.**

In addition to our line of standard heat pumps, Marlow Industries sells a complete line of temperature controller/power supplies, heat sinks and accessories.
Please call or write today for further information or technical assistance.

mi marlow industries
incorporated

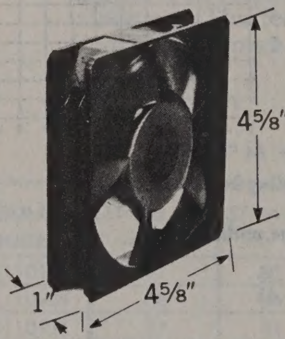
THERMOELECTRIC INNOVATION THROUGH RESEARCH

10451 VISTA PARK ROAD • DALLAS, TEXAS 75238
(214) 340-4900 • TWX 910-860-5161

ETRI tube

ETRI has long been a leader in the design of air-moving devices, from large mine ventilators to miniature flat axial fans. Today, ETRI air movers are cooling and protecting the most sophisticated of electronic packages. Throughout this time, our basic commitment to uncompromising quality and high performance standards has not changed. Our history of innovative designs and materials, coupled with precise manufacturing techniques provide you with an efficient, quality product for long maintenance-free operation.

MODEL 98

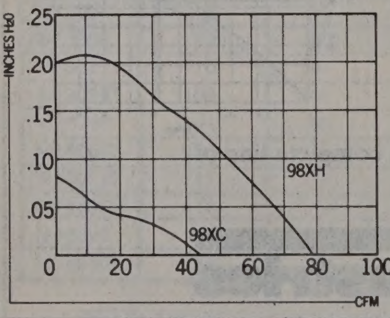


High volume/pressure performance where space is at a premium.

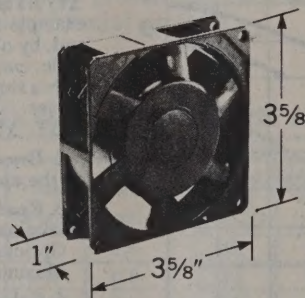
- Unique 1" thin profile on 4⅝" fan.
- Two RPM versions available.
- Available in either sleeve or ball bearing construction.
- Precision engineered blade-to-venturi fit.
- Low input power—as low as 10 watts.
- UL recognized/CSA certified.

PART NUMBER	VOLT (V)	FREQ (Hz)	POWER INPUT (W)	CURRENT INPUT (ma)	SPEED (RPM)	NOISE LEVEL SIL/dB	FREE AIR DELIVERY (CFM)
98XC-2182	115	60	10	110	1700	28	45
98XC-2181	220	60	12	70	1700	28	45
98XH-2182	115	60	11	110	3000	39	79
98XH-2181	220	60	13	65	3000	39	79

Model numbers shown are for sleeve bearing versions. To order ball bearing fans, omit the first "2" from the last group of digits.



MODEL 99

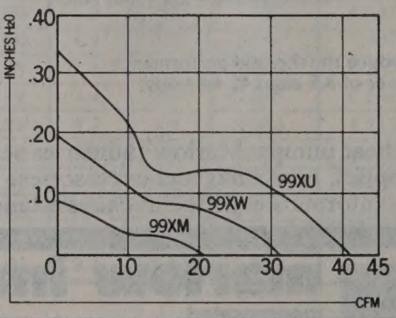


Slim 1" profile takes up less behind-the-panel space.

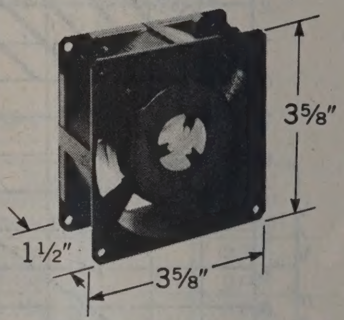
- Three different speed models in two voltage versions.
- Noise levels as low as 23 db (sil).
- True airfoil impeller blades move more air.
- Convenient standard terminals.
- Precision balanced lightweight rotor for longer vibration-free work life.
- UL recognized/CSA approved.

PART NUMBER	VOLT (V)	FREQ (Hz)	POWER INPUT (W)	CURRENT INPUT (ma)	SPEED (RPM)	NOISE LEVEL SIL/dB	FREE AIR DELIVERY (CFM)
99XM-2182	115	60	6	65	1700	23	21
99XM-2181	220	60	7	35	1700	23	21
99XW-2182	115	60	6	70	2500	32	32
99XW-2181	220	60	7	40	2500	32	32
99XU-2182	115	60	9	105	3200	37	40
99XU-2181	220	60	11	60	3200	37	40

Model numbers shown are for sleeve bearing versions. To order ball bearing fans, omit the first "2" from the last group of digits.



MODEL 113

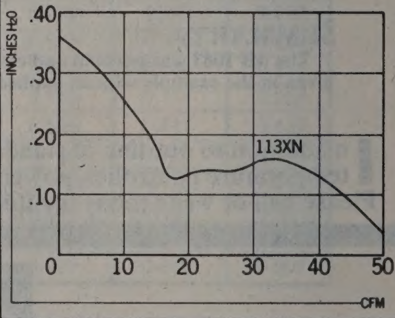


An intermediate size fan. Ideal for power supply applications.

- 3.25" mounting centers.
- Quiet, efficient operation with maximum volume/pressure delivery.
- 94V-O rated glass-filled impeller is heat-stable with high resistance to breakage.
- Available in either sleeve or ball bearing construction.
- UL recognized/CSA approved.

PART NUMBER	VOLT (V)	FREQ (Hz)	POWER INPUT (W)	CURRENT INPUT (ma)	SPEED (RPM)	NOISE LEVEL SIL/dB	FREE AIR DELIVERY (CFM)
113XN-2182	115	60	11	135	3300	35	53
113XN-2181	220	60	12	80	3300	35	53

Model numbers shown are for sleeve bearing versions. To order ball bearing fans, omit the first "2" from the last group of digits.



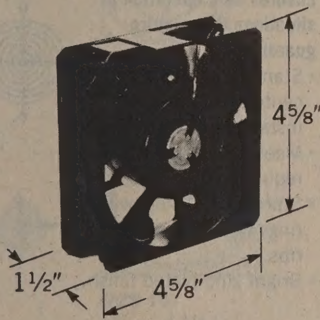
ETRI

ETRI/PO Box 568/608 Broome St/Monroe, NC 28110/TWX 810-649-1352 **(704)289-5423**

axial fans.

ETRI's popular-sized fans utilize rugged die cast housings for strength and durability. Glass-filled thermoplastic impellers (94V-O rated) are heat-stable and resistant to breakage. Rotors are lightweight and precision balanced for vibration-free operation. Bearings (either sleeve or ball) are lifetime lubricated. All models operate efficiently at 50Hz or 60Hz and most are available in either 115VAC or 220VAC. Every model is UL Recognized (file E64887) and CSA Certified (file 43861). Many models are VDE approved. For more information call ETRI at 704/289-5423.

MODEL 125

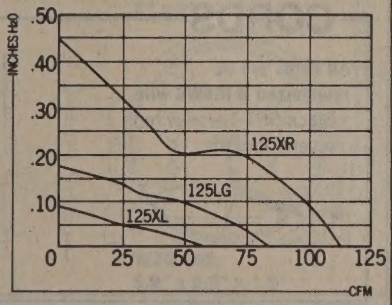


Extremely effective in high density applications where high pressure performance is required.

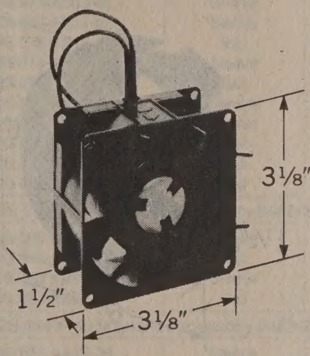
- Develops 90 CFM at .15" H₂O and 75 CFM at .2" H₂O.
- Can replace two conventional fans in demanding applications.
- Produces highest volume of air per watt of power of any fan of its type.
- Available in either sleeve or ball bearing construction.
- UL recognized/CSA certified.

PART NUMBER	VOLT (V)	FREQ (Hz)	POWER INPUT (W)	CURRENT INPUT (ma)	SPEED (RPM)	NOISE LEVEL SIL/dB	FREE AIR DELIVERY (CFM)
125XL-2282	115	60	10	115	1650	29	57
125XL-2281	220	60	10	65	1650	29	57
125LG-2282	115	60	13	160	2400	36	83
125LG-2281	220	60	15	90	2400	36	83
125XR-2282	115	60	15	180	3250	40	112
125XR-2281	220	60	15	105	3250	40	112

Model numbers shown are for sleeve bearing versions. To order ball bearing fans, omit the first "2" from the last group of digits.



MODEL 126

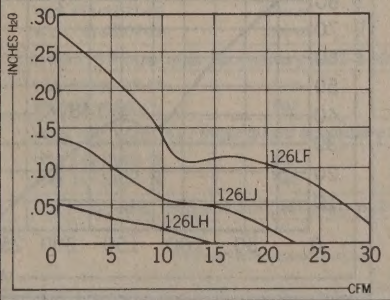


Low input power, low noise, high performance in this fan package.

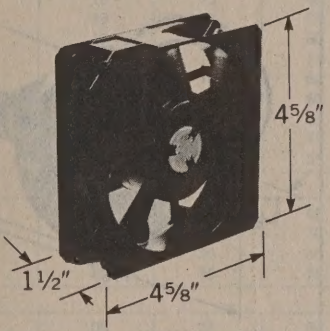
- 2.81" mounting centers.
- Very quiet operation—only 8 db (sil) on Model 126LH.
- #20AWG, 12" long, flying leads.
- Three different RPM models.
- Available in either sleeve or ball bearing construction.
- UL recognized CSA certified.

PART NUMBER	VOLT (V)	FREQ (Hz)	POWER INPUT (W)	CURRENT INPUT (ma)	SPEED (RPM)	NOISE LEVEL SIL/dB	FREE AIR DELIVERY (CFM)
126LH-2182	115	60	3	40	1550	9	15
126LJ-2182	115	60	5	60	2400	19	23
126LF-2182	115	60	8	100	3200	26	32
126LF-2181	220	60	8	60	3200	26	32

Model numbers shown are for sleeve bearing versions. To order ball bearing fans, omit the first "2" from the last group of digits.



MODEL 141

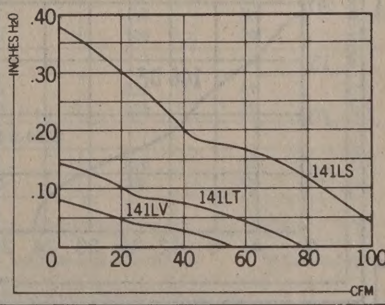


105, 75, and 55 CFM versions are available in this most popular size fan.

- 4.125" mounting centers and standard terminal configuration.
- Low power consumption—only 8 watts on 141LV model
- Tight blade-to-venturi fit assures optimum performance.
- Available in either sleeve or ball bearing construction.
- UL recognized/CSA certified
- Reverse flow models available.

PART NUMBER	VOLT (V)	FREQ (Hz)	POWER INPUT (W)	CURRENT INPUT (ma)	SPEED (RPM)	NOISE LEVEL SIL/dB	FREE AIR DELIVERY (CFM)
141LV-2282	115	60	8	100	1700	23	55
141LV-2281	220	60	9	55	1700	23	55
141LT-2282	115	60	9	110	2300	33	75
141LT-2281	220	60	10	65	2400	33	75
141LS-2282	115	60	12	140	3200	41	105
141LS-2281	220	60	12	80	3200	41	105

Model numbers shown are for sleeve bearing versions. To order ball bearing fans, omit the first "2" from the last group of digits.



SEE FOLLOWING PAGES

ETRI

ETRI PO Box 568 608 Broome St. Monroe, NC 28110 TWX 810-649-1352 **(704) 289-5423**

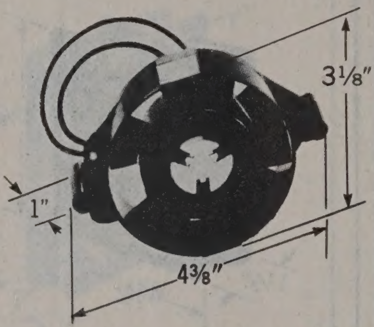
ETRI fans

ETRI's flat tubeaxial fans are quiet, efficient, cost effective components that are ideal for most electronic cooling applications. For complete technical specifications and delivery information call the ETRI factory at (704) 289-5423.

and accessories.

Accessory items assure correct fit on ETRI fans. Finger Guards will retro fit most existing fans.

MODEL 146

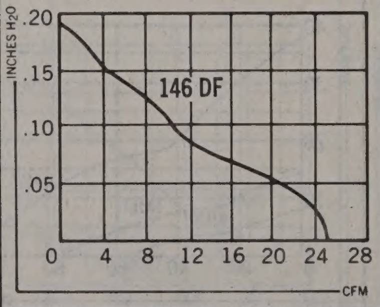


3" x 1" fan specially designed for desk-top electronic applications

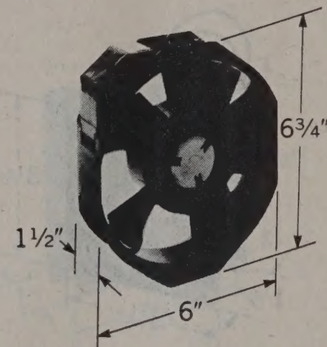
- Low acoustical levels.
- 25 CFM at free air delivery.
- Simplified time saving mounting with bosses and speed nuts provides real economy for high volume installation.
- 115 or 220 volt.
- UL recognized/CSA certified/VDE approved.
- Will fit 3⅛" designs in a 1" profile.

PART NUMBER	VOLT (V)	FREQ (Hz)	POWER INPUT (W)	CURRENT INPUT (ma)	SPEED (RPM)	NOISE LEVEL SIL/dB	FREE AIR DELIVERY (CFM)
146DF-2182	115	60	5	60	3100	247	25
146DF-2181	220	60	9	50	3100	247	25

Model numbers shown are for sleeve bearing versions. To order ball bearing fans, omit the first "2" from the last group of digits.



MODEL 148

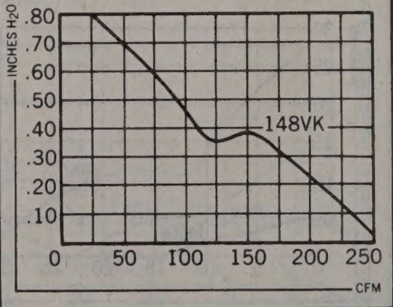


Ideal for high pressure/high flow applications. Develops 180 CFM at .3" H_2O.

- 1½" thick—less than most 6" fans.
- Efficient, permanent split-capacitor motor, thermally protected.
- Pre-loaded ABEC-3, double-shielded, ball bearing system runs quietly in any position.
- UL recognized/CSA certified.
- Reduced speed versions available.
- Provides wide range cooling with low acoustical disturbances.

PART NUMBER	VOLT (V)	FREQ (Hz)	POWER INPUT (W)	CURRENT INPUT (ma)	SPEED (RPM)	NOISE LEVEL SIL/dB	FREE AIR DELIVERY (CFM)
148VE282	115	60	11	90	1650	33	123
148VE281	220	60	14	80	1650	33	123
148VP282	115	60	18	160	2100	39	149
148VP281	220	60	22	100	2350	45	172
148VK282	115	60	32	270	3300	51	255
148VK281	220	60	33	170	3200	50.5	255

Model numbers shown are for sleeve bearing versions. To order ball bearing fans, omit the first "2" from the last group of digits.

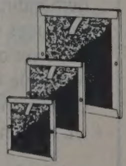


FINGER GUARDS

Ensures safe operation in situations that require guarding.

- Standard mounting centers for versatile installation.
- Meets UL Spacing requirements.
- Sturdy .062" steel wire rings welded to .080" ribs.
- Bright zinc-plated finish.

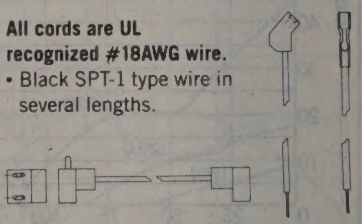
FILTERS



Provides maximum air flow while permitting effective filtering.

- Expanded/slit aluminum foil traps dust particles.
- Minimum pressure loss.
- Complies with UL requirements.

CORDS



All cords are UL recognized #18AWG wire.

- Black SPT-1 type wire in several lengths.

SEE PREVIOUS PAGES

ETRI

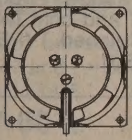
QUALITY FANS FOR ELECTRONICS.
ETRI/PO Box 568/608 Broome St./Monroe, NC 28110/TWX 810-649-1352 **(704) 289-5423**

For More Information. Circle No. 118

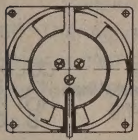
ebm Tubeaxial Fans

AC, DC or Dual Voltage AC (115/230) UL, CSA, VDE Approved

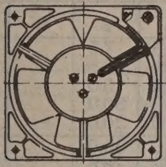
Specifications



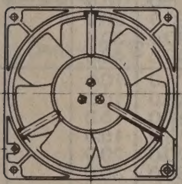
W2S 075
3⅛" x 1½"



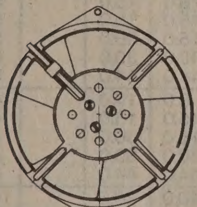
W2S 086
3⅝" x 1½"



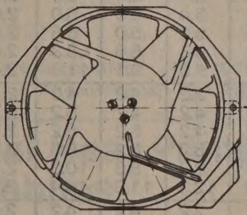
W2S 107
4¹¹/₁₆" x 1½'



W2S 115
5" x 1½"



W2S 130
6" x 2"



W2S 142
5.9" x 6.8" x 1.5"

Type	Bearing	Volts†	CFM††	db(SIL)††	Max. Oper. Temp. °C
W2S 075-AA11-02	Sleeve	115	32	23	60
W2S 075-AA11-01	Ball	115	32	23	75
W2S 075-AA13-02	Sleeve	230	32	23	60
W2S 075-AA13-01	Ball	230	32	23	75
W2S 075-AA13-81	Sleeve	115/230	32	23	60
W2S 075-AD11-02	Sleeve	115	25	18	60
W2S 075-AD11-01	Ball	115	25	18	75
W2S 075-AD13-02	Sleeve	230	25	18	60
W2S 075-AD13-01	Ball	230	25	18	75
W2S 075-AD13-81	Sleeve	115/230	25	18	60
W2S 075-AE11-02	Sleeve	115	18	16	60
W2S 075-AE11-01	Ball	115	18	17	75
W2S 075-AE13-02	Sleeve	230	18	16	60
W2S 075-AE13-01	Ball	230	18	17	75
W2S 075-AE13-81	Sleeve	115/230	18	16	60
A2S 075-BA11-02*	Sleeve	115	32	23	60
W2G 075-AB22-01	Ball	12 DC	34	23	55
W2G 075-AB24-01	Ball	24 DC	34	23	55
W2G 075-AB26-01	Ball	48 DC	34	23	55
W2S 075 Finger guard accessory 9480-2-4039					
W2S 086-AA07-02	Sleeve	115	46	33	60
W2S 086-AA07-01	Ball	115	46	33	70
W2S 086-AA05-02	Sleeve	230	46	33	60
W2S 086-AA05-01	Ball	230	46	33	75
W2S 086 Finger guard accessory 9483-2-4039					
W2S 107-AA15-39	Sleeve	115	106	34	60
W2S 107-AA15-13	Ball	115	106	34	75
W2S 107-AA01-39	Sleeve	230	106	34	60
W2S 107-AA01-13	Ball	230	106	34	75
W2S 107-AA01-67	Sleeve	115/230	106	34	60
W2S 107-AB07-39	Sleeve	115	71	23	60
W2S 107-AB07-13	Ball	115	71	23	75
W2S 107-AB05-39	Sleeve	230	71	23	60
W2S 107-AB05-13	Ball	230	71	23	75
W2S 107-AB05-67	Sleeve	115/230	71	23	60
W2S 107-AB11-39	Sleeve	115	48	15	60
W2S 107-AB11-13	Ball	115	48	15	75
W2S 107-AB13-39	Sleeve	230	48	15	60
W2S 107-AB13-13	Ball	230	48	15	75
W2S 107-AB13-67	Sleeve	115/230	48	15	60
A2S 107-BA15-02*	Sleeve	115	106	34	60
A2S 107-BB07-02*	Sleeve	115	71	23	60
W2G 107-AB02-01	Ball	12 DC	100	32	55
W2G 107-AB04-01	Ball	24 DC	100	32	55
W2G 107-AB06-01	Ball	48 DC	100	32	55
W2S 107 Finger guard accessory 9497-2-4039					
W2S 115-AA03-39	Sleeve	115	127	34	60
W2S 115-AA03-13	Ball	115	127	34	75
W2S 115-AA01-39	Sleeve	230	127	34	60
W2S 115-AA01-13	Ball	230	127	34	75
W2S 115-AB11-39	Sleeve	115	106	30	60
W2S 115-AB07-39	Sleeve	230	106	30	60
W2S 115 Finger guard accessory 9496-2-4039					
W2S 130-AA25-01	Ball	115	233	41	75
W2S 130-AA03-01	Ball	230	233	41	75
W2S 130, W2E 142 Finger guard accessory 9498-2-4039					
W2E 142-BB05-16	Ball	115	236	53	75
W2E 142-BB01-16	Ball	230	236	53	75
For all models: Plug and cord set 1434-4-6711					

*Skeleton fans without housing

† AC volts rated at 50/60 Hertz

†† 0 static pressure

ebm Industries, Inc.—525 New Britain Avenue
Unionville, CT 06085, phone (203) 674-1515

MELCOR

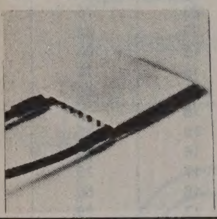
MATERIALS ELECTRONIC PRODUCTS CORP.
994 SPRUCE STREET
TRENTON, NEW JERSEY 08648 U.S.A.
TELEPHONE (609) 393-4178 / TELEX 843314

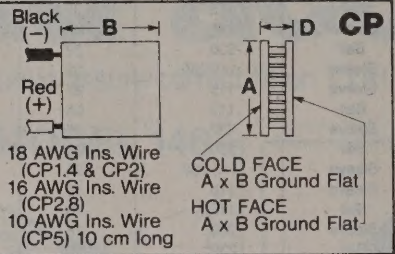
SOLID STATE COOLING WITH THERMOELECTRICS

Thermoelectric (Peltier) Heat Pump Module Specifications

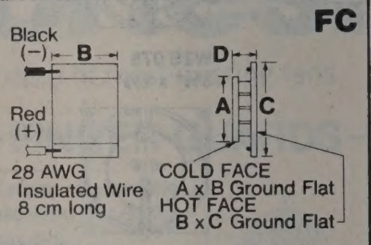
Thermocouples constructed of N & P elements of highest grade bismuth telluride in form of oriented polycrystalline ingots. Ingot ends soldered to copper bus bars interfaced with ceramic plates, affording good mechanical integrity, high dielectric strength and thermal conduction. Temperature range, −150°C to +110°C. Solid state construction. Both hot and cold faces lapped flat, TYPE L. Both faces metallized and tinned, TYPE TT. Hybrid, hot face tinned, cold face lapped, TYPE TL.

CP SERIES





FC SERIES



			HOT FACE Th = 25°C			UNIVERSAL MULTIPLIERS			DIMENSIONS, MM				
	CATALOG NUMBER	I MAX AMPS	Q MAX WATTS	V MAX VOLTS	△ T MAX °C	N NO. COUPLES	G GEOMETRY FACTOR	G x N	A	B	C	D*	WEIGHT GRAMS
CP SERIES	CP 1.0- 7-06L	3.3	1.5	0.85	67	7	0.066	0.46	7.5	7.5		3.7	1.5
	CP 1.0- 14-06L	3.3	3.1	1.69	67	14	0.066	0.92	11.5	9.5		3.7	2.1
	CP 1.0- 31-06L	3.3	6.9	3.75	67	31	0.066	2.05	15.0	15.0		3.7	3.6
	CP 1.0- 63-06L	3.3	14.0	7.62	67	63	0.066	4.16	15.0	30.0		3.7	6.4
	CP 1.0-127-06L	3.3	28.2	15.4	67	127	0.066	8.38	30.0	30.0		3.7	12.0
	CP 1.0-127-05L	3.9	33.4	15.4	67	127	0.078	9.91	30.0	30.0		3.2	11.3
	CP 1.4- 3-10L	3.9	0.77	0.36	70	3	0.078	0.23	5.0	10.0		4.7	0.6
	CP 1.4- 7-10L	3.9	1.85	0.85	70	7	0.078	0.55	10.0	10.0		4.7	1.4
	CP 1.4- 11-10L	3.9	2.90	1.33	70	11	0.078	0.86	10.0	15.0		4.7	2.2
	CP 1.4- 17-10L	3.9	4.48	2.06	70	17	0.078	1.33	15.0	15.0		4.7	3.4
	CP 1.4- 31-10L	3.9	8.15	3.75	70	31	0.078	2.4	20.0	20.0		4.7	6.4
	CP 1.4- 71-10L	3.9	18.7	8.60	70	71	0.078	5.54	30.0	30.0		4.7	14.2
	CP 1.4-127-10L	3.9	33.4	15.4	70	127	0.078	9.91	40.0	40.0		4.7	25.4
	CP 1.4- 3-06L	6.0	1.2	0.36	67	3	0.12	0.36	5.0	10.0		3.8	0.5
	CP 1.4- 7-06L	6.0	2.8	0.85	67	7	0.12	0.84	10.0	10.0		3.8	1.2
	CP 1.4- 11-06L	6.0	4.4	1.33	67	11	0.12	1.32	10.0	15.0		3.8	1.8
	CP 1.4- 17-06L	6.0	6.9	2.06	67	17	0.12	2.04	15.0	15.0		3.8	2.9
	CP 1.4- 31-06L	6.0	12.5	3.75	67	31	0.12	3.72	20.0	20.0		3.8	5.5
	CP 1.4- 71-06L	6.0	28.7	8.60	67	71	0.12	8.52	30.0	30.0		3.8	12.2
	CP 1.4-127-06L	6.0	51.4	15.4	67	127	0.12	15.24	40.0	40.0		3.8	21.8
	CP 1.4-127-045L	8.5	68.8	15.4	65	127	0.17	21.60	40.0	40.0		3.3	20.0
	CP 2 - 3-10L	9.0	1.8	0.36	70	3	0.18	0.54	8.0	15.0		5.6	1.9
	CP 2 - 7-10L	9.0	4.2	0.85	70	7	0.18	1.26	15.0	15.0		5.6	4.3
	CP 2 - 15-10L	9.0	9.1	1.81	70	15	0.18	2.70	15.0	30.0		5.6	8.9
	CP 2 - 31-10L	9.0	18.8	3.75	70	31	0.18	5.58	30.0	30.0		5.6	18.5
	CP 2 - 71-10L	9.0	43.1	8.60	70	71	0.18	12.78	44.0	44.0		5.6	42.0
	CP 2 - 3-06L	14.0	2.8	0.36	67	3	0.28	0.84	8.0	15.0		4.6	1.9
	CP 2 - 7-06L	14.0	6.6	0.85	67	7	0.28	1.96	15.0	15.0		4.6	4.3
	CP 2 - 15-06L	14.0	14.1	1.81	67	15	0.28	4.20	15.0	30.0		4.6	8.9
	CP 2 - 31-06L	14.0	29.2	3.75	67	31	0.28	8.68	30.0	30.0		4.6	18.5
	CP 2 - 71-06L	14.0	67.0	8.60	67	71	0.28	19.88	44.0	44.0		4.6	35.6
	CP 2.8- 32-06L	24.0	51.8	3.87	67	32	0.48	15.36	40.0	40.0		4.9	34.0
	CP 5 - 31-10L	39.0	81.5	3.75	67	31	0.78	24.18	55.0	55.0		5.8	73.0
	CP 5 - 31-06L	60.0	125.4	3.75	67	31	1.20	37.20	55.0	55.0		4.9	64.5
FC SERIES	FC 0.45- 4-05L	0.8	0.22	0.48	67	4	0.016	0.064	1.8	3.4	3.4	2.4	All weights below 0.7 g
	FC 0.45- 8-05L	0.8	0.43	0.97	67	8	0.016	0.13	3.4	3.4	5.0	2.4	
	FC 0.45- 12-05L	0.8	0.65	1.45	67	12	0.016	0.19	3.4	5.0	5.0	2.4	
	FC 0.45- 18-05L	0.8	0.97	2.18	67	18	0.016	0.29	5.0	5.0	6.6	2.4	
	FC 0.45- 32-05L	0.8	1.72	3.87	67	32	0.016	0.51	6.6	6.6	8.3	2.4	
	FC 0.45- 66-05L	0.8	3.56	7.98	67	66	0.016	1.06	9.9	9.1	11.5	2.4	
	FC 0.6- 4-06L	1.2	0.32	0.48	67	4	0.024	0.096	2.2	4.2	4.2	2.7	All weights below 0.7 g
	FC 0.6- 8-06L	1.2	0.65	0.97	67	8	0.024	0.19	4.2	4.2	6.2	2.7	
	FC 0.6- 12-06L	1.2	0.97	1.45	67	12	0.024	0.29	4.2	6.2	6.2	2.7	
	FC 0.6- 18-06L	1.2	1.46	2.18	67	18	0.024	0.43	6.2	6.2	8.3	2.7	
	FC 0.6- 32-06L	1.2	2.59	3.87	67	32	0.024	0.77	8.3	8.3	10.3	2.7	
	FC 0.6- 66-06L	1.2	5.34	7.98	67	66	0.024	1.58	12.3	11.3	14.4	2.7	
	FC 0.6- 4-05L	1.5	0.40	0.48	67	4	0.030	0.12	2.2	4.2	4.2	2.4	All weights below 0.7 g
	FC 0.6- 8-05L	1.5	0.81	0.97	67	8	0.030	0.24	4.2	4.2	6.2	2.4	
	FC 0.6- 12-05L	1.5	1.21	1.45	67	12	0.030	0.36	4.2	6.2	6.2	2.4	
	FC 0.6- 18-05L	1.5	1.82	2.18	67	18	0.030	0.54	6.2	6.2	8.3	2.4	
	FC 0.6- 32-05L	1.5	3.23	3.87	67	32	0.030	0.96	8.3	8.3	10.3	2.4	
	FC 0.6- 66-05L	1.5	6.67	7.98	67	66	0.030	1.98	12.3	11.3	14.4	2.4	
	FC 0.7- 4-05L	2.0	0.54	0.48	67	4	0.040	0.16	2.4	4.7	4.7	2.4	All weights below 0.7 g
	FC 0.7- 8-05L	2.0	1.08	0.97	67	8	0.040	0.32	4.7	4.7	7.0	2.4	
	FC 0.7- 12-05L	2.0	1.62	1.45	67	12	0.040	0.48	4.7	7.0	7.0	2.4	
	FC 0.7- 18-05L	2.0	2.43	2.18	67	18	0.040	0.72	7.0	7.0	9.3	2.4	
	FC 0.7- 32-05L	2.0	4.31	3.87	67	32	0.040	1.28	9.3	9.3	11.6	2.4	

*Thickness (D, mm) for TYPE L only

"SEE OUR IMMEDIATE ACTION CARD IN VOLUME IV"

MELCOR

MATERIALS ELECTRONIC PRODUCTS CORP.
994 SPRUCE STREET
TRENTON, NEW JERSEY 08648 U.S.A.
TELEPHONE (609) 393-4178 / TELEX 843314

SOLID STATE COOLING WITH THERMOELECTRICS

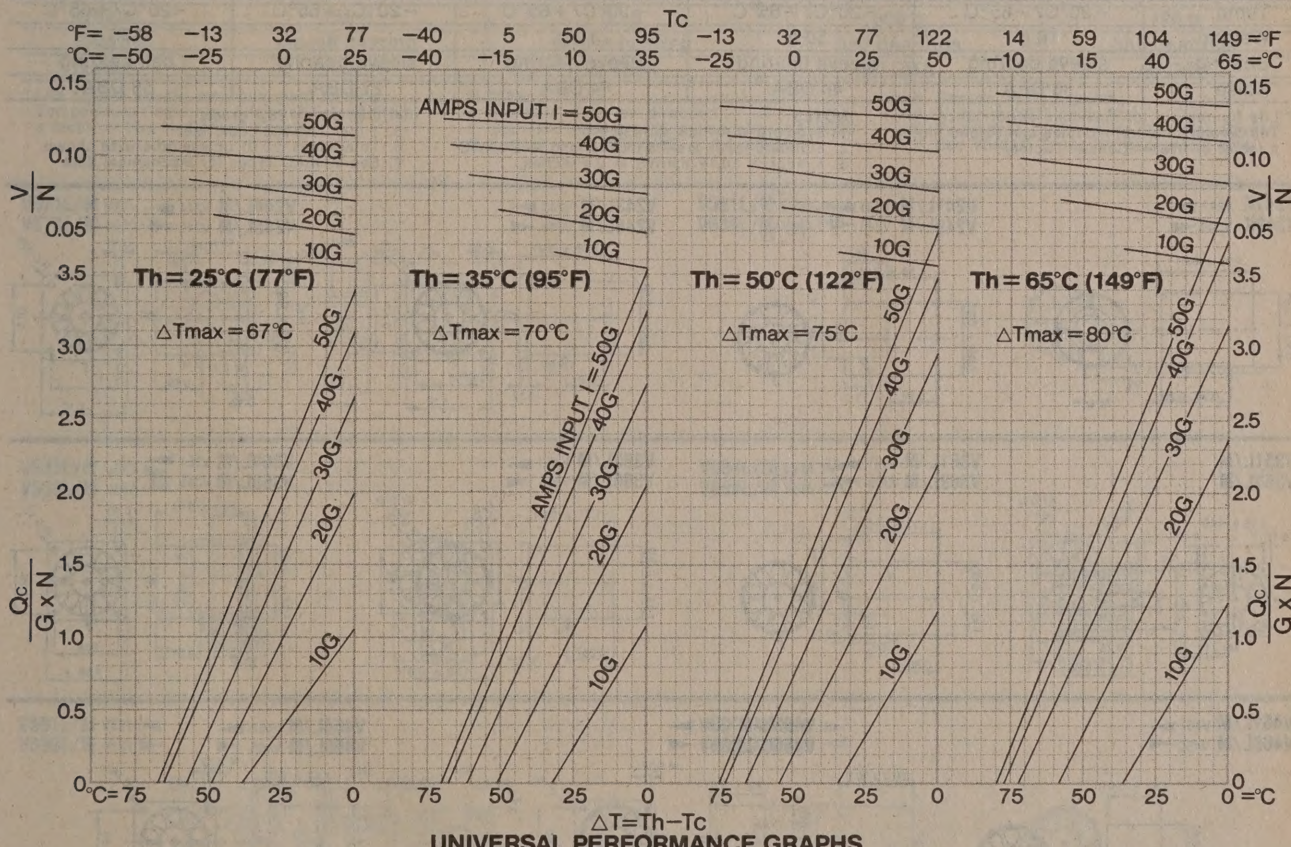
How to Use Universal Performance Graphs

Example: Convert universal scale values of Q_C/ GxN, V/N and I = 50G for Module Number CP1.4-127-06 L.

CP1.4-127-06 L

L — Hot and Cold Faces Lapped Flat, Type L
.06″ Thermocouple Height
127 Thermocouples
1.4 mm x 1.4 mm Thermoelement Cross Section

1. Obtain universal multipliers for CP1.4-127-06L from Module Specifications Chart: N = 127 (number of thermocouples)
G = 0.12
(thermoelement geometry factor)
G x N = 15.24
2. Calculate amps input Imax = 50G = 50 x 0.12 = 6.0 amps. Also identify I = 40G = 40 x 0.12 = 4.8 amps, etc. Note: Imax values are also listed in Module Specifications Table.
3. Convert Q_C/GxN scale values to Q_C = Watts Heat Pumped values: Q_C = Q_C/GxN x GxN. Example: from universal scale, Q_C/GxN = 3, then Q_C = 3 x 15.24 = 45.72
4. Convert V/N scale values to V = Volts Input values: V = V/N x N. Example: from universal scale, V/N = 0.09, then V = 0.09 x 127 = 11.4 x 3.
5. From graphs, determine Input Current (I) and Heat Pumped Rating (Q_C) for CP1.4-127-06L, operating at Input Voltage V = 12, Tc = 5°C, Th = 35°C; ΔT = Th − Tc = 35 − 5 = 30°C. From V vs. Tc (upper) graphs, Th = 35°C panel, locate I = 4.3 amps (36G) at V = 12, Tc = 5. Drop down vertically on Tc = 5°C/ΔT = 30°C abscissa to point corresponding to I = 4.3 amps. Read Q_C = 25.1 watts (Q_C/GxN = 1.65) heat pumped.

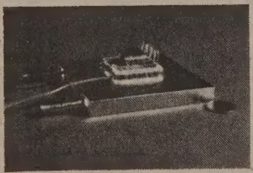


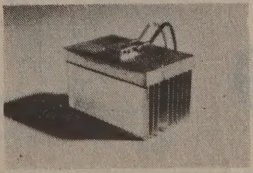
UNIVERSAL PERFORMANCE GRAPHS

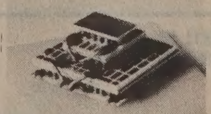
Tc = Cold Face Temperature; Th = Hot Face Temperature; I = Module Current, Amps; V = Module Voltage, Volts; Qc = Watts Heat Pumped; N = Number of Thermocouples; G = Thermoelement Geometry Factor

Special Heat Pump Assemblies

Special assemblies are available in O.E.M. quantities, designed to customer requirements using heat exchangers furnished by customer or by Melcor. Multistage cascades also available in standard and custom configuration, with temperatures to −95°C (6 stage). Ceramic construction with solder interfacing between stages.







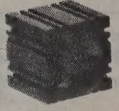
"SEE OUR IMMEDIATE ACTION CARD IN VOLUME IV"

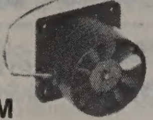
MINIATURE FANS DC

Technical data

V244L

V361L


V359L


V463M

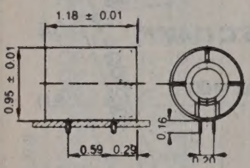
V484M

MODEL	V240	V350 340⁷	V360	V460	V480
Size	ϕ 0.95 x 1.18	ϕ 1.5 x 1.5 x 1.4	ϕ 1.42 x 1.77	ϕ 1.89 x 1.42	ϕ 1.89 x 2.36
Voltage	6/12 V =	6/12/24	6/12/24 V =	6/12 V =	12/24 V =
Housing	cylindrical	square/cyl.⁷	cylindrical	cylindrical	cylindrical
Power	0.3 W	1.6 W	1.6 W	0.25 W	4.2 W
Speed	14000 min⁻¹	13000 min⁻¹	13000 min⁻¹	4200 min⁻¹	11000 min⁻¹
Air Vol.	90 l/min (3.15 CFM)	360 l/min (11.4 CFM)	360 l/min (11.4 CFM)	200 l/min (7.0 CFM)	660 l/min (23 CFM)
Air Pres.	0.6 mar	1.5 mbar	1.5 mbar	0.2 mbar	2 mbar
Life	1000 h*	1500 h*	1500 h*	8000 h*	12000 h* 170 g
Temp.	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C
Weight	16 g	50 g	50 g	74 g	170 g
Bearing	sleeve bearing	sleeve bearing	sleeve bearing	sleeve bearing	ball bearing
Noise	36 DBA	44 DBA	44 DBA	27 DBA	55 DBA

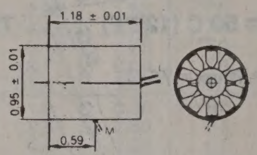
* Life figures are for maximum performance Temperature Control modules can extend life by a factor of five — Consult Factory

NOTES:
1. Symbols ◀ Airflow direction
2. Standard leads are 7.5 inches long — 24 AWG
3. 1 mbar = 10,197mmWS = 0.4 inches
4. One oz. = 28.4 grams
5. 1 liter = 0.035 cubic feet
6. Tolerances ±0.01 unless otherwise shown
7. See V340AC Types for mechanical data

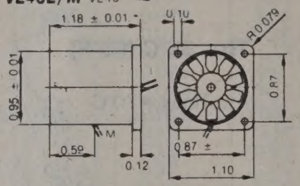
V241K V241 ▶
V249K V249 ◀


1.18 ± 0.01
0.95 ± 0.01
0.16
0.59
0.29
0.20

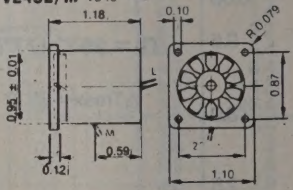
V241L/M V241 ▶
V249L/M V249 ◀


1.18 ± 0.01
0.95 ± 0.01
L
0.59
M

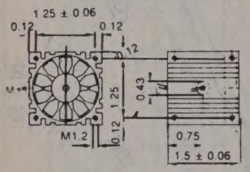
V243L/M V243 ▶
V246L/M V246 ◀


1.18 ± 0.01
0.10
R0.079
0.95 ± 0.01
L
0.87
M
0.59
0.12
0.87 ±
1.10

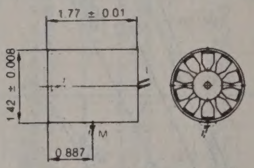
V244L/M V244 ▶
V245L/M V245 ◀


1.18
0.10
R0.079
0.95 ± 0.01
L
0.87
M
0.12
0.59
1.10

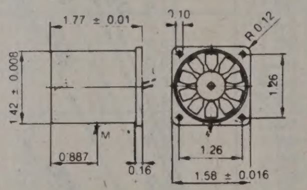
V351L/M
V359L/M


1.25 ± 0.06
0.12
0.12
12
M
1.25
0.43
M1.2
0.12
0.75
1.5 ± 0.06

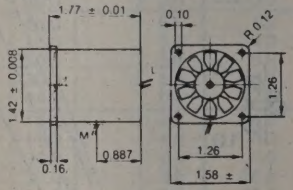
V361L/M V361 ▶
V369L/M V369 ◀


1.77 ± 0.01
1.42 ± 0.008
L
M
0.887

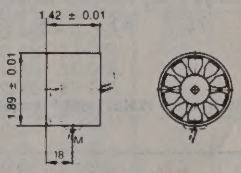
V363L/M V363 ▶
V366L/M V366 ◀


1.77 ± 0.01
0.10
R0.12
1.42 ± 0.008
L
1.26
M
0.887
0.16
1.26
1.58 ± 0.016

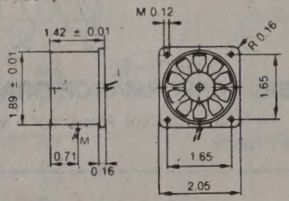
V364L/M V364 ▶
V365L/M V365 ◀


1.77 ± 0.01
0.10
R0.12
1.42 ± 0.008
L
1.26
M
0.887
0.16
1.26
1.58 ±

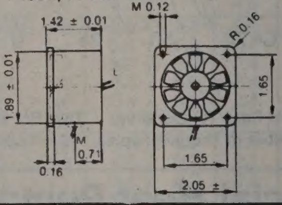
V461L/M V461 ▶
V469L/M V469 ◀


1.42 ± 0.01
1.89 ± 0.01
L
M
18

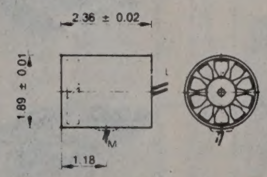
V463L/M V463 ▶
V466L/M V466 ◀


M 0.12
1.42 ± 0.01
R0.16
1.89 ± 0.01
L
1.65
M
0.71
0.16
1.65
2.05

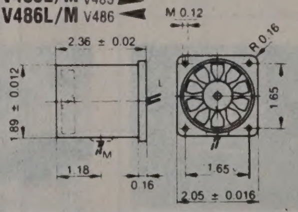
V464L/M V464 ▶
V465L/M V465 ◀


M 0.12
1.42 ± 0.01
R0.16
1.89 ± 0.01
L
1.65
M
0.71
0.16
1.65
2.05 ±

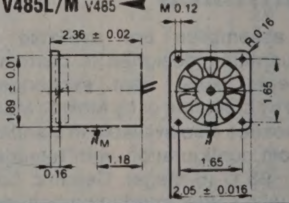
V481L/M V481 ▶
V489L/M V489 ◀


2.36 ± 0.02
1.89 ± 0.01
L
M
1.18

V483L/M V483 ▶
V486L/M V486 ◀


M 0.12
2.36 ± 0.02
R0.16
1.89 ± 0.012
L
1.65
M
1.18
0.16
1.65
2.05 ± 0.016

V484L/M V484 ▶
V485L/M V485 ◀


M 0.12
2.36 ± 0.02
R0.16
1.89 ± 0.01
1.65
M
1.18
0.16
1.65
2.05 ± 0.016

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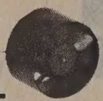
For More Information. Circle No. 121

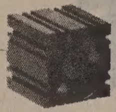
MINIATURE FANS DC

Technical data

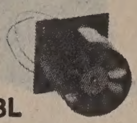
V571M



V581L



V591L



V603L

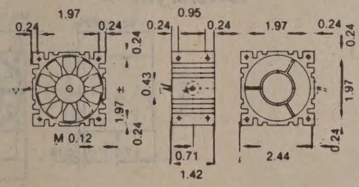
MODEL	V570	V580	V590	V600
Size	ϕ 2.44 x 2.44 x 1.42	ϕ 2.36 x 1.42	ϕ 2.44 x 2.44 x 2.36	ϕ 2.36 x 2.36
Voltage	6/12 V =	6/12 V =	12/24 V =	12/24 V =
Housing	square	cylindrical	square	cylindrical
Power	0.6 W	0.6 W	9.6 W	9.6 W
Speed	3800 min^{-1}	3800 min^{-1}	10200 min^{-1}	10200 min^{-1}
Air Vol.	530 l/min (19 CFM)	530 l/min (19 CFM)	1320 l/min (46 CFM)	1320 l/min (46 CFM)
Air Pres.	0.35 mbar	0.35 mber	3 mbar	3 mbar
Life	8000 h*	8000 h*	12000 h*	12000 h
Temp.	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C
Weight	155 g	90 g	300 g	190 g
Bearing	sleeve bearing	sleeve bearing	ball bearings	ball bearings
Noise	27 DBA	27 DBA	50 DBA	50 DBA

* Life figures are for maximum performance Temperature Control modules can extend life by a factor of five — Consult Factory

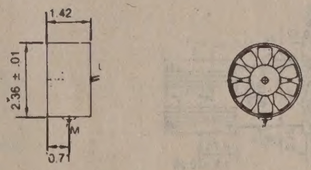
NOTES:

1. Symbols ◄ Airflow direction
2. Standard leads are 7.5 inches long — 24 AWG
3. 1 mbar = 10,197mmWS = 0.4 inches
4. One oz. = 28.4 grams
5. 1 liter = 0.035 cubic feet
6. Tolerances ±0.01 unless otherwise shown
7. See V340AC Types for mechanical data

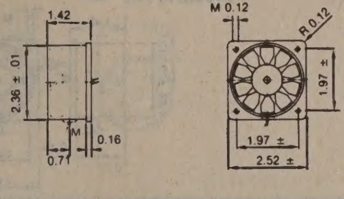
V571L/M V571 ◄
V579L/M V579 ►


1.97
0.24
0.24
0.95
0.24
0.24
1.97
0.24
0.24
0.43
1.97 ±
0.24
1.97
M 0.12
0.71
1.42
2.44
0.24

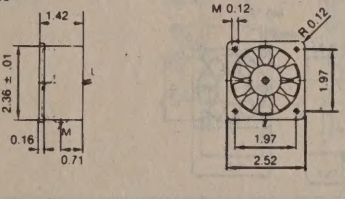
V581L/M V581 ►
V589L/M V589 ◄


1.42
2.36 ± .01
L
M
0.71

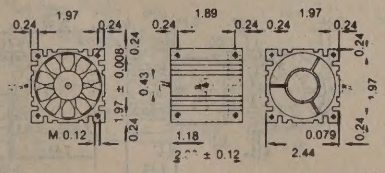
V583L/M V583 ►
V586L/M V586 ◄


1.42
2.36 ± .01
M
0.16
0.71
M 0.12
R 0.12
1.97 ±
1.97 ±
2.52 ±

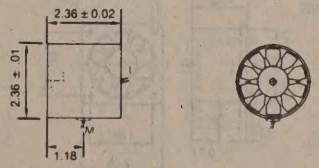
V584L/M V584 ►
V585L/M V585 ◄


1.42
2.36 ± .01
L
0.16
M
0.71
M 0.12
R 0.12
1.97
1.97
2.52

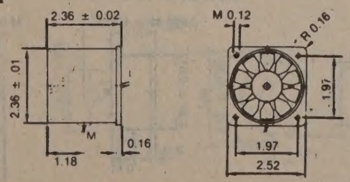
V591L/M V591 ◄
V599L/M V591 ►


1.97
0.24
0.24
1.89
0.24
0.24
0.24
1.97
0.24
1.97 ± 0.008
0.24
0.43
0.24
M 0.12
1.18
0.079
0.24
1.97
2.44
0.12

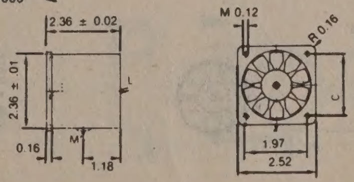
V601L/M V601 ►
V609L/M V609 ◄


2.36 ± 0.02
2.36 ± .01
L
M
1.18

V603L/M V603 ►
V606L/M V606 ◄


2.36 ± 0.02
2.36 ± .01
L
M
0.16
1.18
M 0.12
R 0.16
1.97
1.97
2.52

V604L/M V604 ►
V605L/M V605 ◄


2.36 ± 0.02
2.36 ± .01
L
0.16
M
1.18
M 0.12
R 0.16
C
1.97
2.52

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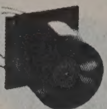
MINIATURE FANS AC

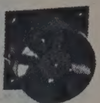
Technical data

V359L


V349L

V464M

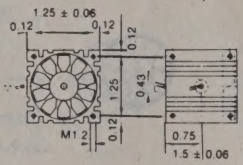
V571M


V583M

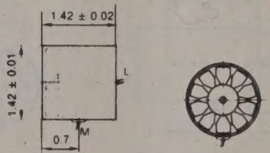
MODEL	V350	V340	V460	V570	V580
Size	ϕ 1.5 x 1.5 x 1.4	ϕ 1.42 x 1.42	ϕ 1.89 x 1.42	ϕ 2.44 x 2.44 x 1.42	ϕ 2.36 x 1.42
Voltage	12/24 VAC∼A	12/24 VAC∼A	12/24 VAC∼A	12/24 VAC∼A	12/24 VAC∼A
Housing	square	cylindrical	cylindrical	square	cylindrical
Power	3.3 VA	3.3 VA	3.3 VA	3.3 VA	3.3 VA
Speed	3600 min^{-1}	3600 min^{-1}	3600 min^{-1}	3600 min^{-1}	3600 min^{-1}
Air Vol.	65 l/min (2.3 CFM)	65 l/min (2.3 CFM)	132 l/min (4.7 CFM)	444 l/min (15.6 CFM)	484 l/min (15.6 CFM)
Air Pres.	0.42 mbar	0.42 mbar	0.15 mbar	0.25 mbar	0.25 mbar
Life	15000 h	15000 h	15000 h	15000 h	15000 h
Temp.	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C
Weight	62 g	52 g	80 g	162 g	95 g
Bearing	sleeve bearing	sleeve bearing	sleeve bearing	sleeve bearing	sleeve bearing
Noise	20 DBA	20 DBA	16 DBA	27 DBA	27 DBA

NOTES: A. May be operated on 115 VAC with use of a series capacitor B. Also available in 6, 36, and 48 VAC on special order. External phase shift capacitor required

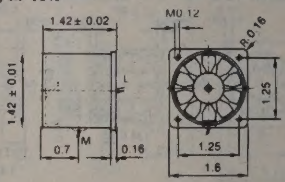
V351L/M V351 ◄
V359L/M V359 ►


1.25 ± 0.06
0.12
0.12
0.12
1.25
0.43
0.12
M1.2
0.75
1.5 ± 0.06

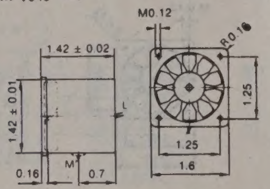
V341L/M V341 ►
V349L/M V349 ◄


1.42 ± 0.02
1.42 ± 0.01
L
0.7
M

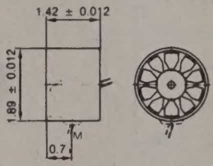
V343L/M V343 ►
V349L/M V349 ◄


1.42 ± 0.02
M0.12
R0.16
1.42 ± 0.01
L
M
0.7
0.16
1.25
1.25
1.6

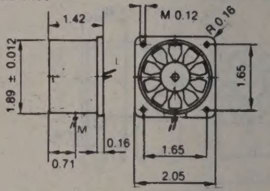
V344L/M V344 ►
V345L/M V345 ◄


M0.12
R0.16
1.42 ± 0.02
1.42 ± 0.01
L
1.25
1.25
1.6
0.16
M
0.7

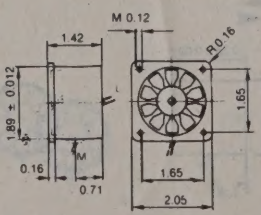
V461L V461 ►
V469L V469 ◄


1.42 ± 0.012
1.89 ± 0.012
0.7
M

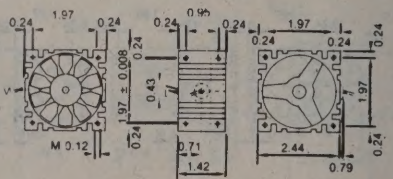
V463L/M V463 ►
V466L/M V466 ◄


1.42
M 0.12
R0.16
1.89 ± 0.012
L
1.65
M
0.16
0.71
1.65
2.05

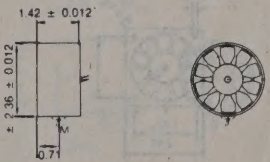
V464L/M V464 ►
V465L/M V465 ◄


M 0.12
R0.16
1.42
1.89 ± 0.012
L
1.65
M
0.16
0.71
1.65
2.05

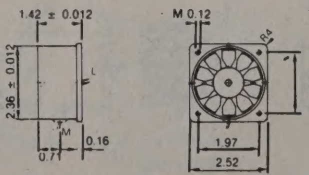
V571L/M V571 ◄
V579L/M V579 ►


1.97
0.24
0.24
0.95
0.24
0.24
1.97
0.24
0.24
0.24
0.24
1.97 ± 0.008
0.43
0.24
M 0.12
0.71
1.42
1.97
2.44
0.79
0.24

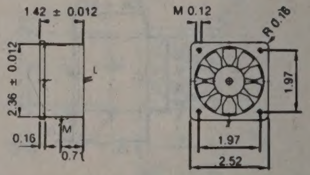
V581L/M V581 ►
V589L/M V589 ◄


1.42 ± 0.012
± 2.36 ± 0.012
M
0.71

V583L/M V583 ►
V586L/M V586 ◄


1.42 ± 0.012
M 0.12
R4
2.36 ± 0.012
L
M
0.71
0.16
1.97
2.52

V584L M V584 ►
V585L/M V585 ◄


1.42 ± 0.012
M 0.12
R0.16
2.36 ± 0.012
L
1.97
0.16
M
0.71
1.97
2.52

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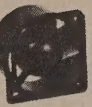
MINIATURE FANS AC

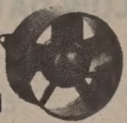
Technical data

V60TL

V624L



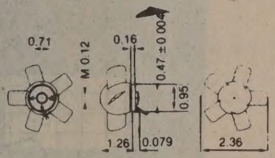
V72JM



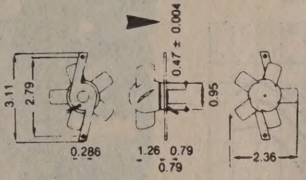
MODEL	V60	V620	V630	V72CL/TL	V72CL/PM
Size	φ 2.36 x 1.34	φ 2.36 x 1.42	φ 2.44 x 2.44 x 1.42	φ2.84 x 1.5	φ 3.1 x 1.5
Voltage	12/24V~A	12/24/110/ 120V~B	12/24/110/ 120V~B	12/24/110/ 120V~B	12/24/110/ 120V~B
Housing	no housing	cylindrical	square	no housing	cylindrical
Power	3.3 VA	6.6 VA	6.6 VA	6.6 VA	6.6 VA
Speed	3400 min^{-1}	3600 min^{-1}	3600 min^{-1}	3600 min^{-1}	3600 min^{-1}
Air Vol.	534 l/min (19 CFM)	504 l/min (17.6 CFM)	504 l/min (17.6 CFM)	912 l/min (32 CFM)	1100 l/min (38 CFM)
Air Pres.	——	0.25 mbar	0.25 mbar	——	0.3 mbar
Life	15000 h	15000 h	15000 h	15000 h	15000 h
Temp.	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C	−20°C/+65°C
Weight	55 g	140 g	200 g	108 g	128 g
Bearing	sleeve bearing	sleeve bearing	sleeve bearing	sleeve bearing	sleeve bearing
Noise	16 DBA	22 DBA	22 DBA	30 DBA	30 DBA

NOTES: A. May be operated on 115 VAC with use of a series capacitor B. Also available in 6, 36, and 48 VAC on special order. External phase shift capacitor required

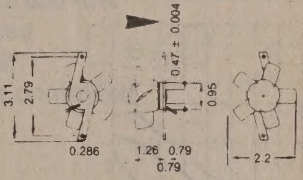
V60CL


0.71
0.16
M 0.12
0.47 ± 0.004
0.95
1.26
0.079
2.36

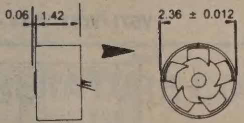
V60TL


0.47 ± 0.004
3.11
2.79
0.95
0.286
1.26
0.79
0.79
2.36

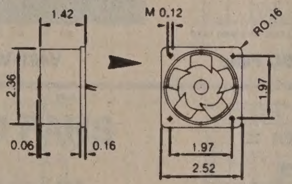
V60TLS

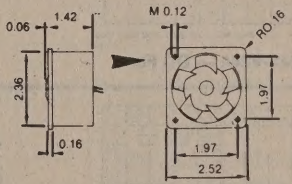

0.47 ± 0.004
3.11
2.79
0.95
0.286
1.26
0.79
0.79
2.2

V621L

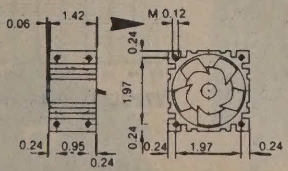

0.06
1.42
2.36 ± 0.012

V623L

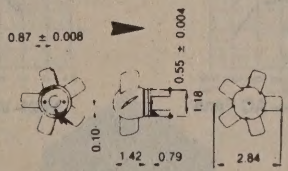

1.42
M 0.12
RO.16
2.36
1.97
0.06
0.16
1.97
2.52


0.06
1.42
M 0.12
RO.16
2.36
1.97
0.16
1.97
2.52

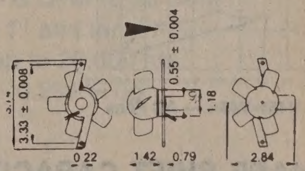
V631L


0.06
1.42
M 0.12
0.24
1.97
0.24
0.24
0.95
0.24
0.24
1.97
0.24

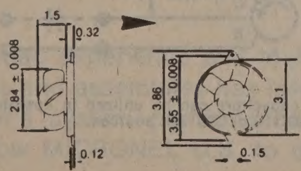
V72CL


0.87 ± 0.008
0.55 ± 0.004
1.18
0.10
1.42
0.79
2.84

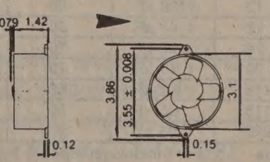
V72TL


3.33 ± 0.008
0.55 ± 0.004
1.18
0.22
1.42
0.79
2.84

V72PM


1.5
0.32
2.84 ± 0.008
3.86
3.55 ± 0.008
3.1
0.12
0.15

V72JM


0.079
1.42
3.86
3.55 ± 0.008
3.1
0.12
0.15

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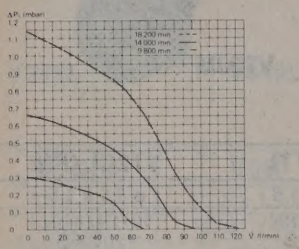
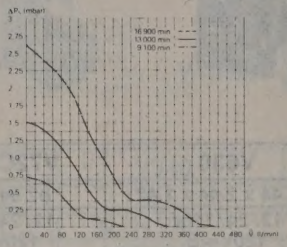
MINIATURE FANS

Airflow Data

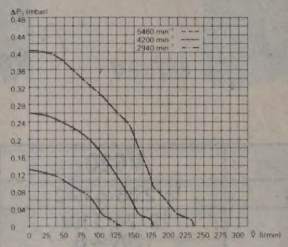
AIRFLOW DATA



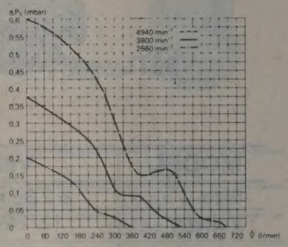
Liters/min.
V241-V244 — DC Fans



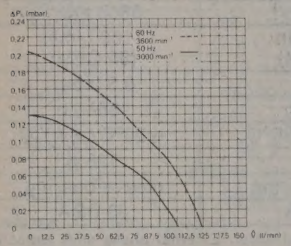
Liters/min.
V361-V364 — DC Fans



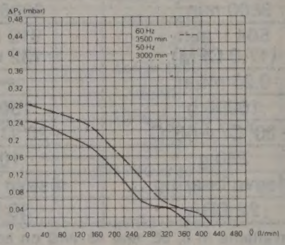
Liters/min.
V461-V464 — DC Fans



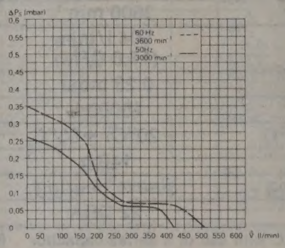
Liters/min.
V571/V581-V584 — DC Fans



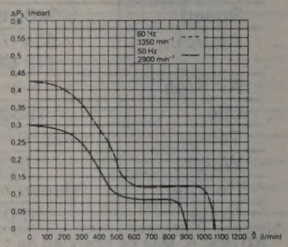
Liters/min.
V461-V464 — AC Fans



Liters/min.
V571/V581-V584 — AC Fans

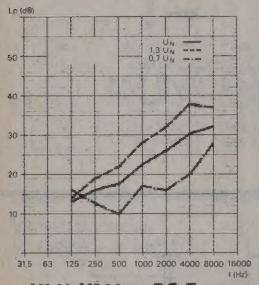


Liters/min.
V621-V624/V631 — AC Fans

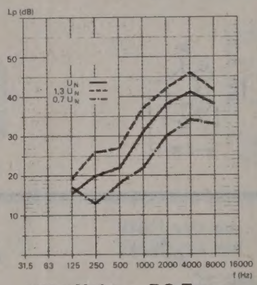


Liters/min.
V72JM — DC Fans

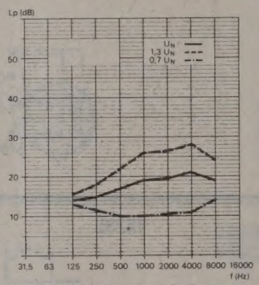
ACOUSTICAL DATA



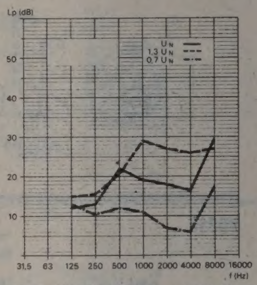
V241-V244 — DC Fans



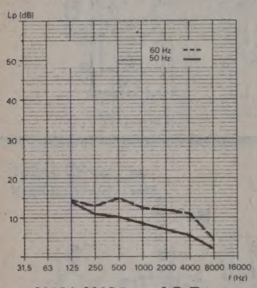
V361-V364 — DC Fans



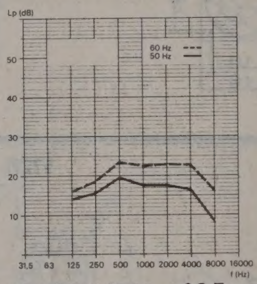
V461-V464 — DC Fans



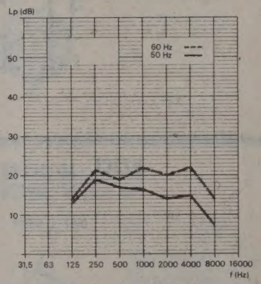
V571/V581-V584 — DC Fans



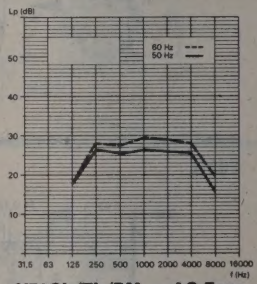
V461-V464 — AC Fans



V571/V581-V584 — AC Fans



V621-V624 — AC Fans



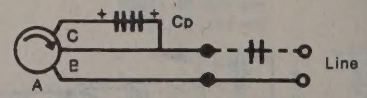
V72CL/TL/PM — AC Fans

PHASE SHIFT CAPACITOR SPECIFICATIONS FOR AC FANS

TYPE FAN	LINE VOLTAGE	Cp VALUE µF	Cp VOLTAGE	LEAD COLORS**		
				A	B	C
V60-V72	12	†100 µF	50	Black	Yellow	Red
All others	12	† 47 µF	50	Black	Yellow	Red
V60-V72	24	† 22 µF	75	Green	Yellow	Red
All others	24	† 10 µF	75	Green	Yellow	Red
V60-V72	115	2.2 µF	150	Grey	Yellow	Red
All others	115	1.5 µF	150	Grey	Yellow	Red
V60-V72	220	.68 µF	180	White	Yellow	Red

† Electrolytic Caps

** For clockwise impeller rotation.
Reverse leads and C for CCW rotation.



* Line capacitors can be utilized to operate any fan off 115 or 220 volt sources.

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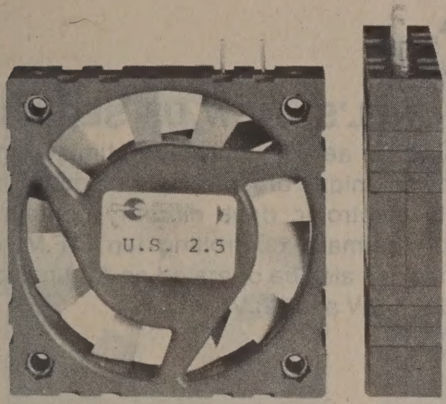
For More Information. Circle No. 121

SPECIAL MINIATURE FANS

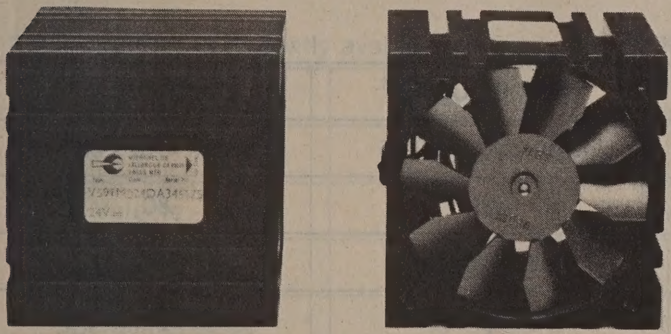
BRUSHLESS DC FANS



FEATURES

- Ultra Thin Design - 0.55″
- High performance - up to 20 CFM
- Low noise ≤20 DBA
- Long life ≥20,000 hrs.
- Low EMI/RFI
- Polarity protected

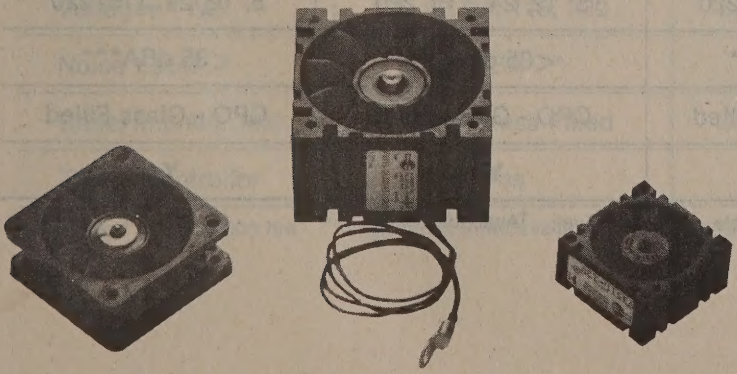
HIGH TEMPERATURE FANS



FEATURES

- Operational temp. to 85°C
- High performance - up to 50 CFM
- Long life ≥12,000 hrs.
- Variable speed
- Bi-directional
- Temperature controlled

TEMPERATURE CONTROLLED FANS



FEATURES

- CFM proportional to cooling needs
- Low noise ≥10 DBA
- Air volume - 3 CFM to 50 CFM
- Small dia. - 1″ and larger
- Long life - up to 20,000 hrs.
- Low power - 0.25W - up

MICRONEL's broad experience and technical expertise in development and design of high performance precision motors and assemblies has been utilized to develop the product shown herein. Our appreciation of the customer's system performance requirements, thermal constraints, mechanical interfaces, and cost factors allow MICRONEL U.S. to offer unique solutions to your problems. TRY US!

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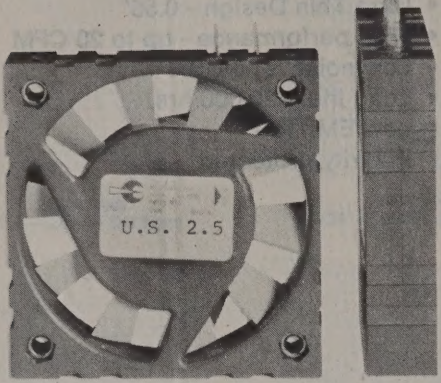
MINIATURE BRUSHLESS DC/AC FANS

ULTRA-SLIM SERIES



"Actual Size"
Model US 2.5

NEW!

MICRONEL'S* NEW US SERIES

fans utilize an aerodynamically optimized impeller driven by an unique brushless D.C. motor. The high reliability electronic drive circuitry contain provisions for thermally controlling fan C.F.M. output. The series can also be operated on AC line voltages of 5V, 12V, 115V and 220V.

* Patent Pending

The US Series is currently available in the following sizes:

	MODEL US 2.5	MODEL US 3.1[†]	MODEL US 4.1[†]
Size	2.45 x 2.45 x 0.55	3.15 x 3.15 x 0.55	4.13 x 4.13 x 0.55
Air Volume	10 CFM	30	80
Expected Life	>10,000 Hrs.*	>10,000 Hrs.*	>10,000 Hrs.*
Operating Range	−10°C➤55°C**	−10°C➤55°C**	−10°C➤55°C**
Input Power	<2 Watts	<5 Watts	<12 Watts
Voltages - DC	5, 12, 24	5, 12, 24	5, 12, 24
Voltages - AC	5, 12, 24, 115, 220	5, 12, 24, 115, 220	5, 12, 24, 115, 220
Noise Level	<35 dBA***	<35 dBA***	<35 dBA***
Case/Impeller Mat.	CPO - Glass Filled	CPO - Glass Filled	CPO - Glass Filled
Temp. Controller	Yes	Yes	Yes

* Projected life >25,000 hrs. ** High temp. units available. *** Max. level. [†] Available 1985

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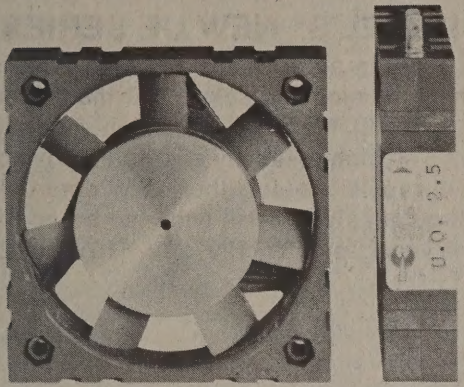
For More Information. Circle No. 121

MINIATURE BRUSHLESS DC/AC FANS

ULTRA-QUIET SERIES-22 dBA



Actual Size
Model UQ 2.5

NEW!

MICRONEL'S* NEW UQ SERIES

fans utilize an aerodynamically optimized impeller driven by an unique brushless D.C. motor. Utilization of Rare Earth Magnets results in improved efficiency. The high reliability electronic drive circuitry contain provisions for thermally controlling fan C.F.M. output. The series can also be operated on AC line voltages of 5V, 12V, 24V, 115V and 220V.

* Patent Pending

The UQ Series is currently available in the following sizes:

	MODEL UQ 2.5	MODEL UQ 3.1†	MODEL UQ 4.1†
Size	2.45 x 2.45 x 0.75	3.15 x 3.15 x 0.75	4.13 x 4.13 x 0.75
Air Volume - Max.	10	30	80
Expected Life	>10,000 Hrs.*	>10,000 Hrs.*	>10,000 Hrs.*
Operating Range	−10°C➤55°C**	−10°C➤55°C**	−10°C➤55°C**
Input Power	<2 Watts	<5 Watts	<12 Watts
Voltages - DC	5, 12, 24	5, 12, 24	5, 12, 24
Voltages - AC	5, 12, 24, 115, 220	5, 12, 24, 115, 220	5, 12, 24, 115, 220
Noise Level	22 dBA***	22 dBA***	22 dBA***
Case/Impeller Mat.	CPO - Glass Filled	CPO - Glass Filled	CPO - Glass Filled
Temp. Controller	Yes	Yes	Yes

* Projected life >25,000 hrs. ** High temp. units available. *** Max. level. †Available 1985

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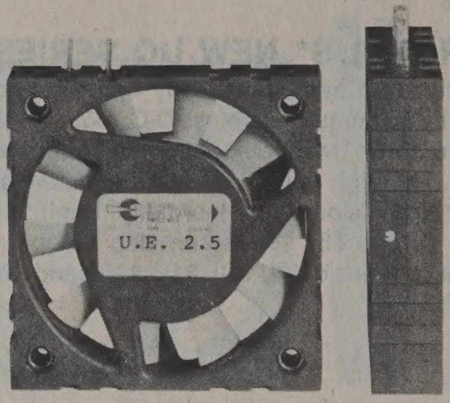
micronel®

MINIATURE BRUSHLESS DC/AC FANS

ULTRA-EFFICIENT SERIES



Actual Size
Model UE 2.5

MICRONEL'S* NEW UE SERIES

fans utilize an aerodynamically optimized impeller driven by an unique brushless D.C. motor. Utilization of Rare Earth Magnets results in improved efficiency. The high reliability electronic drive circuitry contain provisions for thermally controlling fan C.F.M. output. The series can also be operated on AC line voltages of 5V, 12V, 24V, 115V and 220V.

* Patent Pending

The UE Series is currently available in the following sizes:

	MODEL UE 2.5	MODEL UE 3.1†	MODEL UE 4.1†
Size	2.45 x 2.45 x 0.75***	3.15 x 3.15 x 0.75***	4.13 x 4.13 x 0.75***
Air Volume - Max.	10	30	80
Expected Life	>10,000 Hrs.*	>10,000 Hrs.*	>10,000 Hrs.*
Operating Range	−10°C➤55°C**	−10°C➤55°C**	−10°C➤55°C**
Input Power	0.5 Watts	1.5 Watts	4.0 Watts
Voltages - DC	5, 12, 24	5, 12, 24	5, 12, 24
Voltages - AC	5, 12, 24, 115, 220	5, 12, 24, 115, 220	5, 12, 24, 115, 220
Noise Level	22 dBA	22 dBA	22 dBA
Case/Impeller Mat.	CPO - Glass Filled	CPO - Glass Filled	CPO - Glass Filled
Temp. Controller	Yes	Yes	Yes

* Projected life >25,000 hrs. ** High temp. units available. *** Can be reduced to 0.65". †Available 1985

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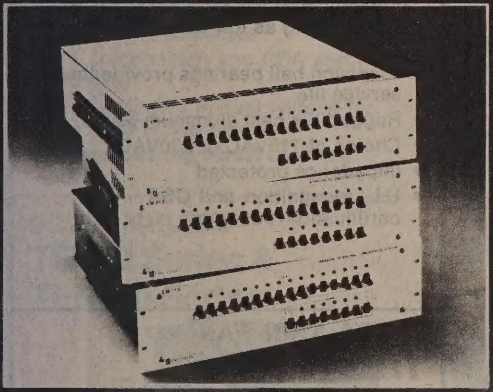

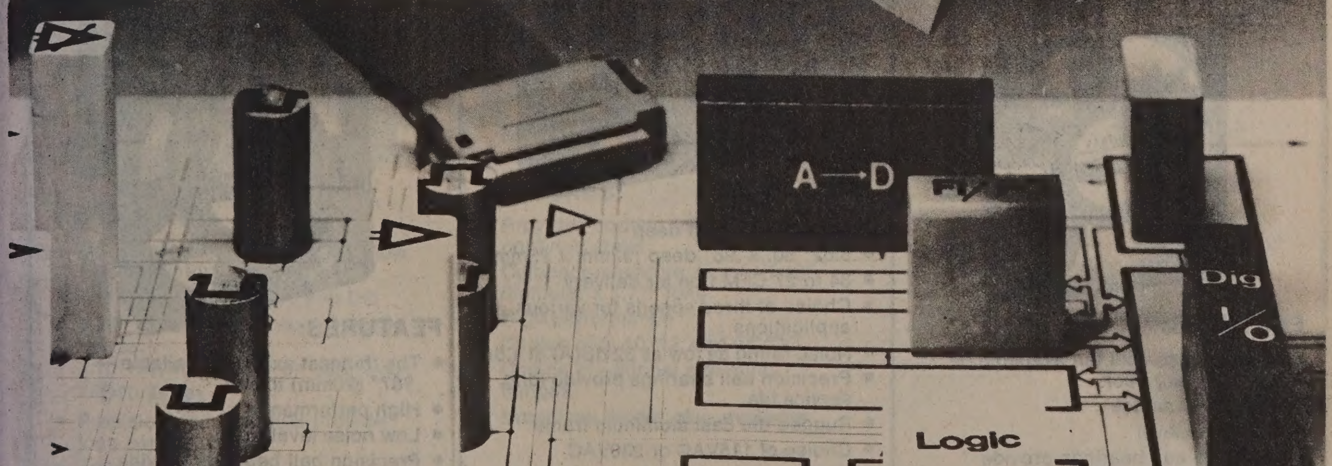

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U.S. TOYO FAN CORPORATION

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San Gabriel, California 91776
(818) 287-5297
TWX (910) 589-1540

TF120 Series

FEATURES:

- 4.70″ sq. x 1.50″ deep (119.5mm x 38mm)
- 104 to 76 CFM free air delivery
- Choice of three speeds for various applications
- Noise rating as low as 38 dB(A) at 1.5m
- Precision ball bearings provide long service life
- Rugged die cast aluminum frame
- Choice of 115VAC or 230VAC
- Choice of terminals or wire leads
- Impedance protected
- U.L. recognized — File No. E75082
- CSA certified — File No. LR48371
- Also available in dual voltage fan Model TF120345 Series
- **Sleeve bearing model available soon**

ULTRA THIN FAN
TF120RX Series

FEATURES:

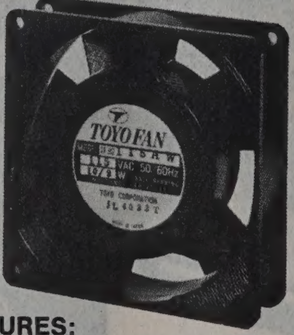
- The thinnest axial fan available — .787″ (20mm) thick
- High performance
- Low noise level
- Precision ball bearings provide long service life
- Durable die cast aluminum frame
- Choice of 115VAC or 230VAC
- Impedance protected
- U.L. recognition and CSA certification pending

QUIET FAN
TF120U Series

FEATURES:

- Designed for low noise level applications
- Precision ball bearings provide long service life
- Durable die cast aluminum frame
- Choice of 115VAC or 230VAC
- Impedance protected
- U.L. recognized — File No. E75082
- CSA certification pending

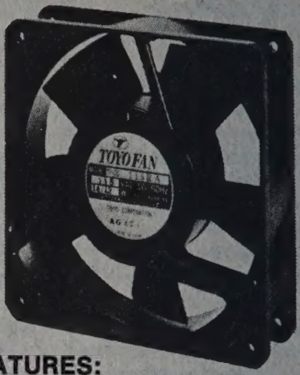
TF92 Series



FEATURES:

- Less than 1 inch deep
- 3.62″ sq. x .98″ deep (92mm x 25mm)
- 34 to 27 CFM free air delivery
- Choice of three speeds for various applications
- Noise rating as low as 32 dB(A) at 1.5m
- Precision ball bearings provide long service life
- Rugged die cast aluminum frame
- Choice of 115VAC or 230VAC
- Choice of terminals or wire leads
- Impedance protected
- U.L. recognized — File No. E75082
- CSA certified — File No. LR48371
- Also available in dual voltage fan Model TF92345 Series
- **Sleeve bearing model available soon**

THE THIN FAN
TF120R Series



FEATURES:

- Less than 1 inch deep
- 4.70″ x .98″ deep (119.5mm x 25mm)
- 92 to 76 CFM free air delivery
- Choice of two speeds for various applications
- Noise rating as low as 34 dB(A) at 1.5m
- Precision ball bearings provide long service life
- Rugged die cast aluminum frame.
- Choice of 115VAC or 230VAC
- Impedance protected
- U.L. recognition and CSA certification pending

ULTRA THIN FAN
TF92RX Series

FEATURES:

- The thinnest axial fan available — .787″ (20mm) thick
- High performance
- Low noise level
- Precision ball bearings provide long service life
- Durable die cast aluminum frame
- Impedance protected
- U.L. recognition and CSA certification pending

For More Information. Circle No. 122

U.S. TOYO FAN CORPORATION

4915 Walnut Grove Avenue
San Gabriel, California 91776
(818) 287-5297
TWX (910) 589-1540

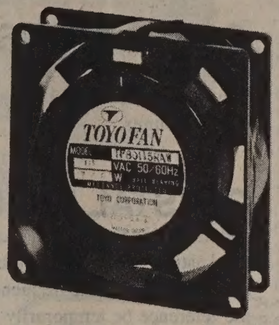
TF80 Series

TOYO FAN
VAC 50/60Hz
TOYO CORPORATION
MADE IN JAPAN

FEATURES:

- Low profile design — 3.15″ sq. x 1.50″ (80mm x 38mm)
- High performance airflow
- Low noise level
- Precision ball bearings provide long service life
- Rugged die cast aluminum frame
- Choice of 115VAC or 230VAC
- Choice of terminals or lead wires
- Impedance protected
- U.L. recognition and CSA certification pending
- Also available in dual voltage fan Model TF80345 Series
- **Sleeve bearing model available soon**

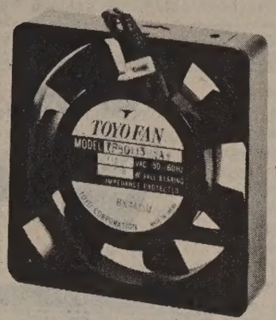
SMALL-THIN FAN
TF80R Series



FEATURES:

- Low profile design — 3⅛″ square
- Less than 1 inch thick — .984″ (25mm)
- Precision ball bearings provide long service life
- Durable die cast aluminum frame
- Choice of 115VAC or 230VAC
- Impedance protected
- U.L. recognition and CSA certification pending

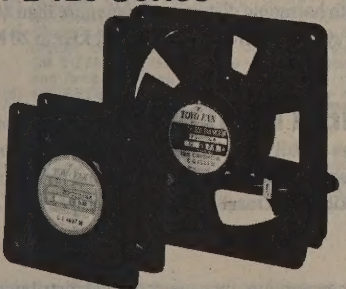
SMALL-ULTRA THIN FAN
TF80RX Series



FEATURES:

- The thinnest axial fan available — .787″ (20mm thick)
- Low profile design — 3⅛″ square
- High performance
- Low noise level
- Precision ball bearings provide long service life
- Durable die cast aluminum frame
- Choice of 115VAC or 230VAC
- Impedance protected
- U.L. recognition and CSA certification pending

DC BRUSHLESS
TFD80 Series & TFD120 Series



FEATURES:

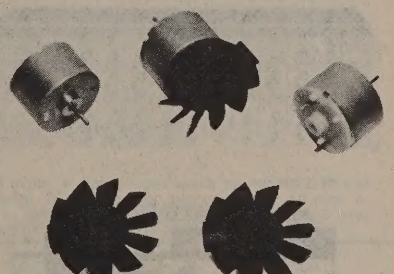
- DC brushless motor provides low EMI/RFI interference
- Available in 12 and 24 Volt DC
- 4.70″ square x 1½″ thick TFD120 Series
- 3.15″ square x .984″ or 1.26″ thick TFD80 Series
- Precision ball bearings provide long service life
- Polarity protected
- Impedance protected

DC MICRO FAN
SMF1836 Series

FEATURES:

- Provides cooling in extremely confined areas
- Compact-miniature size — 1.42″ diameter x 1.77″ long
- High performance
- Choice of 5, 10, 12, and 24VDC
- Choice of optional mounting flanges
- **Brushless model also available**

DC MINI FAN
SL510 Series



FEATURES:

- Low cost
- Miniature size — 1.50″ long x 1.72″ diameter including impeller
- Low acoustical noise
- Dependable performance

WARRANTY — All U.S. Toyo fans are warranted to be free of defects in materials and workmanship for a period of one year from date of delivery.

AIRFLOW PERFORMANCE DATA — Performance data obtained with test chamber and methods in accordance with AMCA Standard 210-74.

ACOUSTICAL NOISE DATA — Acoustical measurements made at distances of 1.0 and 1.5 meters from fan intake. All measurements made on dB (A) scale. Fans operating at 60Hz line frequency.

OPERATING TEMPERATURE — Recommended ambient operating temperature is −30°C to +70°C.

IMPEDANCE PROTECTION — All fans are designed and manufactured to prevent "burn-out" failure caused by restriction of rotating parts.

LIFE EXPECTANCY — Life test data available on request.

SAFETY — All fans are designed and manufactured to meet UL and CSA standards. Approved fans are listed as follows: UL File No. E75082 and CSA File No. 48371M2.

AUSTRON INC.

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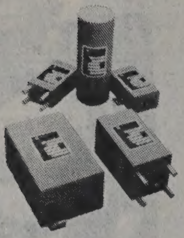
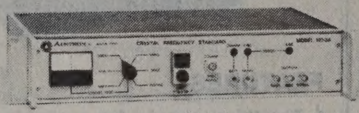
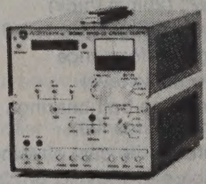
PRODUCTS THAT HAVE MADE AUSTRON A PACESETTER:



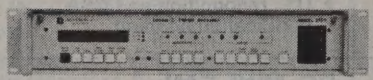
OSCILLATORS—high stability, precision, ovenized crystal oscillators with frequencies up to 125 MHz and aging rates as low as 5 × 10^{-11}/24 hours. Units can be configured to user requirements including commercial versions and JANTX and radiation hardened units.



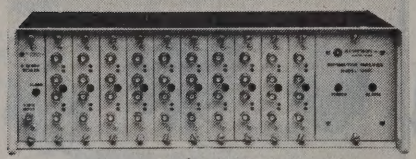
CRYSTAL FREQUENCY STANDARDS—free running and disciplined units with excellent waveform and spectral purity. These standards employ the Austron Model 1150 Crystal Oscillator to provide a highly stable output. The disciplined standard "learns" the frequency offset and aging rate of the internal oscillator so that should the reference be temporarily unavailable, the phase and frequency will continue in close agreement with the extrapolated reference.



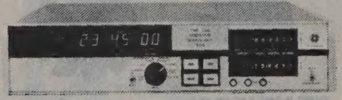
CRYSTAL CLOCKS—portable crystal clocks used to transfer precise time from one geographic location to another. These self-powered time references provide stable time and pulse outputs and are packaged in a rugged carrying case dimensioned to fit under the seat of most commercial aircraft.



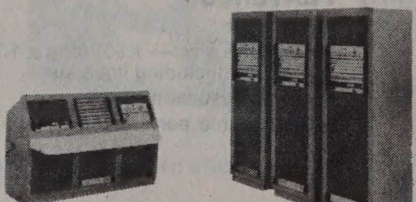
LORAN-C RECEIVERS—microprocessor based automatic acquisition and tracking receivers that utilize the Loran-C groundwave to provide a traceable reference for time epoch determination, frequency management, calibration, and control. These receivers provide time accuracy to one microsecond and frequency accuracy to parts in 10^{-12}.



DISTRIBUTION AMPLIFIERS—provides up to 40 outputs adjustable to 3V RMS capable of driving 1,000 ft. of RG-58 c/u when terminated into a 50 Ω load. Channel isolation is more than 50 db with harmonic distortion down more than 40 db. Input modules are available to buffer, scale, or synthesize frequencies from 1 kHz to 20 Mhz.



TIME CODE INSTRUMENTATION—a complete line of instruments from basic generators and readers to full complement tape search and control units. Available for bench, panel, rack or portable; all standard IRIG, XR3 and NASA codes are available to give these instruments the flexibility to meet any system requirements.



SYSTEMS—complete systems for generation, management, and distribution of precise time and frequency. Austron's engineering has led to such sophistication as the secure communications frequency control sets AN/GSQ-174 and AN/GSQ-183. Time and Frequency Receivers, Disciplined Frequency Standards, Distribution Amplifiers, Time Code Generators and Readers, and all ancillary equipment along with Austron Engineering . . . put it to work, for you!

As a matter of fact, Austron has been attracting attention for its time determination and frequency control instruments and systems for over ten years.

Austron Loran-C Timing Instruments, for example, are by international agreement used to intercompare the master clocks throughout the world. And that's just the beginning.

Austron's design and test capabilities have won it contracts ranging from feasibility studies through design, manufacturing, support, training and equipment updates.

And updates designed with Austron proprietary instruments have become standards for the Government Communications Groups, Missile Tracking Agencies, Commercial Satellite Tracking, AT&T Long Lines, NASA, Canadian Pacific, NBS, Naval Observatory, U.S. Coast guard and the State Department.

So if you're looking for the number one designer and subsystem manufacturer in time and frequency technology, look to Austron. When time is critical, count on Austron.

CROVEN CRYSTALS

500 Beech Street
Whitby, Ontario
Canada L1N 5S5
416 668-3324
TWX: 610-384-2750

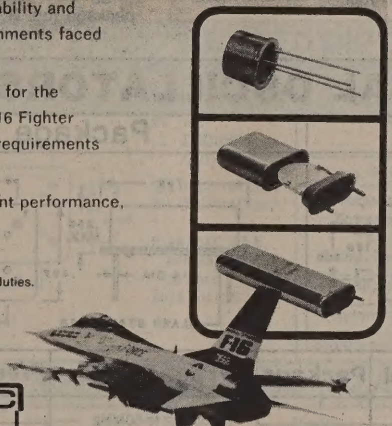
Proven Reliability

Croven Crystals perform with proven reliability and frequency stability in the toughest environments faced by men and machines.

Croven Crystals were the ultimate choice for the sophisticated radar system used in the F-16 Fighter Aircraft, as well as other high reliability requirements around the world.

If your system requires superior component performance, call us or write for our free catalogue.

All U.S. shipments are quoted in U.S. dollars f.o.b. BUFFALO, N.Y. We clear customs and pay all duties.



croven crystals LIMITED

500 Beech Street, Whitby, Ontario, Canada L1N 5S5
Telephone 416-668-3324, TWX 610-384-2750

MILITARY CRYSTAL UNITS

We are on the Qualified Products List (QPL) for the types below.

MILITARY CR-TYPE	MILITARY SPEC. NO.	FREQUENCY RANGE IN MHZ	CROVEN CODE
CR-5A/U*	3098/77	2.000- 10.000	A170 FWM-25
CR-6A/U*	3098/78	2.000- 10.000	A170 FWJ-13
CR-8A/U*	3098/111	1.000- 10.000	A170 FWJ-00
CR-18A/U*	3098/3	0.800- 20.000	A061 FWM-32
CR-19A/U*	3098/4	0.800- 20.000	A061 FWM-00
CR-52A/U*	3098/30	10.000- 61.000	B061 FWM-00
CR-55A/U*	3098/33	17.000- 62.000	B180 FWM-00
CR-56A/U*	3098/34	50.000-125.000	C180 FWM-00
CR-58A/U*	3098/36	0.800- 20.000	A170 FWM-32
CR-59A/U*	3098/37	50.000-125.000	C180 EBS-00
CR-6OA/U*	3098/38	5.000- 20.000	A180 FWM-00
CR-61/U*	3098/39	17.000- 61.000	B180 EBS-00
CR-64/U*	3098/42	2.900- 20.000	A180 FWM-30
CR-65/U*	3098/43	10.000- 61.000	B061 CXP-00
CR-67A/U*	3098/45	17.000- 62.000	B180 CUM-00
CR-69A/U*	3098/47	2.900- 25.000	A180 CSM-30
CR-72/U*	3098/50	17.000- 61.000	B259 FWM-00
CR-76A/U*	3098/53	16.000- 61.000	B180 CSM-00
CR-77/U*	3098/55	17.000- 62.000	B251 CSM-00
CR-78A/U*	3098/62	2.200- 20.000	A251 FWM-30
CR-79/U*	3098/63	2.200- 20.000	A251 FWM-00
CR-80/U*	3098/57	50.000-125.000	C180 CSM-00
CR-81/U*	3098/58	17.000- 61.000	B251 FWM-00
CR-82/U*	3098/59	50.000-125.000	C251 FWM-00
CR-83/U*	3098/60	50.000-125.000	C251 CSM-00
CR-84/U*	3098/61	17.000- 61.000	B251 EBS-00
CR-89/U*	3098/67	2.120- 6.200	A321 FWM-30
CR-97/U*	3098/72	8.000- 10.000	A180 FWJ-32
CR-106A/U*	3098/82	10.500- 11.500	A180 FWM-32
CR-117/U*	3098/93	30.000- 63.000	B251 DEJ-00
CR-139/U*	3098/118	20.000- 22.000	A180 FWM-30
CR-140/U*	3098/119	9.500- 12.500	A061 FWM-60
CR-157/U*	3098/137	0.800- 20.000	A330 FWM-00

HOW TO SPECIFY A QUARTZ CRYSTAL

If the parameters for the crystal in question are not already covered by a MIL-SPECIFICATION or by a formal SPECIFICATION CONTROL DRAWING, then Items 1 through 6 are essential.

(1) **MODE OF OPERATION** i.e. fundamental, third, fifth, seventh, ninth or eleventh overtone.
(2) **HOLDER STYLE** i.e. HC-6/u, HC-18/u, HC-35/u, etc. depending on your individual application and the frequency.
(3) **CALIBRATION TOLERANCE AT REFERENCE TEMPERATURE** i.e. ± 20 ppm @ + 25°C, ± 5 ppm @ + 75°C, etc.
(4) **TEMPERATURE STABILITY** the allowable frequency deviation over a specified temperature range, with reference to the actual frequency measured at the calibration temperature. (i.e. ± 15 ppm, ± 2.0 ppm, etc.)
OR TOTAL TOLERANCE the total allowable deviation over a specified temperature range, with reference to the nominal frequency (i.e. calibration tolerance and temperature stability combined). (i.e. ± 50 ppm, ± 30 ppm, etc.)
(5) **OPERATING TEMPERATURE RANGE** the temperature range over which the temperature stability or the total tolerance is to be effective.
(6) **CIRCUIT CONDITION** will be either PARALLEL or SERIES resonance. If PARALLEL resonance, please state the load capacitance.

SPECIFICATION CODING

We use a system whereby we code the major parameters of a crystal specification using a combination of 9 digits. A typical code would be **A251DFE-32** and would be interpreted as follows. **A** = fundamental mode, **25** = HC-25/U holder, **1** = undercut pins per MIL-H-10056, **D** = calibration tolerance of ± 10 ppm @ + 25°C, **F** = temperature stability of ± 20 ppm with reference to the actual frequency measured @ + 25°C, **E** = temperature range of — 15°C to + 65°C over which the temperature stability is effective, **-32** = a circuit condition of parallel resonance and with a load capacitance of 32 pF.

MODE		HOLDER				CALIBRATION TOLERANCE AT REFERENCE TEMPERATURE		TEMPERATURE STABILITY OR TOTAL TOLERANCE		OPERATING TEMPERATURE RANGE (°C)		CIRCUIT CONDITION	
CODE	DESC.	CODE	DESCRIPTION	CODE	DESCRIPTION ***	CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION	CODE	DESCRIPTION
A	Fund	06	HC- 6 standard **	0	Standard			X	± 2PPM stability	X	— 15 to + 35	00	Series resonance
B	3rd ot.	13	HC-13 standard	1	Undercut pins			Y	± 3PPM stability	Y	— 10 to + 40		
C*	5th ot.	17	HC-17 standard	2	Modified can height			Z	± 4PPM stability	Z	— 5 to + 45		
D*	7th ot.	18	HC-18 standard							A	+ 0 to + 50		
E*	9th ot.	25	HC-25 standard	3	Slimline	B	± 5 PPM	B	± 5PPM stability	B	— 5 to + 55		
		32	HC-32 standard	4	3rd wire	C	± 7 PPM	C	± 7PPM stability				
		33	HC-33 (HC-6 wires)	5	Modified can height	D	± 10PPM	D	± 10PPM stability	D	— 10 to + 60	01	Parallel resonance load capacity 100pf or more.
		34	HC-34 (HC-13 wires)			E	± 15PPM	E	± 15PPM stability	E	— 15 to + 65		
		35	HC-35 (TO 5 - type)	6	Modified can height	F	± 20PPM	F	± 20PPM stability	F	— 20 to + 70		
		37	HC-37 (TO 8 - type)			G	± 25PPM	G	± 25PPM stability	G	— 25 to + 75		
		39	HC-39 (Flat-Pack)	7	Coldweld	H	± 30PPM	H	± 30PPM stability	H	— 30 to + 80		
		80	HC-45 (micro-min.)					J	± 40PPM stability	J	— 40 to + 90		
				9	Resistance Weld	M	± 50PPM	M	± 50PPM stability	M	— 55 to + 105		
								L	± 75PPM stability	L	+ 55 + 65 Oven		
								K	±100PPM stability	T	+ 60 + 70 Oven	10 to 90	Parallel resonance load capacity in pf as indicated by code. ****
								N	±150PPM stability	N	+ 65 + 75 Oven		
								S	Specific curve	P	+ 70 + 80 Oven		
								T	± 20PPM‡ (B)†	R	+ 75 + 85 Oven		
								U	± 25PPM‡ (C)†	S	+ 80 + 90 Oven		
								V	± 30PPM‡ (D)†				
								W	± 50PPM‡ (F)†		Reference or Calibration temperature is the mid-point of the above ranges	99	Calibration at reference temperature in customer's oscillator.
								P	±100PPM‡ (H)†				
								R	±200PPM‡ (M)†				
								O	Not Specified	O	Not Specified		
									† We use these calibration codes with corresponding total tolerances				

* Available at series resonance only
** Standard types for all codes as per MIL-H-10056
*** Not all holders available with modifications
**** When using a Croven code only to describe your requirement, you must choose from one of the following standard load capacitance values, 10, 12, 14, 16, 18, 20, 24, 27, 30, 32, 35, 40, 45, 50, 55, 60, 70, 80, 90, 100 pf.
‡ Total tolerance (measured from nominal frequency)

For More Information. Circle No. 124

THE CONNOR–WINFIELD CORPORATION

West Chicago, IL 60185
CABLE: CONWINWCGO

PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

For over twenty years, the CONNOR-WINFIELD Corporation has been producing high quality frequency control products for both military and commercial applications. CONNOR-WINFIELD has built an excellent reputation as a source of custom designed oscillators. We are also able to provide attractive discounts on large volume orders, but if you are in a hurry, our low volume lead times are consistently short on all standard models.

What follows is only a partial listing of the extensive oscillator capabilities we have available. We invite you to write or call us with your special oscillator requirements.

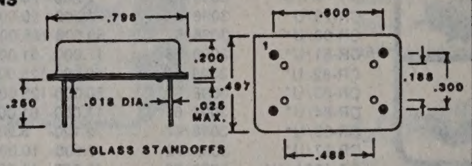
CONNOR-WINFIELD spotlights these new models:

★ECL-A,B	ECL logic in an all metal DIP-up to 180MHz (pg.1)
★S15R8	Low cost, fast delivery of TTL DIP oscillators—stock frequencies only. (pg. 2)
★C14R5L	Low current CMOS logic– <2mA. (pg. 1)
★SW44-1,2	Hi frequency Sine wave in an epoxy encapsulated DIP package- up to 200MHz. (pg. 2)
★C13R1,2,3,	Rugged non-xtal oscillator in a .2" high, all metal DIP package. (pg. 1)

DIP CRYSTAL OSCILLATORS

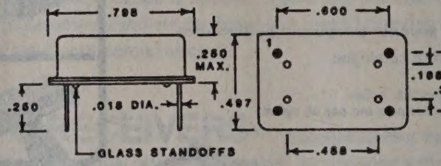
Package Outline 1

PIN CONNECTIONS
1 N/C
7 GROUND
8 OUTPUT
14 Vcc



Package Outline 2

PIN CONNECTIONS
1 OUTPUT
7 GROUND
8 OSC. MON.
14 Vcc



TTL SERIES

Output Load	1 – 10 TTL
Duty Cycle	50/50 ± 10%
Supply Voltage	+5Vdc ±10%
Supply Current	85mA Max.

Available Options:

Gating Pin 1 Logic 0 enables Logic 1 disables.

Other Temperature Ranges and Frequency Tolerances Available.

Low Cost on Large Volume Orders.

LSTTL SERIES

Output Load 1 – 10 LSTTL 1 – 3 TTL
Duty Cycle 50/50 ± 10%
Supply Voltage +5Vdc ±10% Supply Current 50mA Max.

CMOS SERIES

Output Load	CMOS
Duty Cycle	50/50 ± 10%
Supply Voltage	+ 5Vdc to + 15Vdc
Supply Current 3 – 20mA	(C14R5L) ≤ 2mA at 5Vdc ≤ 15mA at 15Vdc

NON–CRYSTAL SOLID STATE

Output Load CMOS Supply Voltage 3 – 15Vdc ± 10%
Duty Cycle 50/50 ± 10% Supply Current 25mA Max.

100K ECL SERIES

Output Load 100K ECL
Duty Cycle 50/50 ± 5%
Supply Voltage – 4.5 or – 5.2Vdc Current 50mA

SINEWAVE SERIES

DPS1 & DPS3 –	Supply Voltage	+5Vdc ± 10%
	Output Voltage	1Vrms 10K Load
DPS2 & DPS4 –	Supply Voltage	+8Vdc to +15Vdc
	Output Voltage	1.5Vrms – 3Vrms 10K Load

Model	Package	Freq. Range	Freq. Toler.	Temp. Range
S14R6	1	255KHz to 60MHz	±.005%	– 25°C to + 75°C
S15R6	1		±.01%	0°C to + 70°C
S14R7	1	1Hz to 255KHz	±.005%	– 25°C to + 75°C
S15R7	1		±.01%	0°C to + 70°C
S16R6	1	255KHz to 60MHz	±.01%	– 40°C to + 85°C
S17R6	1			– 55°C to + 125°C
SR721	1	25MHz to 80MHz	±.01%	0°C to + 70°C
SR722	1		±.005%	
SR723	1		±.01%	– 40°C to + 85°C
SR724	1		±.005%	
SR725	1		±.01%	– 55°C to + 125°C
S14P5	2	< 1Hz to 10MHz	±.005%	– 25°C to + 75°C
S15P5	2		±.01%	0°C to + 70°C
S14P6	1	20KHz to 20MHz	±.005%	– 25°C to + 75°C
S15P6	1		±.01%	0°C to + 70°C
C14R5	1	200Hz to 8MHz	±.005%	– 25°C to + 75°C
C15R5	1		±.01%	0°C to + 70°C
C14R5L	1	200Hz to 2MHz	±.005%	– 25°C to + 75°C
C15R5L	1		±.01%	0°C to + 70°C
C14C5	2	< 1Hz to 200Hz	±.005%	– 25°C to + 75°C
C15C5	2		±.01%	0°C to + 70°C
C13R1	1	150Hz to 4MHz	± 1.0%	0°C to + 50°C
C13R2	1		± 0.1%	
C13R3	1		± 1.0%	
ECLA	1 for pin connections 2 for Height	8MHz to 150MHz	±.005%	0°C to + 70°C
ECLB	1 for pin connections 2 for Height	8MHz to 180MHz	±.01%	0°C to + 70°C
DPS1	2	1KHz to 75KHz	±.01%	– 25°C to + 75°C
DPS3	2		±.005%	
DPS2	2	100Hz to 100KHz	±.01%	
DPS4	2		±.005%	

All dimensions in inches. Specifications subject to change without notice.

For More Information. Circle No. 125

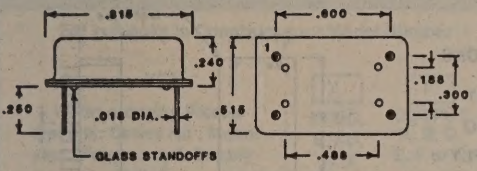
THE CONNOR–WINFIELD CORPORATION

West Chicago, IL 60185
CABLE: CONWINWCGO

PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

FAST DELIVERY/LOW COST TTL DIP CRYSTAL CLOCKS



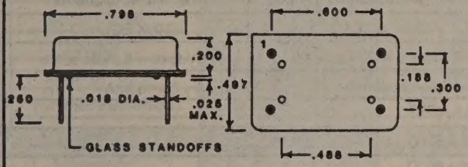
Stock Frequencies

1MHz 2MHz 2.048MHz
4MHz 5MHz 6MHz
8MHz 10MHz 12MHz
16MHz 20MHz 24MHz
40MHz 70MHz

Model	S14R8	S15R8
Freq. Tolerance	±.005%	±.01%
Temp. Range	0°C to +70°C	
Supply Voltage	+5Vdc ± 10%	
Supply Current	60 mA Maximum	
Load	1 to 10 TTL	

PIN CONNECTIONS
1 N/C 8 OUTPUT
7 GROUND 14 Vcc

EPOXY ENCAPSULATED DIP CRYSTAL CLOCKS



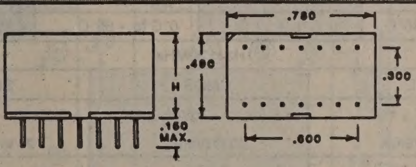
PIN CONNECTIONS
14 Vcc
7 GROUND
OUTPUT:
S13, D13, Pin 8 Output
S14, D14, Pin 1 Output

S13 & S14 C, D & E
All metal package
version of
D13 & D14 C, D & E

Model Number	S13R1 S14R1	S13R1A S14R1A	S13R1B S14R1B	D13C D14C S13C S14C	D13D D14D S13D S14D	D13E D14E S13E S14E
Freq. Range	3MHz to 25MHz			15KHz to 20MHz		
Frequency Tolerance & Temp. Range	±.01% −25°C to +75°C	±.005% 0°C to +70°C	±.01% −40°C to +85°C	±.005% 0°C to +50°C	±.0075% 0°C to +65°C	±.01% −25°C to +75°C
Output	TTL			1 to 10 TTL		
Symmetry	50 / 50 ± 10%					
Supply Voltage	+5Vdc ± 10% <20mA			+5Vdc 20 to 75mA		

TIGHT TOLERANCE TTL/SINEWAVE DIP

Pin Conn.
7 Ground
14 +
Output:
Per chart



TTL or Sinewave Series

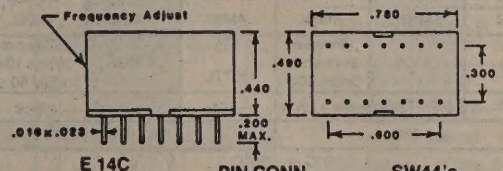
Tight Tolerance Crystal Oscillators

L11 through L14 Series-Discrete Oscillators

F11 through F14 Series-Thick Film Oscillators

Model	L12	F12	L14	F14	L11	F11	L13	F13
Freq. Range	<1Hz to 70MHz							
Output Logic	TTL-Suffix C,D,E				Sinewave-Suffix F,G,I			
Freq. Tolerance add suffix to model number	C–F ±.001% 0°C to +50°C							
	D–G ±.0025% 0°C to +65°C							
	E–I ±.005% −25°C to +75°C							
Output Pins	8	8	12	12	8	8	12	12
Pin Sizes	Flat Pins .016 × .023				Square Pins .017 × .017			
Output Load	1–10 TTL 50/50 ± 10%				3Vrms ± 1Vrms 10K Ω			
Supply Voltage	+5Vdc ± 5%				20mA to 100mA			
H: Height	.44				.57			

HIGH FREQUENCY ECL/SINEWAVE EPOXY ENCAPSULATED DIP



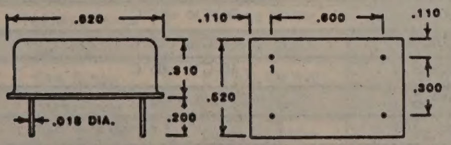
E 14C
1 Comp. Output
7 Vee
8 Output
14 Vcc

PIN CONN.

SW44's
7 Ground
8 Output
14 (+) Supply

Model	E14C	SW44–1	SW44–2
Freq. Range	30MHz to 200MHz	30MHz to 200MHz	
Freq. Tolerance	±.01%	±.01%	
Temp. Range	0°C to +70°C	0°C to +70°C	
Output (please specify)	10K ECL or 100K ECL Duty Cycle 50/50 ± 10% Rise/Fall Times 1.5ns	Sinewave 0 dBm into a 50 Ω Load	Sinewave 10 dBm into a 50 Ω Load
Supply Voltage (please specify)	10K ECL −5.2Vdc ±5% 100K ECL −4.5Vdc ±5%	+5Vdc ±5%	+12Vdc ±5%
Supply Current	50mA Maximum	20mA Maximum	

TTL VCO DIP OSCILLATORS



PIN CONN.
1 Con. Volt.
7 Ground
8 Output
14 (+) Supply

Model	PL14R1	PL14R2	PL14R3
Freq. Range	20MHz to 80MHz		
Freq. Tolerance	±1%		±2%
Temp. Range	0°C to +70°C		
Supply Voltage	+5Vdc ±5°C		
Control Voltage	0V to 5V F (nominal) at 2 – 3V		
Deviation	±1% to ±1.5%	±5% to ±10%	±10% to ±15%

All dimensions in inches.

Specifications subject to change without notice.

For More Information. Circle No. 125

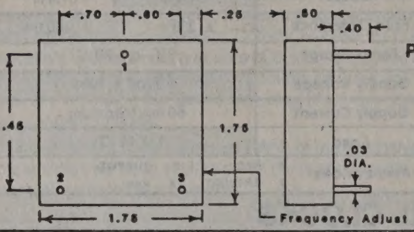
THE CONNOR–WINFIELD CORPORATION

West Chicago, IL 60185
CABLE: CONWINWCGO

PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

TCXO SERIES

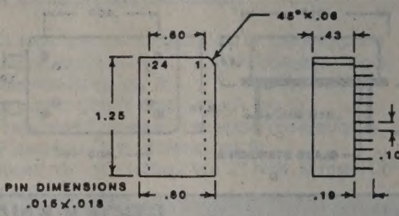

.70
.60
.25
.60
.40
1
1.45
1.75
.03 DIA.
2
3
1.75
Frequency Adjust

C12's PIN CONNECTIONS

1 OUTPUT
2 (+) SUPPLY
3 GROUND

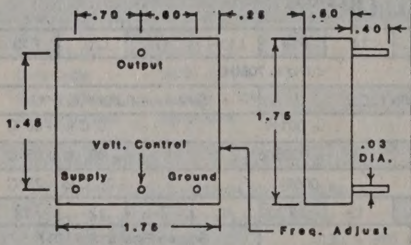
C24's PIN CONNECTIONS

5 OUTPUT
12 GROUND
24 (+) SUPPLY


45°×.06
.60
.43
24
1
1.25
.10
PIN DIMENSIONS .015×.018
.60
.10

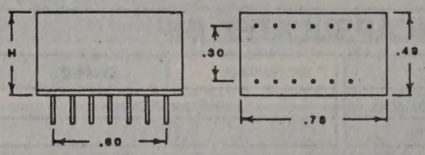
Outputs	TTL	CMOS		SINE	ECL
Frequency Range	C12's 1Hz to 30MHz C24's 15KHz to 30MHz	1Hz to 8MHz	1Hz to 12MHz	(C12 only) 1Hz to 30MHz	C12's 1Hz to 30MHz C24's 4MHz to 30MHz
Output Load	1 to 10 TTL	CMOS		50Ω or 10KΩ	100K ECL
Supply Voltage	+5Vdc ± 1%	+5 to + 8Vdc ± 1%	+ 8 to + 15Vdc ± 1%	+5Vdc to +30Vdc ± 1%	−4.5Vdc or −5.2Vdc ± 1%
Supply Current	<60mA	<25mA		<60mA	<150mA
Frequency Tolerance add suffix to model number	A	±.00005%	+20°C to +40°C		
	B	±.00015%	0°C to +50°C		
	C	±.00025%	−25°C to +65°C		

VCXO SERIES


.70
.60
.25
.60
.40
Output
1.45
1.75
Volt. Control
.03 DIA.
Supply
Ground
1.75
Freq. Adjust

Model	V175A	V175B	V175C	V175D
Freq. Tolerance	±.001%	±.0025%	±.005%	±.0075%
Temp. Range	+20°C to +40°C	0°C to +50°C	0°C to +65°C	+25°C to +65°C
Freq. Range	<1Hz to 30MHz			
Output	TTL	CMOS	SINE	
Supply	+5Vdc ± 1% 10 to 75mA	+5Vdc to +15Vdc ± 1% 25 to 50mA	+5Vdc to +30Vdc ± 1% 25 to 50mA	
Load	1 to 10 TTL	CMOS	50Ω or 10K Ω	
Voltage Control	5Vdc supply: 0 to +4V or ±2V 12Vdc supply: 0 to +10V or ±5V	20ppm/V ± 1ppm/V Wider deviations available		

SOLID STATE EPOXY ENCAPSULATED DIPS



PIN CONNECTIONS

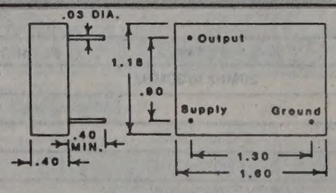
7 GROUND
12 OUTPUT
14 Vcc

L13–Square Pins
.017 × .017

L14–Flat Pins
.016 × .023

Model	L13LT L14LT	L13LC L14LC	L13SW L14SW	L13Q L14Q	L13QC L14QC	L13B L14B
Freq. Tolerance	<1Hz to 4MHz	<1Hz to 4MHz	500KHz to 4MHz	<1Hz to 4MHz	<1Hz to 4MHz	1KHz to 4MHz
Output	TTL 10 TTL	CMOS	Sinewave 3Vrms 10K 0dBm 50Ω	TTL 10TTL	CMOS	Sinewave 3Vrms 10K 0dBM 50 Ω
Supply Voltage	+5Vdc	+5 to +15Vdc	+5 to +15Vdc	+5Vdc	+5 to+15Vdc	+5Vdc
Freq. Stability	±0.1%			±1.0%		
Temp. Range	0°C to +50°C					
Freq. Trimmer	Internal ±2% minimum			External resistor ±2% minimum		
Height	.17 to .57 (depending on frequency)					

TTL/CMOS PC BOARD MOUNT OSCILLATORS


.03 DIA.
Output
1.18
.90
Supply
Ground
.40 MIN.
.40
1.30
1.60

Model		IC5 TTL Series	C123MS CMOS Series
Freq. Range		50Hz to 500KHz	.1Hz to 8MHz
Freq. Tolerance (please specify)	K	±.001%	+20°C to +40°C
	R	±.0025%	+0°C to +50°C
	M	±.005%	−40°C to +85°C
	V	±.01%	−55°C to +125°C
Supply Voltage		+5Vdc ± 10%	+5Vdc to +15Vdc
Supply Current		5mA to 50mA	depends on frequency

All dimensions in inches.

Specifications subject to change without notice.

For More Information. Circle No. 125

THE CONNOR–WINFIELD CORPORATION

West Chicago, IL 60185
CABLE: CONWINWCGO
PHONE (312) 231-5270
TWX # 910-230-3231

OSCILLATORS

SERIES 76

Fill in Blanks to Construct your Model Number

Example: XF3

When ordering Please Specify: Series No., Model No., Frequency & Supply Voltage

X	F	3
FREQ. STAB. W, X or Z	OUTPUT A, B, D, E, F or G	PACKAGE 1, 2, 3, 4 or 5

Frequency Stability

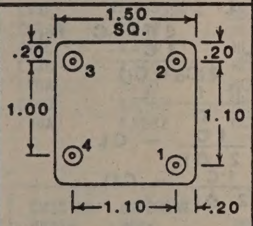
Parameter	Ordering Guide		
	W	X	Z
Temperature Range	−55°C to +75°C	0°C to +60°C	+15°C to +35°C
Frequency Stability	±.005%	±.001%	±.0005%

Output Specifications

Parameter	Ordering Guide																	
	A			B			D			E			F			G		
Frequency Range	1Hz to 5MHz			100Hz to 100MHz			10MHz to 300MHz			60Hz to 1MHz			1MHz to 400MHz			30MHz to 300MHz		
Supply Voltage	+5 to +15Vdc			+5Vdc ±5%			−5.2Vdc ±5%			+12Vdc ±5%			+12Vdc ±5%			−4.5Vdc ±5%		
Supply Current	3 to 20mA			70mA			100mA			25mA			70mA			100mA @ No Load		
Output	CMOS			TTL			10K ECL Compatible			Sine 1Vrms ±10%			Sine +10dBm ±3dBm			100K ECL		
Rise/Fall Time	<100nS			<100nS			≤1.5nS			----			----			≤1ns		
Symmetry/Distortion	50/50 ±10%			50/50 ±10%			----			<5%			−25 dBm			50/50 ±10%		
Load	CMOS			1-10 TTL			ECL			10K Ω			50Ω			ECL		
Termination	1	4	5	1	4	5	1	2	3	1	4	5	1	2	3	1	2	3
Height	.62	1.50	1.50	.62	1.50	1.50	.62	2.00	2.50	1.50	2.00	2.00	1.50	2.00	2.50	.62	2.00	2.50

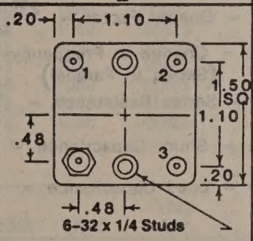
Terminations

1



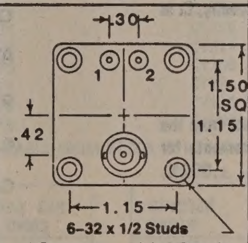
1 (+) Supply 2 Common
3 Common 4 Output

2



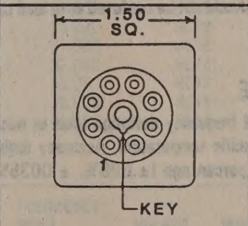
1 (+) Supply 2 Common
3 Common OSM Output

3



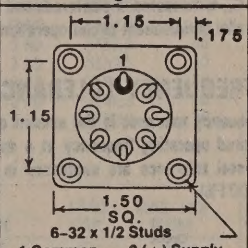
1 Common 2 (+) Supply
BNC Output

4



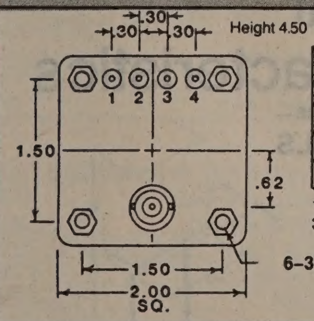
1 Common 2 (+) Supply
8 Output

5



1 Common 2 (+) Supply
8 Output

SERIES 79 OVENIZED

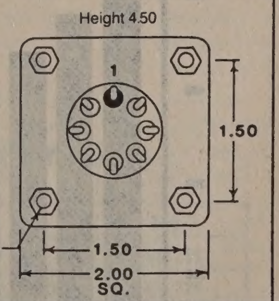


Frequency Stability

Parameter	Ordering Guide		
	A	B	C
Frequency Range	1MHz to 20MHz	20MHz to 60MHz	60MHz to 150MHz
Temperature Range	0°C to +60°C	0°C to +60°C	0°C to +60°C
Frequency Stability	$\pm 5 \times 10^{-8}$	$\pm .1 \times 10^{-7}$	$\pm .5 \times 10^{-7}$

1 Osc. Supply 2 Osc. Common
3 Ovn. Common 4 Ovn. Supply
BNC Output
6-32 x 1/2 Studs

1 Osc. Common 2 Osc. Supply
5 Ovn. Supply 6 Ovn. Common
8 Output
6-32 x 1/2 Studs



Output Specifications

Parameter	Ordering Guide					
	S	T	V	W	X	Y
Frequency Range	1MHz to 20MHz	20MHz to 60MHz	60MHz to 100MHz	100MHz to 150MHz	1MHz to 20MHz	20MHz to 60MHz
Osc. Supply	+12Vdc, 35mA	+12Vdc, 50mA	+12Vdc, 50mA	+12Vdc, 50mA	+12Vdc, 30mA	+12Vdc, 50mA
Ovn. Supply	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.	+28Vdc, 6W Avg.
Output, Load	Sine, 50Ω	Sine, 50Ω	Sine, 50Ω	Sine, 50Ω	TTL, 1-10 TTL	TTL, 1-10 TTL
Output Voltage	0dBm ±1.5dBm	0dBm ±1.5dBm	0dBm ±1.5dBm	0dBm ±1.5dBm	TTL	TTL
Harmonic Content	−30dBm	−30dBm	−30dBm	−30dBm	----	----

All Dimensions in Inches.

Specifications subject to change without notice.

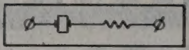
For More Information. Circle No. 125

CRYSTEK CRYSTALS

P.O. BOX 06135, FORT MYERS, FLORIDA 33906
TWX – 510-951-7448
TELEPHONE: 813-936-2109

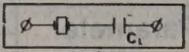
GENERAL ENGINEERING AND DESIGN INFORMATION

SERIES RESONANCE



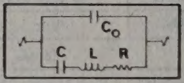
When the crystal is operating at series resonance, it looks resistive in the circuit. In a well designed series resonant circuit, correlation is not a problem. When load capacity is not specified, CRYSTEK will manufacture the unit at series resonance.

PARALLEL (ANTI)RESONANCE



When the crystal is operating at parallel resonance, it will look inductive in the circuit. Therefore, change in circuit reactance values will have the effect of pulling the frequency of the crystal. If the crystal is to be used at parallel resonance, the load capacity that the crystal is looking into should always be specified. This load capacity is the dynamic capacity of the total circuit measured or computed across the crystal terminals. In parallel circuit-design, the load capacity should be selected to operate the crystal at a stable point.

CRYSTAL EQUIVALENT CIRCUIT



The equivalent circuit of a crystal, as illustrated, is useful to explain the basic concepts governing the crystal's performance. C_o represents the static capacitance and is the sum of the capacitance between the electrodes and capacitances added by the wire leads and holder. The R, L, C, branch is known as the motional arm. C is a function of the mass and R is the sum of the bulk crystal losses.

SHUNT CAPACITY

Shunt capacity is the capacitance between the terminals of the crystal. Shunt capacity, C_o, is measured in picofarads and should not be confused with load capacity, C_L in parallel antiresonant circuit operation.

FREQUENCY TOLERANCE

Frequency tolerance is the amount of frequency deviation (plus or minus) from the desired operating frequency at a specific temperature. Accuracy requirements for crystal tolerance are expressed in percentage (±.005%, ±.0035%, ±.002%, ±.001%).

TC (TEMPERATURE COEFFICIENT)

TC (Temperature Coefficient) is frequency stability or deviation with temperature change. TC is expressed in parts per million change or plus or minus percentage change over the operating temperature range.

DRIVE LEVEL

Drive level is the amount of power dissipation experienced by the crystal in a given operating circuit. Drive level is expressed in milliwatts or microwatts. Excessive drive level will result in possible fracture of the quartz resonator or excessive long-term drift. An indication of excessive drive level is a constant frequency drift.

RESONANT RESISTANCE

Resonant resistance is the value of equivalent impedance the crystal has in the operating resonant circuit. The higher the resistance, the less activity of the quartz and more drive is required to excite the quartz. Resonant resistance is directly affected by the type of crystal cut and operating frequency.

Formulas

$$f = \text{(Series) Frequency} = \frac{1}{2\pi \sqrt{LC}}$$

$$L = \text{Motional Inductance} = \frac{1}{4\pi^2 F^2 C}$$

$$C_1 = \text{Motional Capacitance} = \frac{2(C_O + C_L)\Delta f}{f}$$

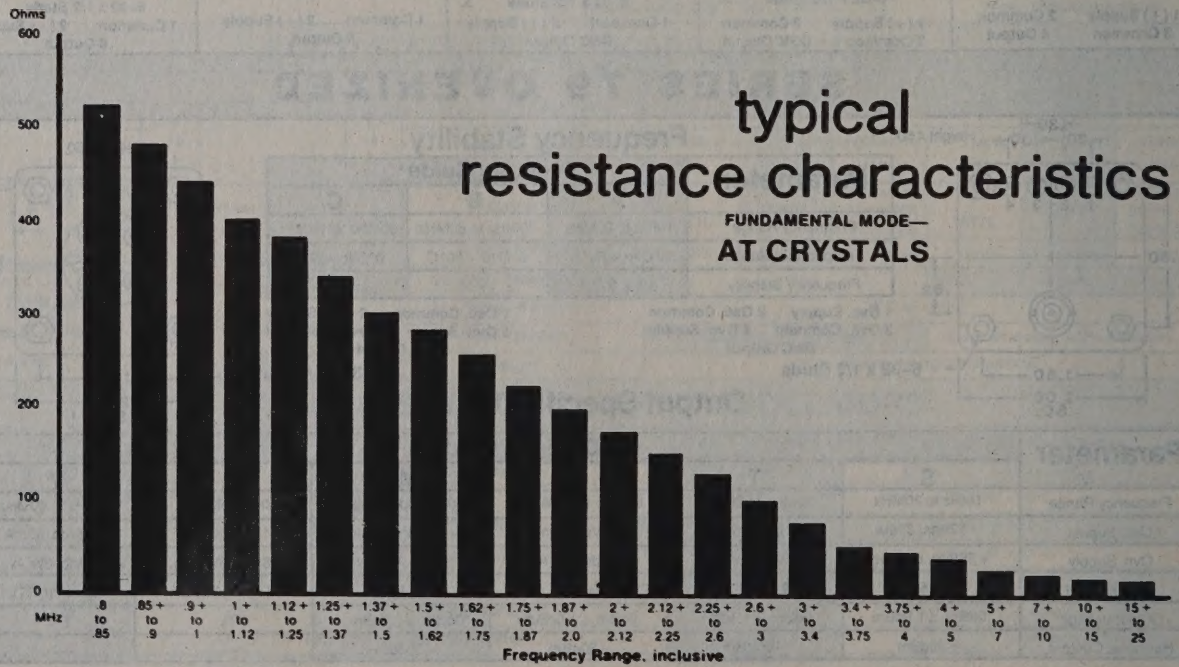
$$Q = \text{Quality Factor} = \frac{2\pi f L}{R} = \frac{1}{2\pi f C R}$$

$$\Delta f = \text{Change in Frequency (Series to Parallel)} = \frac{f\,C}{2(C_O + C_L)}$$

$$R = \text{Series Resistance} = \frac{2\pi f L}{Q}$$

$$C_O = \text{Shunt Capacitance} = \frac{f\,C}{2\,\Delta f} - CL$$

$$C_L = \text{Load Capacitance} = \frac{f\,C}{2\,\Delta f} - CO$$



typical resistance characteristics

FUNDAMENTAL MODE—
AT CRYSTALS

Note: The above chart is intended as a guide only.

For More Information. Circle No. 126

MICROPROCESSOR SPECIFICATIONS

±.005% at +25°C
±.01% from 0° to +70°C
7 pF maximum shunt capacitance

CRYSTEK PART #	FREQUENCY (MHz)	HOLDER	MODE	LOAD CAP.	MAX. ESR OHMS
CY1A*	1.000	HC33	FUND	SERIES	800
CY1B	1.025	HC33	FUND	SERIES	800
CY1C	1.018	HC33	FUND	12 PF	800
CD1A*	1.8432	HC33	FUND	13 PF	550
CD1AM	1.8432	HC18	FUND	13 PF	550
CY2A*	2.000	HC33	FUND	SERIES	500
CY2AM	2.000	HC18	FUND	SERIES	500
CY2D	2.012	HC33	FUND	SERIES	500
CY2DM	2.012	HC18	FUND	SERIES	500
CY2C	2.097152	HC33	FUND	SERIES	500
CY2CM	2.097152	HC18	FUND	SERIES	500
CY2B*	2.4576	HC33	FUND	32 PF	320
CY2BM	2.4576	HC18	FUND	32 PF	320
CY2E	2.500	HC33	FUND	SERIES	320
CY2EM	2.500	HC18	FUND	SERIES	320
CY3G*	3.000	HC33	FUND	SERIES	175
CY3GM*	3.000	HC18	FUND	SERIES	175
CY3B	3.2768	HC33	FUND	18 PF	175
CY3BM	3.2768	HC18	FUND	18 PF	175
CY3C	3.330	HC33	FUND	SERIES	175
CY3CM	3.330	HC18	FUND	SERIES	175
CY3E	3.579325	HC33	FUND	SERIES	175
CY3EM	3.579325	HC18	FUND	SERIES	175
CY3D*	3.579545	HC33	FUND	18 PF	175
CY3DM*	3.579545	HC18	FUND	18 PF	175
CY3H	3.600	HC33	FUND	SERIES	175
CY3HM	3.600	HC18	FUND	SERIES	175
CY3JM	3.6864	HC18	FUND	18PF	175
CY3F	3.93216	HC18	FUND	SERIES	100
CY3A*	4.000	HC18	FUND	SERIES	100
CY3AL	4.000	HC33	FUND	SERIES	100
CY4E*	4.194304	HC18	FUND	12 PF	75
CY4A	4.440	HC18	FUND	SERIES	75
CY4C	4.434	HC18	FUND	SERIES	75
CY4B	4.550	HC18	FUND	SERIES	75
CY5A	4.750	HC18	FUND	SERIES	75
CY4D	4.9152	HC18	FUND	SERIES	75
CY6A	4.9562	HC18	FUND	SERIES	75

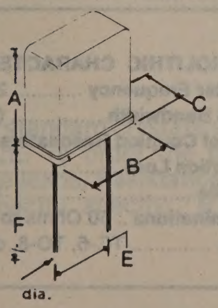
CRYSTEK PART #	FREQUENCY (MHz)	HOLDER	MODE	LOAD CAP.	MAX. ESR OHMS
CY7A*	5.000	HC18	FUND	SERIES	50
CY5B*	5.0688	HC18	FUND	SERIES	50
CY5D	5.333	HC18	FUND	SERIES	50
CY5E	5.760	HC18	FUND	32PF	50
CY8A*	5.185	HC18	FUND	SERIES	50
CY8B	5.585	HC18	FUND	SERIES	50
CY10A*	5.587	HC18	FUND	SERIES	50
CB5C	5.7143	HC18	FUND	SERIES	50
CY6B*	6.000	HC18	FUND	SERIES	40
CY6C*	6.144	HC18	FUND	30 PF	40
CY6D	6.5536	HC18	FUND	22 PF	40
CY6E	6.666	HC18	FUND	SERIES	40
CY6F	6.250	HC18	FUND	SERIES	40
CY6G	6.400	HC18	FUND	20 PF	40
CY7B	7.3728	HC18	FUND	SERIES	30
CY8G*	8.000	HC18	FUND	SERIES	30
CY8H	8.448	HC18	FUND	SERIES	30
CY9B	9.8304	HC18	FUND	SERIES	30
CY12A*	10.000	HC18	FUND	SERIES	30
CY11B	11.0592	HC18	FUND	SERIES	30
CY12B*	12.000	HC18	FUND	SERIES	30
CY11A	11.43	HC18	FUND	SERIES	30
CY13A	13.5168	HC18	FUND	SERIES	30
CY14A	14.31818	HC18	FUND	SERIES	30
CY14B	14.7456	HC18	FUND	SERIES	30
CY16B	16.000	HC18	FUND	SERIES	30
CY15A	15.000	HC18	FUND	SERIES	30
CY16A	16.58880	HC18	FUND	SERIES	30
CY19A*	18.000	HC18	FUND	SERIES	30
CY19B*	18.432	HC18	FUND	SERIES	30
CY19D	19.354	HC18	FUND	SERIES	30
CY20A*	19.6608	HC18	FUND	SERIES	30
CY22A*	20.000	HC18	FUND	SERIES	30
CY21B	21.427	HC18	FUND	SERIES	30
CY22C*	22.032	HC18	FUND	SERIES	30
CY22B*	22.1184	HC18	FUND	SERIES	30
CY23A*	23.400	HC18	FUND	SERIES	40
CY23B	23.684	HC18	FUND	SERIES	40
CY24A	24.000	HC18	FUND	SERIES	40
CY25A	25.000	HC18	FUND	SERIES	40
CY27A	27.000	HC18	3 RD	SERIES	40
CY30B	32.000	HC18	3 RD	SERIES	40
CY36A	36.00	HC18	3 RD	SERIES	40
CY48A*	48.000	HC18	3 RD	SERIES	40
CY100A	100.000	HC18	5 TH	SERIES	90

*** AVAILABLE FROM STOCK IN MANY CASES.**

CRYSTEK PART#	FREQUENCY (MHz)	HOLDER	MODE	LOAD CAP.	MAX. ESR OHMS
M8A	8.000	HC44	Fund	S	80
M14A	14.000	HC44	Fund	S	60
M14E	14.4000	HC44	Fund	S	60
M15A	15.000	HC44	Fund	S	55
M18E	18.4320	HC44	Fund	S	40

CRYSTEK PART#	FREQUENCY (MHz)	HOLDER	MODE	LOAD CAP.	MAX. ESR OHMS
M19D	19.3540	HC44	Fund	S	40
M19G	19.6608	HC44	Fund	S	40
M22B	22.1184	HC44	Fund	S	40
M24A	24.000	HC44	Fund	S	40
M25A	25.000	HC44	Fund	S	40

Standard Holders Available



MAXIMUM DIMENSIONS AND FREQUENCY RANGES

HC-	A	B	C	D	E	F	MHz
6	.775	.757	.352	.052	.494	.248	0.8 to 225
18	.530	.435	.183	.019	.200	.787 Min.	1.8 to 225
25	.530	.435	.183	.042	.200	.248	1.8 to 225
33	.775	.757	.352	.032	.494	.787 Min.	0.8 to 225
44	.287	.291	.099	.019	.115	.787 Min.	8.0 to 70

CRYSTEK
CRYSTALS
P.O. BOX 06135
FT. MYERS, FL 33906

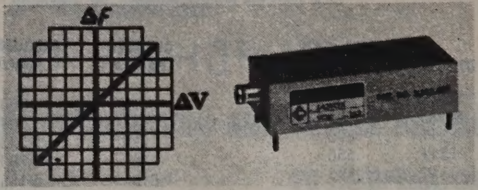
Special holders available on request

TWX: 510-951-7448 • TEL: 813-936-2109

DAMON *THE FORM FACTOR SPECIALISTS*

VCXOs — 1 KHz to 500 MHz

Damon VCXOs provide high stability over a broad range of center frequencies. An optional square wave or pulse output signal compatible with I. C. logic circuits is available.

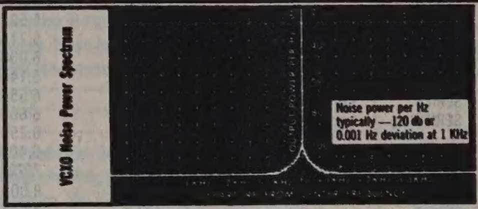


VCXO CHARACTERISTICS:

Center Frequency	1 KHz to 500 MHz
Deviation	.01% to 0.5% of Center Frequency
Linearity	1% to 5% of Peak Deviation
Frequency Stability	Determined by Peak Deviation and Operating Temp.
Modulation Rates	DC to 2 MHz

Low Noise VCXOs

Damon low noise miniaturized VCXOs are all solid state quartz crystal stable oscillators whose frequencies can be varied linearly by an external DC or AC modulating signal. Only a source of power and control signal are required . . . no auxiliary compensating circuitry.

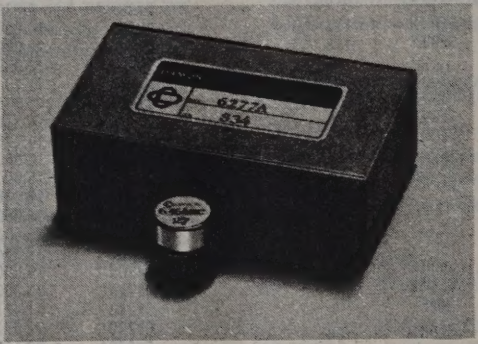


TYPICAL CHARACTERISTICS:

Center Frequency	10.000 MHz ±1 KHz
Deviation	±10 KHz
Linearity	±1%
Modulation Rate	Flat to 4 KHz
Output Power	>1 MW

Gaussian Crystal Filters

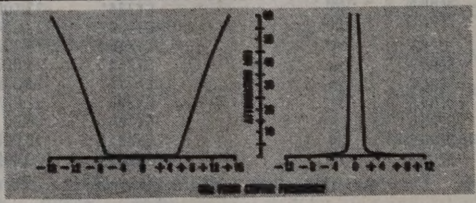
Gaussian Crystal Filters of either conventional or monolithic design. Useful in FM communications or radar systems where flat time delay is required. In a coherent pulsed radar, it can minimize return-pulse overshoot. Eliminates ringing problems in swept spectrum analysis. Available in 2 to 8 pole designs.



Center Frequency	
Conventional	10 KHz - 35 MHz
Monolithic	3 - 30 MHz
3 dB Bandwidth	100 Hz - 30 KHz
Shape Factor, 30 dB to 3 dB	3:1 to 7:1
Ringing, Pulse or Impulse	25 - 50 dB down
Phase Linearity	±2%
No. of Poles	
Conventional	2 - 8
Monolithic	2 - 4
Volume	
Conventional	1 - 6 cu. in.
Monolithic	0.016 - 0.4 cu. in.

Band-Pass/Reject Crystal Filters

A wide variety of conventional crystal filters are produced at Damon. Standards designs such as Butterworth, Chebyshev, Gaussian, Bessel, and Legendre, as well as custom tailored designs are available.



RANGE OF PARAMETERS:

Center Frequency	10 KHz - 75 MHz
Bandwidth	.01% - 3% of C.F.
Shape Factor	Down to 1.2:1
Differential Phase Shift	±2°
Group Delay Uniformity	±5%

Surface-Wave Delay Lines

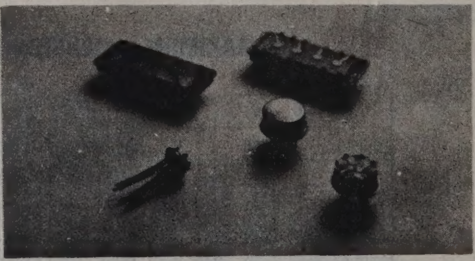
With signal transfer **across** the surface instead of through the body (a state-of-the-art development), the new Surface-Wave concept results in substantially smaller packages, lower cost in production quantities and superior performance over a 20 MHz to 300 MHz range.

RANGE OF PARAMETERS:

Frequency Range	20 MHz - 300 MHz
Time Delay Range	0.5 - 20 Microsecs.
Bandwidth at −3 dB	3% - 30% of Center Frequency
Insertion Loss	10 - 20 dB
Spurious Responses	25 - 30 dB below Desired Response
Environment	Full Military Temp., Shock, Vibration Available
Typical Size	< 1 cu. in.

Monolithic Crystal Filters

Damon Monolithic Filters utilize a single quartz plate for multiple resonators and the coupling medium between them. Advantages over conventional crystal filters include smaller size, superior stability, and lower cost. Available in a wide variety of computer-assisted designs from Chebyshev to Gaussian characteristics and from 2 to 8 poles.



MONOLITHIC CHARACTERISTICS:

Center Frequency	2.5 - 30 MHz
3 dB Bandwidth	0.3 - 30 KHz
No. of Coupled Resonators	2 - 6
Insertion Loss	1 - 6 dB
Ripple	0.5 dB Max.
Terminations	50 Ohms to 20 Kohms
Size	TC-5, TO-8, or Flat-Pack

Write for technical bulletins.

DAMON/ELECTRONICS DIVISION
80 WILSON WAY, DEPT. G, WESTWOOD, MASS. 02090, TEL: (617) 449-0800

CTS® CORPORATION*
KNIGHTS DIVISION

1.0-175.0 MHz CRYSTALS

STANDARD DESIGNS

CTS Knights offers standard crystals, available in **Resistance Weld, Solder Seal** and **Coldweld** packages. All three are available in the two basic holder sizes (HC-18 and HC-6), with pin or wire lead terminations.

CHART A shows standard part numbers which can be purchased by specifying only part number and frequency. The type of seal is indicated by the part number prefix.

R = Resistance Weld
S = Solder Seal
K = Coldweld

In chart A all part numbers have the R prefix. If you wish **Solder Seal** or **Coldweld,** change the prefix letter. When ordering standard crystals by part number, you will receive the following electrical specifications:

CALIBRATION TOLERANCE:
Solder Seal ±.003% @ 25°C
Resistance Weld ±.002% @ 25°C
Coldweld ±.002% @ 25°C

LOAD CAPACITY: Last letter specifies load:
A = 20 PF
B = 32 PF
C = series resonance

RESISTANCE: Specified on chart A

SHUNT CAPACITY: 7 PF Max.

STABILITY: ±.003% of 25°C frequency from −40 to +70°C

AGING:
Solder Seal — < 10 PPM/YR
Resistance Weld — < 5 PPM/YR
Coldweld — < 3 PPM/YR

To order standard crystals, specify P/N and frequency. EXAMPLE: To order the basic HC-49 package size with wire leads, **Resistance Weld,** at 4.00 MHz, 20 PF load capacity, specify: "R1335-2-BA @ 4.00 MHz."

CRYSTAL PERFORMANCE CURVES

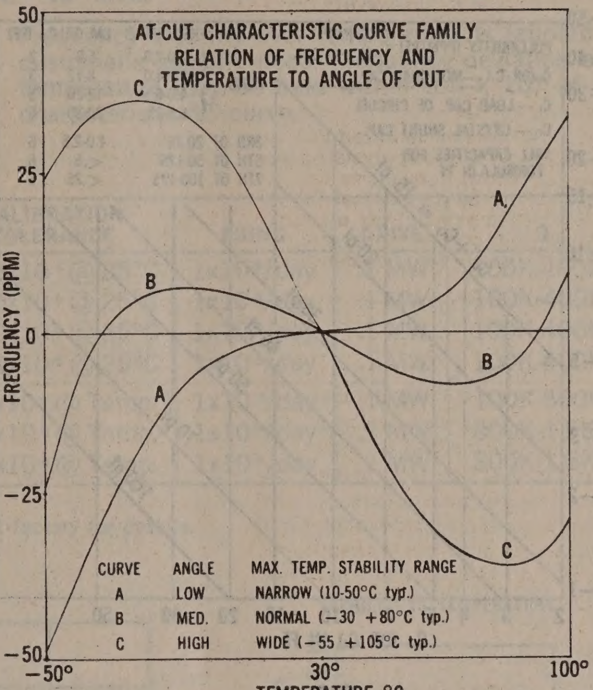


FIG. 1

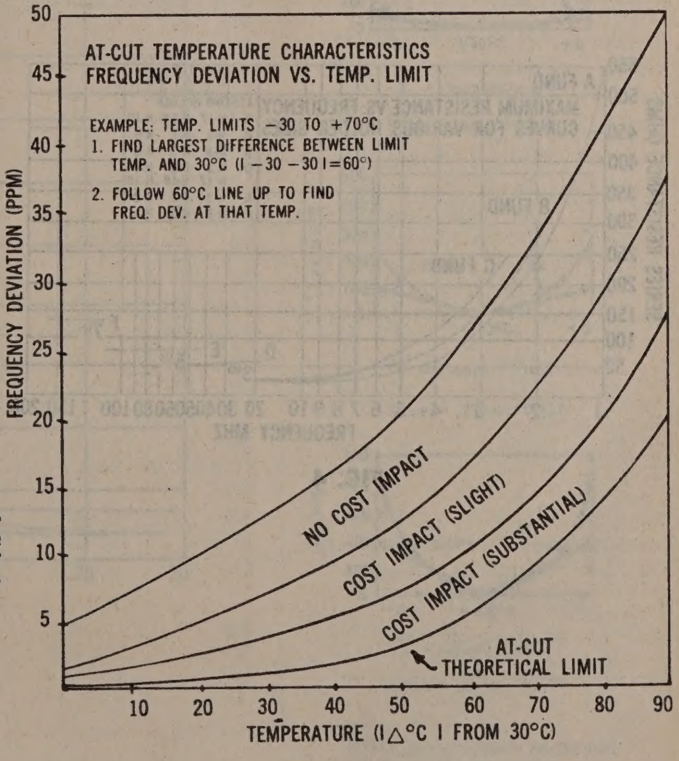


FIG. 2

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1.0-175.0 MHz CRYSTALS

CRYSTAL PERFORMANCE CURVES

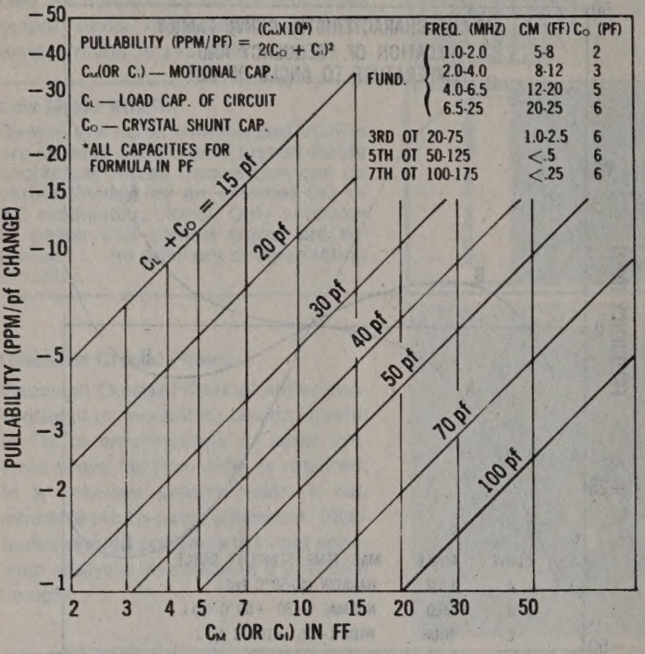


FIG. 3

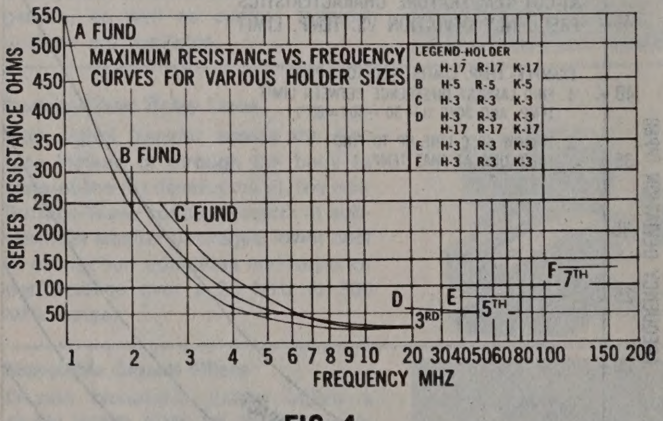


FIG. 4

CUSTOM DESIGNS

Custom crystals include any which cannot be ordered by Specific CTS Knights part number. It does not automatically mean increased cost. Tighter specifications, detailed parameter testing, etc., involve additional cost factors.

Design limits are stated below. Your own specification can be written within these limits. This is intended as a practical window and does not exclude other designs. Query us first on State-of-the-Art needs.

HOLDER: **Resistance Weld, Solder Seal** and **Coldweld** holders are available. See outline drawings section. Note availability of hold-down top wires.

FREQUENCY RANGE: 1 MHz to 175 MHz (see chart A for holder vs frequency).

CALIBRATION: ±.0005 to ±0.1% @ 25°C

TEMP. STABILITY: ±.0002% to ±.01% of 25°C Frequency depending on temperature range.

TEMPERATURE RANGE: Common ranges are:

0 to 70°C
−30 to + 85°C
−55 to +105°C

PULLABILITY: If required (see Fig. 3)

LOAD CAPACITY: When designing your circuit, keep in mind that 20 PF, 32 PF and series resonance are common load capacities. Spec the load of your circuit. Loads between 15 PF and series can be specified without cost impact.

SERIES RESISTANCE (Rs): See performance curve

DRIVE LEVEL: 1-10 MHz 0.1 to 5.0 MW
Above 10 MHz 0.1 to 2.0 MW

SPURIOUS FREQUENCY: 6 db min. separation (2:1 for Resistance) is practical for any crystal frequency. Better attenuation is available in many areas.

To order custom crystals, describe the crystal in full, using the parameter format shown. Consult the factory if necessary.

PRECISION CRYSTALS

CTS® CORPORATION*
KNIGHTS DIVISION

HIGH STABILITY PRECISION CRYSTALS 1 MHz - 40 MHz

Precision crystals are used in applications where long term aging of better than 2 PPM/YR is required. Two groups are available; those calibrated at room temperature and those calibrated at an elevated temperature, usually between 70° - 100°C, for ovenized oscillator use.

Frequency stability over temperature is tailored to customer's specific need. Frequency deviation over temperature may be held within $\pm 5 \times 10^{-7}$ of the characteristic AT curve.

CRYSTAL TYPE	CTS HOLDER‡	FREQUENCY RANGE	MODE	CALIBRATION TOLERANCE	AGING	DRIVE	Q
For Room Temperature Oscillator use	K3/K3W	8-25 MHz	Fund.	$\pm 10 \times 10^{-6}$ @ 25°C	1×10^{-8}/day	.1 MW	100K-400K
	K3/K3W	25-40 MHz	3rd	$\pm 10 \times 10^{-6}$ @ 25°C	1×10^{-8}/day	.1 MW	100K-400K
	K5/K5W	3-10 MHz	Fund.	$\pm 10 \times 10^{-6}$ @ 25°C	1×10^{-8}/day	.1 MW	100K-400K
	K17/K17W	1- 5 MHz	Fund.	$\pm 10 \times 10^{-6}$ @ 25°C	1×10^{-8}/day	.1 MW	100K-400K
For Ovenized Oscillator use	K17/K17W	1- 5 MHz	Fund.	$\pm 5 \times 10^{-6}$ @ Temp.	1×10^{-9}/day	.1 MW	100K-500K
	K17/K17W	4- 7 MHz	3rd	$\pm 5 \times 10^{-6}$ @ Temp.	1×10^{-9}/day*	.1 MW	800K-1.5KK
	K17/K17W	7-30 MHz	3rd	$\pm 5 \times 10^{-6}$ @ Temp.	1×10^{-9}/day	.1 MW	800K-1.5KK

* 5×10^{-10}/day available.
‡ TO5 and TO8 holders are available at many frequencies, consult factory for details.

PERFORMANCE CURVES

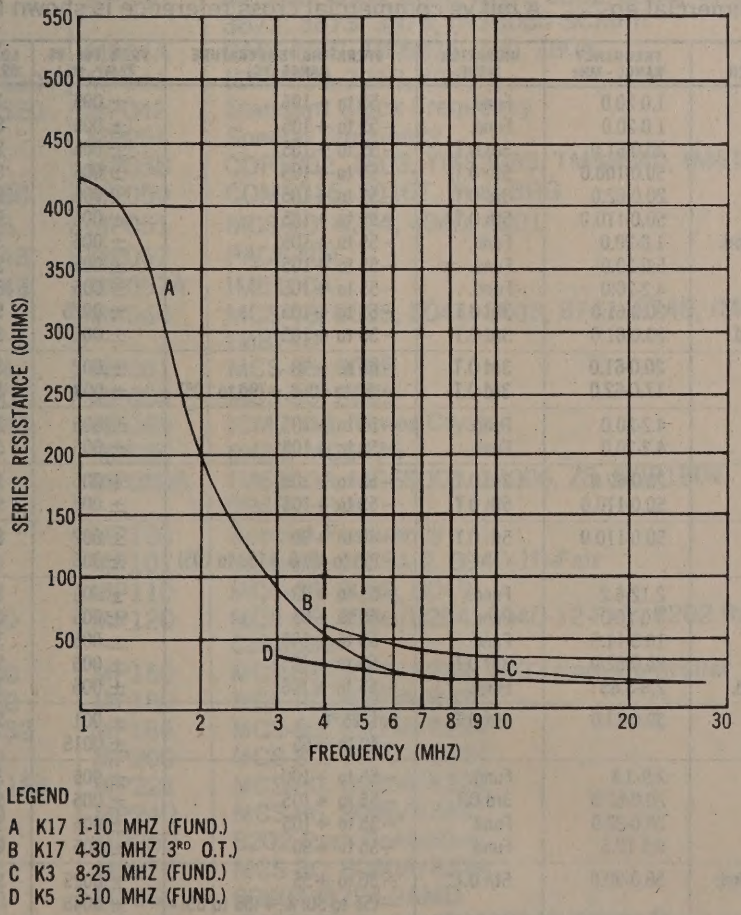
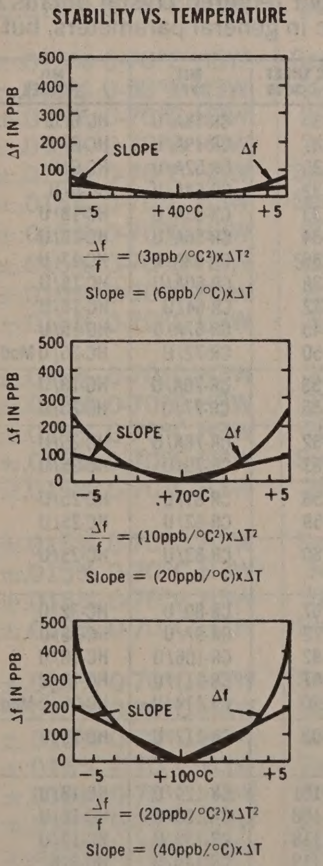


FIG. 5



NOTE: Curves assume no thermal shock due to oven cycling.

FIG. 6

MILITARY CRYSTALS

CTS® CORPORATION*
KNIGHTS DIVISION

MILITARY CRYSTALS

CTS KNIGHT'S test lab is government approved for qualification testing to military specification MIL-C-3098G, and includes equipment for environmental testing such as humidity, shock, vibration and aging.

Production test equipment conforms to maintenance and periodic re-calibration required by US Government calibration system requirements in MIL-C-45662A.

CTS KNIGHTS is QPL Approved On The Following Military Types:

CR-18A/U (1-5, 10-20 MHz)
CR-19A/U (1-5, 10-20 MHz)
CR-52A/U (19-61 MHz)
CR-54A/U (50-110 MHz)
CR-55A/U
CR-56A/U (50-110 MHz)
CR-58A/U (1-20 MHz)
CR-60A/U
CR-64/U (4.2-20 MHz)
CR-67A/U
CR-72/U
CR-75/U (50-110 MHz)
CR76A/U (17-61 MHz)
CR-78A/U (4.2-20 MHz)
CR-79/U (4.2-20 MHz)
CR-81/U (17-62 MHz)
CR-82/U (50-110 MHz)
CR-83/U (50-110 MHz)
CR-89/U
CR-97/U
CR-106/U
CR-111/U
CR-114/U
CR-117/U (30-62 MHz)
CR-124/U
CR-128/U
CR-139/U (20 MHz)
CR-140/U
CR-141/U (50-90 MHz)
CR-157/U (1-20 MHz)

MIL-EQUIVALENT CRYSTALS

MIL-C-3098G requires special testing to ensure compliance with the entire specification. Any crystal marked with the "CR" number must receive this testing.

If your required crystal details match those of a mil spec in general parameters, but your commercial application does not demand the exhaustive testing, you can order a mil equivalent crystal. The design will be the same. The crystal **will not** receive the detailed testing. Marking will be standard commercial marking. The "CR" number will not appear on the crystal.

A mil vs commercial cross reference is shown below:

SPEC SHEET MIL-C-3098	MIL TYPE	MIL HOLDER	CTS HOLDER	FREQUENCY RANGE - MHz	VIBRATION MODE	OPERATING TEMPERATURE RANGE (°C)	FREQ. TOL. VS. TEMP. (%)	LOAD CAP. OR SERIES
/3	CR-18A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/4	CR-19A/U	HC-6/U	R17	1.0-20.0	Fund.	−55 to +105	±.005	Series
/30	CR-52A/U	HC-6/U	R17	20.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/32	CR-54A/U	HC-6/U	R17	50.0-100.0	5th O.T.	−55 to +105	±.005	Series
/33	CR-55A/U	HC-18/U	R3W	20.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/34	CR-56A/U	HC-18/U	R3W	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/36	CR-58A/U	HC-17/U	R17 Mod.	1.0-20.0	Fund.	−55 to +105	±.005	32 pf
/38	CR-60A/U	HC-18/U	R3W	5.0-20.0	Fund.	−55 to +105	±.005	Series
/42	CR-64/U	HC-18/U	R3W	4.2-20.0	Fund.	−55 to +105	±.005	30 pf
/45	CR-67A/U	HC-18/U	R3W	20.0-61.0	3rd O.T.	−55 to +105	±.0025	Series
/50	CR-72/U	HC-25/U Mod.	R3 Mod.	20.0-61.0	3rd O.T.	−55 to +105	±.005	Series
/53	CR-76A/U	HC-18/U	R3W	20.0-61.0	3rd O.T.	−40 to +90	±.002	Series
/55	CR-77/U	HC-25/U	R3	17.0-62.0	3rd O.T.	−(55 to 40) & +(90 to 105)	±.003	Series
/62	CR-78A/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	30 pf
/63	CR-79/U	HC-25/U	R3	4.2-20.0	Fund.	−55 to +105	±.005	Series
/58	CR-81/U	HC-25/U	R3	20.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/59	CR-82/U	HC-25/U	R3	50.0-110.0	5th O.T.	−55 to +105	±.005	Series
/60	CR-83/U	HC-25/U	R3	50.0-110.0	5th O.T.	−40 to +90 −(55 to 40) & +(90 to 105)	±.002 ±.003	Series
/67	CR-89/U	HC-32/U	R5	2.12-6.2	Fund.	−55 to +90	±.005	30 pf
/72	CR-97/U	HC-18/U	R3W	8.0-10.0	Fund.	−40 to +85	±.005	32 pf
/82	CR-106/U	HC-18/U	R3W	10.5-11.5	Fund.	−55 to +105	±.005	32 pf
/87	CR-111/U	HC-18/U	R3W	20.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/90	CR-114/U	HC-25/U Mod.	R3 Mod.	2.9-3.85	Fund.	−55 to +105	±.005	32 pf
/93	CR-117/U	HC-25/U	R3	30.0-63.0	3rd O.T.	Ref. 25°C −40 to +65	±.001 ±.0015	Series
/101	CR-124/U	HC-18/U	R3W	2.9-3.8	Fund.	−55 to +100	±.005	32 pf
/108	CR-128/U	HC-18/U	R3W	20.0-62.0	3rd O.T.	−55 to +105	±.005	Series
/118	CR-139/U	HC-18/U	R3W	20.0-22.0	Fund.	−55 to +105	±.005	30 pf
/119	CR-140/U	HC-6/U	R17	9.5-12.5	Fund.	−55 to +90	±.005	60 pf
/122	CR-141/U	HC-18/U Mod.	R3W Mod.	50.0-90.0	5th O.T.	−30 to +55 −(55 to 30) & +(55 to 65)	±.0025 ±.0045	Series
/137	CR-157/U	HC-33/U	R17W	1.0-20.0	Fund.	−55 to +105	±.005	Series

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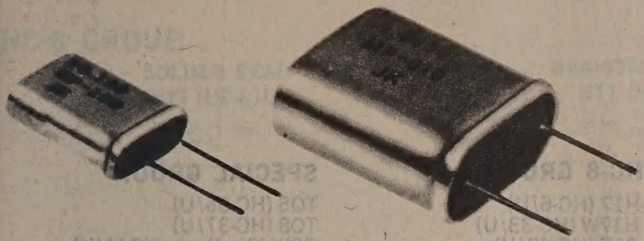
MICROPROCESSOR CRYSTALS

CTS® CORPORATION*
KNIGHTS DIVISION



CTS Knights microprocessor crystals offer a low cost crystal for microprocessor clock applications. Reliability is assured by the use of a mil-approved quality control process. These are solder seal and resistance weld crystals with 0.5" min. lead length.

Microprocessor crystals are available as "off the shelf" items from CTS authorized distributors.

Frequency MHz	CTS P/N	Microprocessor or Clock ICN	Specifications	Load Capacity
1.0	MP010	6800 Series, 6500 Series, INS8060 SCMPII, MC14500, 6809, 6860, 2150(AMI), 2650	±.020% 0-70°C H17W	13pf
1.8432	MP018	MC14411 Baud Rate Generator	±.020% 0-70°C H17W	13pf
2.0	MP020	6800 Series, 6500 Series, INS8060 SCMPII, 2650, INS8090, F8(3850CPU), IM6102, 68B09	±.015% 0-70°C H17W	20pf
2.097152	MP021	MM5378, MM5379 — NSC Auto Clock	±.015% 0-70°C H17W	20pf
2.4576	MP024	34702 Baud Rate Generator	±.015% 0-70°C H17W	32pf
3.0	MP030	MCS-48, 8021, 8022, 8035, 8041, 8048, 8741, 8748, IM8048, IM8748	±.015% 0-70°C H17W	18pf
3.2768	MP032	IM6100C, ICM7205	±.015% 0-70°C H17W	15pf
3.579545	MP036	IM5369, Color tv burst, IM6102, PPS-8, 6801, 6803	±.015% 0-70°C H17W	18pf
3.579545	MP036S	IM5369, Color tv burst, IM6102, PPS-8, 6801, 6803	±.015% 0-70°C H3W	18pf
4.0	MP040	MCS-40, 4004, 4040, 4201, 6802, 6808, MK3870, 3872, 3873, 3876, INS8060 SCMPII	±.015% 0-70°C H3W	20pf
4.0	MP04A	PACE-NSC, MC6875, Z80, Z80A	±.015% 0-70°C H3W	Series
4.194304	MP041	ICM7038, 7213, 7049	±.007% 0-50°C H3W	12pf
4.91520	MP042	Standard Clock Frequency	±.015% 0-70°C H3W	20pf
5.0	MP05A	Special Frequency	±.015% 0-70°C H3W	20pf
5.00	MP05B	CDP1802, 1803, TMS9985, TMS9940, IM6100A	±.015% 0-70°C H3W	Series
5.0688	MP050	COM5016, 5016T, Dual BRG	±.015% 0-70°C H3W	Series
5.185	MP051	MCS-40, 4004, 4040, 4201	±.015% 0-70°C H3W	20pf
5.7143	MP057	PACE-NSC	±.015% 0-70°C H3W	Series
5.7143	MP057A	IM6100A	±.015% 0-70°C H3W	20pf
6.0	MP060	MCS-48, 8035, 8041, 8048, 8741, 8748, IM8048, IM8748	±.015% 0-70°C H3W	20pf
6.144	MP061	MCS-85, 8085	±.015% 0-70°C H3W	20pf
6.250	MP062	MCS-85, 8085	±.015% 0-70°C H3W	30pf
6.5536	MP065	ICM7045, Timer Crystal	±.015% 0-70°C H3W	20pf
8.0	MP080	8X30, MC6875	±.015% 0-70°C H3W	Series
8.00	MP080A	IM6100A, MC68000, Z8000, Z8, CDP1804 9940-8-Fair	±.015% 0-70°C H3W	20pf
10.0	MP100	Special Frequency	±.015% 0-70°C H3W	Series
10.0	MP101	MCS-85, 8085A-2, 9940-10-Fair	±.015% 0-70°C H3W	30pf
11.0	MP110	MCS-48, 8039, 8049	±.015% 0-70°C H3W	18pf
12.00	MP120	MCS-86, 8086/8284, 9940-12-Fair, 8202 Ram Controller	±.015% 0-70°C H3W	Series
15.00	MP150	MCS-86, 8086/8284, 8202 Ram Controller	±.015% 0-70°C H3W	Series
18.00	MP180	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
18.432	MP184	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
20.0	MP200	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
22.1184	MP221	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
24.0	MP240	MCS-86, 8086/8284	±.015% 0-70°C H3W	Series
25.0	MP250	8202 Ram Controller	±.015% 0-70°C H3W	Series
27.0	MP270	MCS-80, 8080A/8224	±.015% 0-70°C H3W	Series
36.0	MP360	9080A/8224-2AMD	±.015% 0-70°C H3W	Series
48.0	MP480	TMS9900 Series/TIM9904(LS362)-TI	±.015% 0-70°C H3W	Series

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KNIGHTS DIVISION

OUTLINE DRAWINGS
CRYSTALS

OUTLINE DRAWINGS

CTS Knights supplies crystals in four package sizes, (groups) of holders. Physical size and configuration distinguish each group. These are:

HC-18 GROUP	HC-32 GROUP	HC-6 GROUP	SPECIAL GROUP
H3 (HC-25/U)	H5 (HC-32/U)	H17 (HC-6/U)	TO5 (HC-35/U)
H3W (HC-18/U)	H5W	H17W (HC-33/U)	TO8 (HC-37/U)
R3 (HC-50/U)	R5	R17 (HC-48/U)	R2W (Similar to HC44/U)
R3W (HC-49/U)	R5W	R17W (HC-51/U)	HC-40/U
K3 (HC-42/U)	K5	K17 (HC-36/U)	
K3W (HC-43/U)	K5W (HC-46/U)	K17W (HC-47/U)	

Three sealing methods are used. "H" holders are solder sealed. "R" holders are resistance welded. "K" and "T" holders are coldwelded. These sealing techniques ensure long term isolation from external environments. Solder sealing, resistance welding and coldwelding are designed to meet the military leak rate specification. Pin-type leads are normally used in sockets; wire-type leads are common for circuit board use. Resistance and coldweld are intrinsically cleaner packages and thus have better reliability.

HC-18 GROUP

mm
(IN.)

SOLDER SEAL
H3 (HC-25/U)

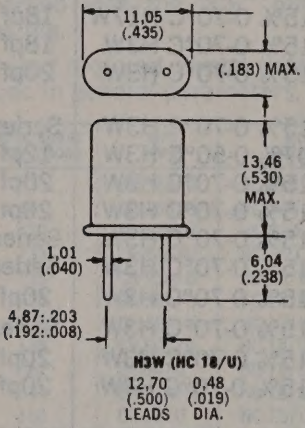

11,05
(.435)
(.183) MAX.
13,46
(.530)
MAX.
1,01
(.040)
6,04
(.238)
4,87:.203
(.192:.008)
H3W (HC 18/U)
12,70
(.500)
LEADS
0,48
(.019)
DIA.

FIG. 7

RESISTANCE WELD
R3 (HC-50/U)

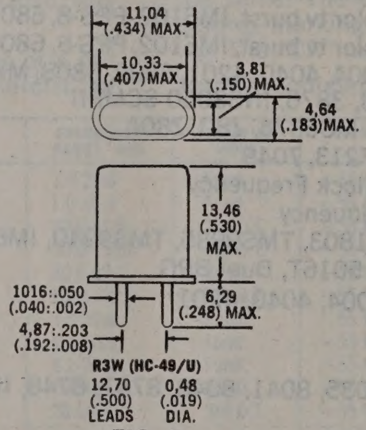

11,04
(.434) MAX.
10,33
(.407) MAX.
3,81
(.150) MAX.
4,64
(.183) MAX.
13,46
(.530)
MAX.
1016:.050
(.040:.002)
6,29
(.248) MAX.
4,87:.203
(.192:.008)
R3W (HC-49/U)
12,70
(.500)
LEADS
0,48
(.019)
DIA.

FIG. 8

COLDWELD
K3 (HC-42/U)

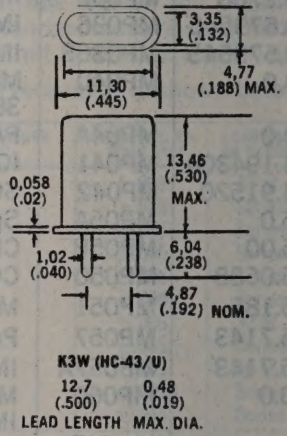

3,35
(.132)
11,30
(.445)
4,77
(.188) MAX.
0,058
(.02)
13,46
(.530)
MAX.
1,02
(.040)
6,04
(.238)
4,87
(.192) NOM.
K3W (HC-43/U)
12,7
(.500)
LEAD LENGTH
0,48
(.019)
MAX. DIA.

FIG. 9

HC-32 GROUP

mm
(IN.)

SOLDER SEAL
H5 (HC-32/U)

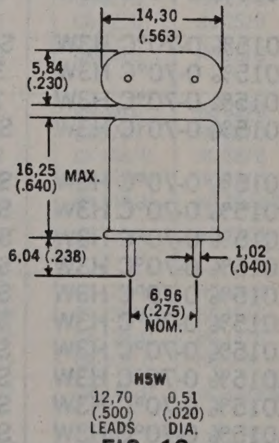
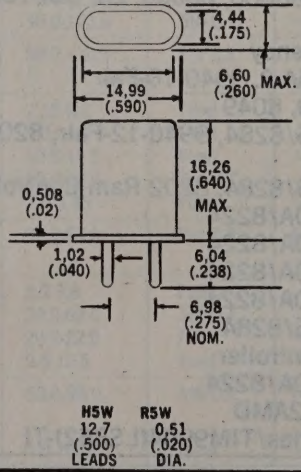

14,30
(.563)
5,84
(.230)
16,25
(.640)
MAX.
6,04 (.238)
1,02
(.040)
6,96
(.275)
NOM.
H5W
12,70
(.500)
LEADS
0,51
(.020)
DIA.

FIG. 10

RESISTANCE WELD
R5


4,44
(.175)
14,99
(.590)
6,60
(.260)
MAX.
16,26
(.640)
MAX.
0,508
(.02)
1,02
(.040)
6,04
(.238)
6,98
(.275)
NOM.
H5W
R5W
12,7
(.500)
LEADS
0,51
(.020)
DIA.

COLDWELD
K5

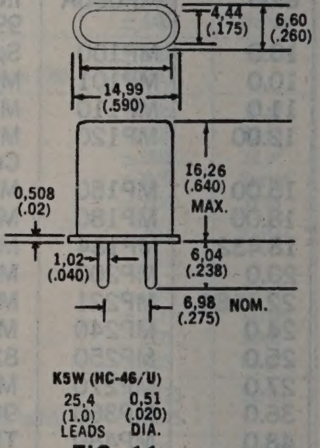

4,44
(.175)
6,60
(.260)
14,99
(.590)
16,26
(.640)
MAX.
0,508
(.02)
1,02
(.040)
6,04
(.238)
6,98
(.275)
NOM.
K5W (HC-46/U)
25,4
(1.0)
LEADS
0,51
(.020)
DIA.

FIG. 11

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*In ILLINOIS dba CTS Electronics Corporation

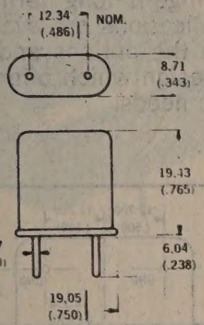
For More Information. Circle No. 128

OUTLINE DRAWINGS CRYSTALS

CTS® CORPORATION*
KNIGHTS DIVISION

HC-6 GROUP

SOLDER SEAL H17 (HC-6/U)

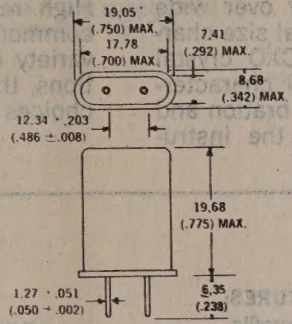

12.34 (.486) NOM.
8.71 (.343)
19.13 (.765)
1.27 (.050)
6.04 (.238)
19.05 (.750)

H17W (HC-33/U)

38.1 LEADS 0.762 DIA.
(1.5) LEADS (.030) DIA.

FIG. 12

RESISTANCE WELD R17 (HC-48/U)

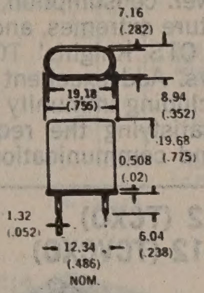

19.05 (.750) MAX.
17.78 (.700) MAX.
7.41 (.292) MAX.
8.68 (.342) MAX.
12.34 ± .203 (.486 ± .008)
19.68 (.775) MAX.
1.27 ± .051 (.050 ± .002)
6.35 (.238)

R17W (HC-51/U)

LEADS 19.15 .750 LEAD LENGTH
.762 ± .051 (.030 ± .002) DIA.

FIG. 13

COLDWELD K17 (HC-36/U)


7.16 (.282)
19.18 (.755)
8.94 (.352)
19.68 (.775)
0.508 (.02)
1.32 (.052)
12.34 (.486) NOM.
6.04 (.238)

K17W (HC-47/U)

19.15 .750 MIN. LEAD LENGTH
0.76 (.030) DIA.

FIG. 14

SPECIAL GROUP

COLDWELD or RESISTANCE WELD TO5 (HC-35/U)

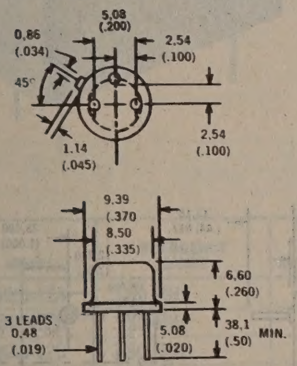

5.08 (.200)
0.86 (.034)
2.54 (.100)
45°
2.54 (.100)
1.14 (.045)
9.39 (.370
8.50 (.335)
6.60 (.260)
3 LEADS 0.48 (.019)
5.08 (.020)
38.1 (.50) MIN.

FIG. 15

R-2W (Similar to HC-44/U) RESISTANCE WELD R-2W

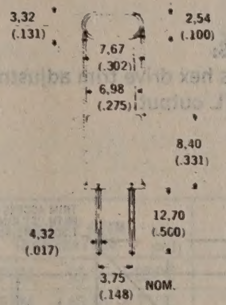

3.32 (.131)
2.54 (.100)
7.67 (.302)
6.98 (.275)
8.40 (.331)
12.70 (.500)
4.32 (.017)
3.75 (.148) NOM.

FIG. 16

TO-8 (HC-37/U) COLDWELD TO-8

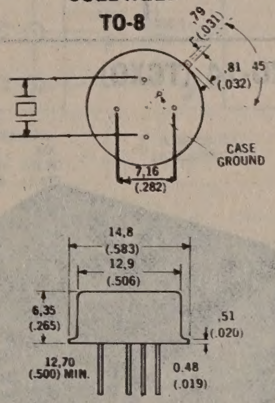

.79 (.031)
.81 45° (.032)
CASE GROUND
7.16 (.282)
14.8 (.583)
12.9 (.506)
6.35 (.265)
.51 (.020)
12.70 (.500) MIN.
0.48 (.019)

FIG. 17

Wire lead versions of Solder Seal, Resistance Weld and Coldweld Holders are available with a hold-down wire for circuit board mounting.

HC-18 GROUP

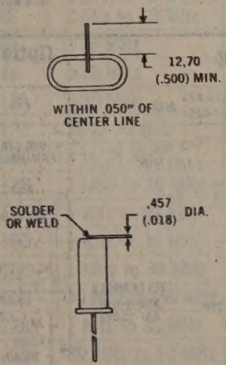

12.70 (.500) MIN.
WITHIN .050" OF CENTER LINE
SOLDER OR WELD
.457 (.018) DIA.

FIG. 18

HC-32 GROUP

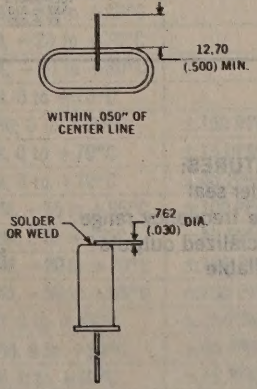

12.70 (.500) MIN.
WITHIN .050" OF CENTER LINE
SOLDER OR WELD
.762 (.030) DIA.

FIG. 19

HC-6 GROUP

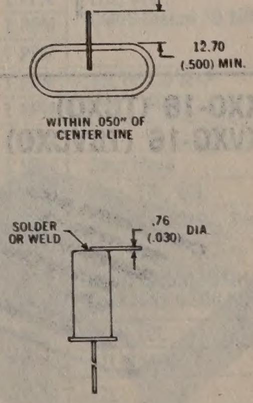

12.70 (.500) MIN.
WITHIN .050" OF CENTER LINE
SOLDER OR WELD
.76 (.030) DIA.

FIG. 20

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CTS® CORPORATION* KNIGHTS DIVISION

TCXO-TCVCXO CRYSTAL OSCILLATORS

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO's) VOLTAGE CONTROLLED - TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCVCXO's)

Low power consumption, high stability over wide temperature extremes, and small physical size characterize CTS Knights' TCXO and TCVCXO crystal oscillators. Add excellent environmental characteristics including immunity to humidity, vibration and shock, satisfying the requirements of the instruments and communications industries.

High reliability and stringent long term qualities common in military applications are available in a variety of designs. Note the options and modifications, the flexibility of design which offers the user choices to fulfill specific needs.

JKXO-12 (TCXO)
JKVXO-12 (TCVCXO)

FEATURES:
Low profile
Solder seal
Vibration 15G's, 10-2000 Hz

* VCO INPUT ON TCVCXO MODELS

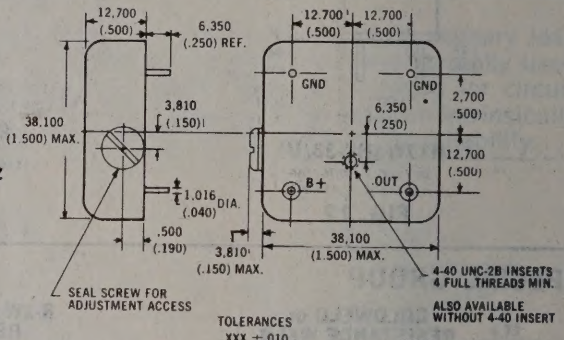
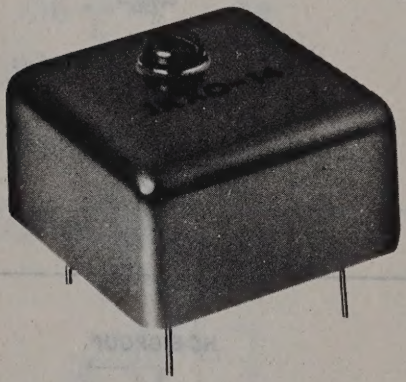

12,700
(.500)
6,350
(.250) REF.
38.100
(1.500) MAX.
3,810
(.150)
1,016
(.040) DIA.
.500
(.190)
3,810
(.150) MAX.
SEAL SCREW FOR
ADJUSTMENT ACCESS
12.700
(.500)
12.700
(.500)
GND
GND
6,350
(.250)
2,700
.500)
12,700
(.500)
B+
OUT
38,100
(1.500) MAX.
4-40 UNC-2B INSERTS
4 FULL THREADS MIN.
ALSO AVAILABLE
WITHOUT 4-40 INSERT
TOLERANCES
.XXX ±.010
.XX ±.020

FIG. 21

JKXO-14 (TCXO)

FEATURES:
Top access hex drive trim adjustment
Sine or TTL output



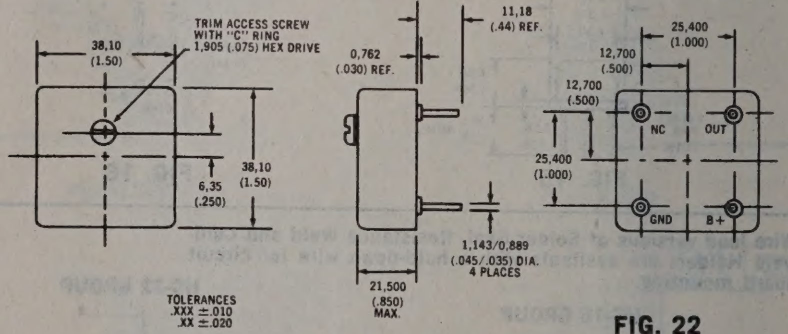
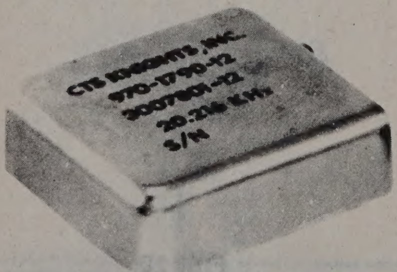
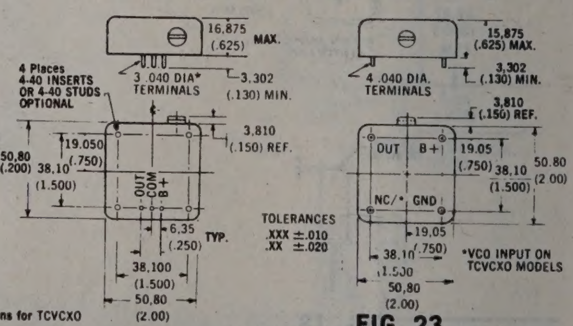

TRIM ACCESS SCREW
WITH "C" RING
1,905 (.075) HEX DRIVE
38,10
(1.50)
6,35
(.250)
38,10
(1.50)
TOLERANCES
.XXX ±.010
.XX ±.020
11,18
(.44) REF.
0,762
(.030) REF.
1,143/0,889
(.045/.035) DIA.
4 PLACES
21,500
(.850)
MAX.
25,400
(1.000)
12,700
(.500)
12,700
(.500)
25,400
(1.000)
NC
OUT
GND
B+

FIG. 22

JKXO-16 (TCXO)
JKVXO-16 (TCVCXO)



FEATURES:
Solder seal
Wide frequency range
Specialized outputs available


Standard Pkg.

Optional Pkg.
16,875
(.625) MAX.
4 Places
4-40 INSERTS
OR 4-40 STUDS
OPTIONAL
3 .040 DIA*
TERMINALS
3,302
(.130) MIN.
3,810
(.150) REF.
19.050
(.750)
50,80
(.200)
38,10
(1.500)
OUT
COM
B+
6,35
(.250) TYP.
38,100
(1.500)
50,80
(2.00)
* 4 Pins for TCVCXO
TOLERANCES
.XXX ±.010
.XX ±.020
15,875
(.625) MAX.
4 .040 DIA.
TERMINALS
3,302
(.130) MIN.
3,810
(.150) REF.
OUT
B+
NC/*
GND
19.05
(.750)
38,10
(1.500)
50.80
(2.00)
19,05
(.750)
38,10
1.500
50,80
(2.00)
*VCO INPUT ON
TCVCXO MODELS

FIG. 23

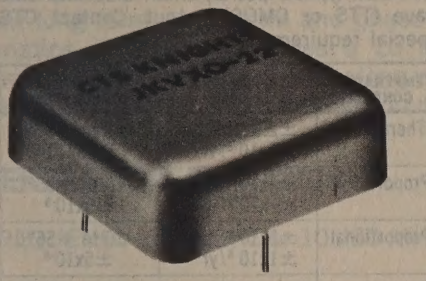
For More Information. Circle No. 128

CTS® CORPORATION*

KNIGHTS DIVISION

TCXO-TCVCXO CRYSTAL OSCILLATORS

JKVXO-22


CTS KNIGHTS
JKVXO-22

FEATURES:

Available as VCXO or TCVCXO. Temperature stability and deviation are customized per application. 5 volt supply, Mod voltage range 0 to +5 VDC.

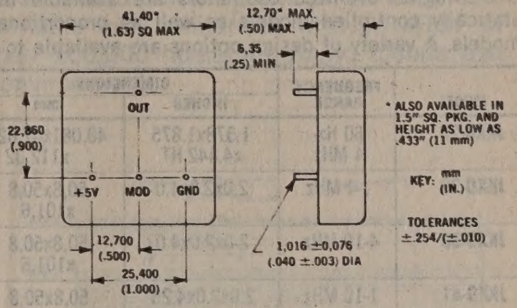
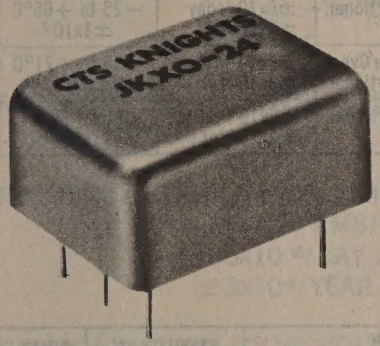

41,40*
(1.63) SQ MAX
12,70* MAX.
(.50) MAX.
6,35
(.25) MIN
OUT
22,860
(.900)
+5V
MOD
GND
12,700
(.500)
25,400
(1.000)
1,016 ±0,076
(.040 ±.003) DIA
* ALSO AVAILABLE IN 1.5" SQ. PKG. AND HEIGHT AS LOW AS .433" (11 mm)
KEY: mm (IN.)
TOLERANCES
±.254/(±.010)

FIG. 24

JKXO-24 (TCXO)


CTS KNIGHTS
JKXO-24

FEATURES:

Compact size with hermetic seal. Frequency adjustment is via an externally applied voltage or a 10K pot. Also available with internal mechanical adjust trimmer with seal screw.

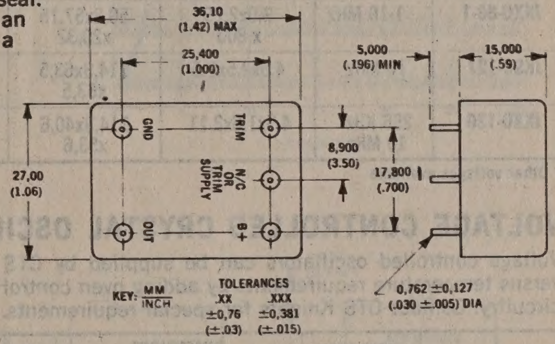

36,10
(1.42) MAX
25,400
(1.000)
GND
TRIM
N/C OR TRIM SUPPLY
OUT
B+
27,00
(1.06)
8,900
(3.50)
17,800
(.700)
5,000
(.196) MIN
15,000
(.59)
KEY: MM/INCH
TOLERANCES
.XX ±0,76 (±.03)
.XXX ±0,381 (±.015)
0,762 ±0,127
(.030 ±.005) DIA

FIG. 25

FIG.	MODEL	FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	TYPICAL AGING PER YEAR	OUTPUT OPTIONS
21	JKXO-12A	3-50 MHz	9-20	±2 PPM, −55 to +85°C	NONE	1 PPM	Sine Wave, TTL CMOS (Below 10 MHz) ECL (−5V Supply Req.)
	JKXO-12B	3-30 MHz	9-20	±1 PPM, −40 to +75°C	NONE	1 PPM	
	JKXO-12C	3-50 MHz	9-20	±.5 PPM, 0 to +70°C	NONE	1 PPM	
22	JKXO-14A	3-30 MHz	9-28	±.5 PPM, 0 to +50°C	NONE	1 PPM	TTL or Sine
	JKXO-14B	3-30 MHz	9-28	±1 PPM, 0 to +70°C	NONE	1 PPM	
23	JKXO-16A	1 Hz to 30 MHz	9-28	±1 PPM, −40 to +75°C	NONE	1 PPM	Sine (Above 500 KHz) ECL, TTL CMOS (Below 10 MHz)
	JKXO-16B	1 Hz to 30 MHz	9-28	±1 PPM, −55 to +85°C	NONE	1 PPM	
	JKXO-16C	1 Hz to 30 MHz	9-28	±2 PPM, −40 to +75°C	NONE	1 PPM	
	JKXO-16D	30 to 100 MHz	9-28	±2 PPM, −20 to +70°C	NONE	1 PPM	
	JKXO-16E	1 KHz to 30 MHz	5	±2 PPM, −20 to +70°C	NONE	1 PPM	
25	JKXO-24A	3-30 MHz	8-20	±2 PPM, −20 to +80°C	NONE	1 PPM	TTL or 1.0 VP-P into 1 KΩ
	JKXO-24B	3-30 MHz	9-20	±1 PPM, 0 to +70°C	NONE	1 PPM	
21	JKVXO-12A	3-30 MHz	9-20	±10 PPM, 0 to +70°C	±150 PPM, ±5V Input	1 PPM	TTL
	JKVXO-12B	30 to 50 MHz	9-20	±2 PPM, 0 to +70°C	±15 PPM, ±3V Input	1 PPM	Sine Wave
	JKVXO-12C	8 to 35 MHz	9-20	±2 PPM, 0 to +70°C	±40 PPM, ±3V Input	1 PPM	Sine, TTL, ECL
	JKVXO-12D	1 MHz to 30 MHz	5	±30 PPM, −55 to +85°C	±100 PPM, ±5 VDC or 0 to 5V	1 PPM	TTL, ECL, CMOS, Sine
23	JKVXO-16A	1 KHz to 30 MHz	9-20	±10 PPM, 0 to +65°C	±40 PPM, 1 to 4 VDC	1 PPM	TTL, ECL CMOS (Below 10 MHz) Sine (Above 500 KHz)
	JKVXO-16B	1 KHz to 30 MHz	9-20	±20 PPM, −20 to +70°C	±150 PPM, ±5V Input	1 PPM	
	JKVXO-16C	1 MHz to 30 MHz	5	±30 PPM, −55 to +85°C	±100 PPM, ±5V Input	1 PPM	
	JKVXO-16D	30 MHz to 150 MHz	12-20	±5 PPM, 0 to +50°C	±15 PPM, ±5V Input	1 PPM	Sine, ECL
24	JKVXO-22A	1 KHz to 30 MHz	5	±10 PPM, 0 to +50°C	±40 PPM, 0 to +5 VDC	2 PPM	TTL, CMOS
	JKVXO-22B	30 MHz to 50 MHz	5	±5 PPM, 0 to +50°C	±15 PPM, 0 to +5 VDC	2 PPM	TTL ECL (−5V Supply Req.)
	JKVXO-22C	1 MHz to 30 MHz	5	±15 PPM, −20 to +70°C	±150 PPM, 0 to +5 VDC	2 PPM	

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CTS® CORPORATION*
KNIGHTS DIVISION

CRYSTAL OSCILLATORS

HIGH STABILITY OVENIZED CRYSTAL OSCILLATORS

CTS Knights ovenized oscillators are available in thermostatically controlled models as well as proportional control models. A variety of design options are available to the user, including very high stability, low power, small size and sine wave or square wave (TTS or CMOS) output. Contact CTS Knights for your special requirements.

MODEL	FREQUENCY RANGE	DIMENSIONS INCHES	DIMENSIONS mm	OSCILLATOR INPUT*	OVEN INPUT*	TEMPERATURE CONTROL	STABILITY VS. TIME	STABILITY VS. TEMPERATURE
JKXO-23	60 Hz- 4 MHz	1.578x1.875 x4.442 HT	40,081x47,625 x112,32	+12 VDC	+28 VDC/AC 115 VAC 11 W.	Thermostat	±2.5x10^{-7}/day ±1x10^{-6}/yr	−40 to +70°C ±7.5x10^{-7}
JKXO-30	1-4 MHz	2.0x2.0x4.0	50,8x50,8 x101,6	+28 VDC	+28 VDC or 115 VAC 10 W. Max.	Proportional	±1x10^{-8}/day ±1x10^{-6}/yr	−10 to +55°C ±5x10^{-8}
JKXO-30	4-10 MHz	2.0x2.0x4.0	50,8x50,8 x101,6	+12 to +28 VDC	+28 VDC or 115 VAC 10 W. Max.	Proportional	±1x10^{-8}/day ±1x10^{-6}/yr	−10 to +55°C ±5x10^{-8}
JKXO-41	1-10 MHz	2.0x2.0x4.25	50,8x50,8 x107,95	+28 VDC	+28 VDC 10 W. Max.	Proportional	±1x10^{-9}/day ±1x10^{-7}/yr	−40 to +70°C ±3x10^{-8}
JKXO-41	10-100 MHz	2.0x2.0x4.25	50,8x50,8 x107,95	+28 VDC	+28 VDC 10 W. Max.	Proportional	±5x10^{-8}/day ±1x10^{-6}/yr	−25 to +65°C ±5x10^{-8}
JKXO-51	1-2 MHz	1.844x2.0 x3.436	46,838x50,8 x87,274	+28 VDC	+28 VDC 10 W. Max.	Proportional	±1x10^{-8}/day ±3x10^{-7}/yr	−55 to +75°C ±5x10^{-8}
JKXO-88-1	1-10 MHz	2.0x2.25 x.800	50,8x57,15 x20,32	5 & 12 VDC	+28 VDC 10 W. Max.	Proportional	±5x10^{-9}/day ±3x10^{-7}/yr	−25 to +65°C ±1x10^{-7}
JKSC-127	10 MHz	4.5x2.5x2.5	114,3x63,5 x63,5	±15 VDC	+28 VDC 32 W. Max.	Double Oven Proportional	±5x10^{-10}/day ±3x10^{-8}/yr	−55 to +71°C ±5x10^{-9}
JKXO-130	256 KHz- 10 MHz	4.5x1.6x2.11	114,3x40,6 x53,6	+15 VDC	+15 VDC 10 W. Max.	Proportional	±5x10^{-10}/day ±3x10^{-8}/yr	0 to +60°C ±1x10^{-8}

* Other voltages available

VOLTAGE CONTROLLED CRYSTAL OSCILLATORS

Voltage controlled oscillators can be supplied by CTS Knights for various stability versus temperature requirements by adding oven control or temperature compensating circuitry. Contact CTS Knights for special requirements.

MODEL	FREQUENCY RANGE	DIMENSIONS INCHES	DIMENSIONS mm	OSCILLATOR INPUT	OVEN INPUT	MODULATION INPUT	MODULATION DEVIATION	MODULATION LINEARITY	STABILITY VS. TEMPERATURE	DIMEN. OUTLINE
JKVXO-86	5-30 MHz	2.0x 2.00x.750	50,8x 50,8x19,05	12 VDC ±1	None	±3 VP.P., DC to 20 KHz	±1000 PPM	±10%	0 to +50°C ±100x10^{-6}	Fig. 26
JKVXO-87	10-27 MHz	2.0x 2.25x.800	50,8x 57,2x20,32	+12 & +5 VDC	+28 VDC	±3 VP.P., DC to 20 KHz	±1000 PPM	±5%	−40 to +70°C ±10x10^{-6}	Fig. 27
JKVXO-87	10-27 MHz	Vibration and shock, satisfying the requirements of the instrument and communications industries.							0 to +55°C ±5x10^{-6}	Fig. 27
JKVXO-100 Hybrid Design	10-25 MHz	.860x .830x.350	21,844x 21,082x8,89	+12 & +5 VDC	None	±5 VP.P., DC to 10 KHz	±200 PPM	±10%	0 to +60°C ±4x10^{-5}	Fig. 28

All dimensions are maximum unless otherwise noted.

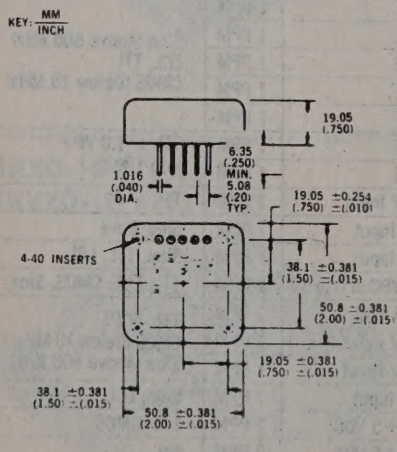
KEY: MM / INCH
19.05 (.750)
6.35 (.250) MIN.
1.016 (.040) DIA.
5.08 (.20) TYP.
19.05 ±0.254 (.750) ±(.010)
4-40 INSERTS
38.1 ±0.381 (1.50) ±(.015)
50.8 ±0.381 (2.00) ±(.015)
19.05 ±0.381 (.750) ±(.015)
38.1 ±0.381 (1.50) ±(.015)
50.8 ±0.381 (2.00) ±(.015)

FIG. 26
JKVXO-86

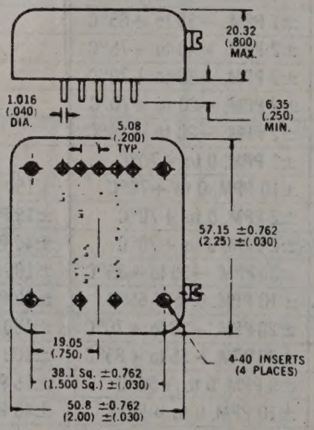
20.32 (.800) MAX.
1.016 (.040) DIA.
6.35 (.250) MIN.
5.08 (.200) TYP.
57.15 ±0.762 (2.25) ±(.030)
19.05 (.750)
4-40 INSERTS (4 PLACES)
38.1 Sq. ±0.762 (1.500 Sq.) ±(.030)
50.8 ±0.762 (2.00) ±(.030)

FIG. 27
JKVXO-87

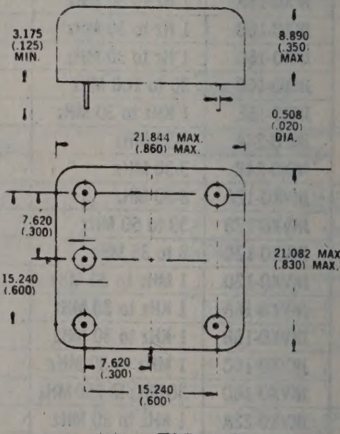
3.175 (.125) MIN.
8.890 (.350) MAX
0.508 (.020) DIA.
21.844 MAX. (.860) MAX.
7.620 (.300)
15.240 (.600)
21.082 MAX (.830) MAX.
7.620 (.300)
15.240 (.600)

FIG. 28
JKVXO-100
HYBRID DESIGN

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*In ILLINOIS dba CTS Electronics Corporation

For More Information. Circle No. 128

CTS. CORPORATION*
KNIGHTS DIVISION

JKSC-127 FAST WARM-UP SC CUT OCXO

The JKSC-127 offers ultra fast warm-up with excellent long term, short term and phase noise characteristics. The design utilizes a 10 MHz Coldweld Sealed SC cut overtone crystal along with a uniquely designed proportionally controlled double oven which minimizes stabilized power consumption. The JKSC-127 is available fully militarized with an MTBF of greater than 100,000 hours in ground mobile and airborne environments.

GENERAL SPECIFICATIONS

FREQUENCY: 10.0 MHz or 10.230 MHz

INPUT VOLTAGE: Oven +28 VDC ±5%
Oscillator +15 VDC ±5%

INPUT CURRENT: Oven @ turn-on 1.2 Amps Maximum
Oven @ 25°C 125 mA Typical
Oven @ −55°C 240 mA Typical
Oscillator 20 mA Maximum

FREQUENCY STABILITY VS. TEMPERATURE: ±2x10^{-9} from −55°C to +71°C

FREQUENCY STABILITY VS. TIME:
±5x10^{-12} RMS/SEC
±5x10^{-10}/DAY **AT SHIPMENT**
±3x10^{-8}/YEAR

FREQUENCY STABILITY VS. VOLTAGE: ±5x10^{-10} for ±5% Change

WARM-UP: Referenced to 30 minutes
@ −55°C <5x10^{-9} in 7 minutes
@ −32°C <5x10^{-9} in 5 minutes
@ +25°C <5x10^{-9} in 3 minutes

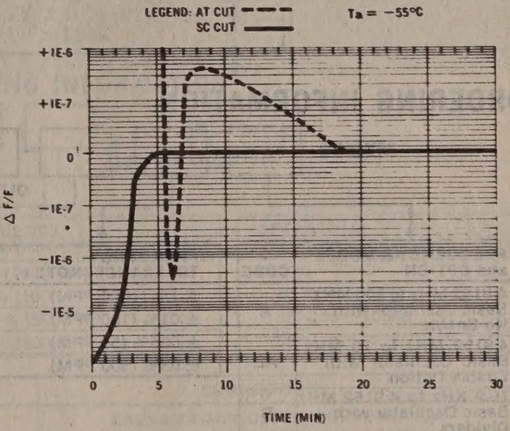
RETRACE: 48 hours off Ta = +25°C < 5x10^{-9} in 15 minutes referenced to the turn off frequency.

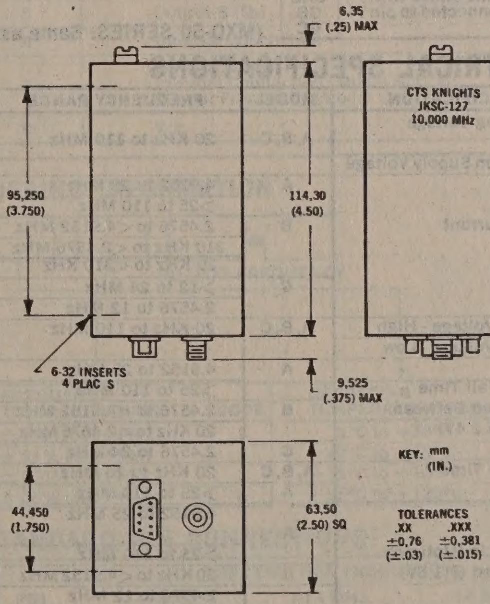
PHASE NOISE (1 HzBW): @ 10 Hz offset −120 dbc
@ 100 Hz offset −140 dbc
@ 1 KHz offset −150 dbc
@ 100 KHz offset −150 dbc

RF OUTPUT: +5 dbm Minimum into 50 Ohms

HARMONICS: −25 dbc

FREQUENCY ADJUSTMENT:
Coarse (Mechanical) ±5x10^{-7} Minimum
Fine (Electrical) ±5x10^{-8} Minimum for ±5 VDC





MODIFICATIONS OF THE JKSC-127 AVAILABLE — CONSULT FACTORY

DATA SUBJECT TO CHANGE WITHOUT NOTICE.

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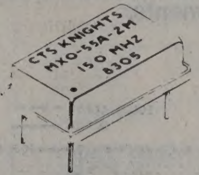
CTS® CORPORATION*
KNIGHTS DIVISION

HYBRID CLOCK OSCILLATORS

MXO-55 SERIES

Fully Hermetic Resistance Weld Package
TTL Compatible
Available with MIL-STD-883B Screening



FREQUENCY STABILITY

±.0025% to ±.1%, inclusive of calibration tolerance @ 25°C, oper. temperature range, environmental conditions, input voltage, aging and load change (See Ordering Table).

PIN CONNECTIONS

Pin 1	N/C, Enable or Output
Pin 7	Ground and/or Case Ground
Pin 8	Output
Pin 14	+5 VDC

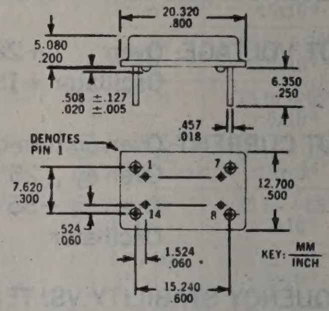


FIG. 29

ORDERING INFORMATION

MXO-55 ☐-☐ ☐-☐.☐

OUTPUT FREQUENCY

FREQUENCY & MODEL and OPTION	CODE
4.9152 MHz to 100 MHz Basic Oscillator with No Enable	A
4.9152 MHz to 70 MHz Basic Oscillator with Enable Option	AE
19.2 KHz to 4.9152 MHz Basic Oscillator with Dividers	B
2.4576 MHz to 24 MHz with Complementary Outputs	C
Any of the above with case connected to pin 7	GA GAE GB GC

FREQUENCY TOLERANCE (NOTE 1)	CODE
±.1% (1000 PPM)	1
±.01% (100 PPM)	2
±.005% (50 PPM)	3
±.05% (500 PPM)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

(MXO-50 SERIES: Same as above except .285 max. seated height)

ELECTRICAL SPECIFICATIONS

SPECIFICATION	MODEL	FREQUENCY RANGE	TEMPERATURE RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B, C	20 KHz to 110 MHz	−55°C to +125°C	Vcc	4.75	5.00	5.25	V
			−40°C to +85°C		4.50	5.00	5.50	
Maximum Supply Voltage			−55°C to +125°C	Vcc Max.			7.00	
Input Current	A	4.9152 to 25 MHz	−55°C to +125°C	Icc		20	30	mA
		>25 to 110 MHz				33	55	
	B	2.4576 to <4.9152 MHz				30	50	
		310 KHz to <2.4576 MHz				45	75	
		20 KHz to <310 KHz				70	125	
	C	>12 to 24 MHz				22	30	
		2.4576 to 12 MHz				30	50	
Output Voltage - High	A, B, C	20 KHz to 110 MHz	−55°C to +125°C	Voh	2.40	3.80		V
Output Voltage - Low				Vol		30	40	
Rise & Fall Time (Measured Between 0.5V and 2.4V)	A	4.9152 to 25 MHz	−55°C to +125°C	t_R & t_F		3	5	nS
		>25 to 110 MHz				2	4	
	B	2.4576 to <4.9152 MHz				3	5	
		20 KHz to <2.4576 MHz				8	15	
	C	2.4576 to 24 MHz				3	5	
Start-Up Time	A, B, C	20 KHz to 25 MHz	−55°C to +125°C			2	5	mS
	A	>25 to 110 MHz				5	15	
Duty Cycle (Uptime) (Measured @ 1.5V)	A	4.9152 to 25 MHz	0°C to +70°C		45	50	55	%
			−55°C to +125°C		40	50	60	
		>25 to 110 MHz	−55°C to +125°C		40	50	60	
	B	20 KHz to <4.9152 MHz			45	50	55	
	C	2.4576 to 12 MHz			45	50	55	
		>12 to 24 MHz	0°C to +70°C		45	50	55	
			−55°C to +125°C		40	50	60	
Phase Delay (Measured @ 1.5V)	C	>12 to 24 MHz	0°C to +70°C	$t_{\delta 1}$ & $t_{\delta 2}$		6	10	nS
		2.4576 to 12 MHz				3	5	
		>12 to 24 MHz	−55°C to +125°C			6	12	
		2.4576 to 12 MHz				3	8	
Enable Input Load Factor	A	4.9152 to 70 MHz	−55°C to +125°C	F_I			1	S-TTL Gates
Fanout (per output)	A, B, C	2.4576 to 110 MHz		F_O			10	
	A	20 KHz to <2.4576 MHz					10	TTL Gates

MIL-O-55310 PRODUCTS
A wide variety of clock oscillators manufactured per MIL-O-55310 are now available in TO-5, TO-8 and Dual-In-Line packages. (See MIL-O-55310).

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For More Information. Circle No. 128

CTS® CORPORATION*

HYBRID CLOCK OSCILLATORS

KNIGHTS DIVISION

MXO-65 SERIES

Microprocessor Driver
MOS Levels
High Capacitance Load Capability (Up to 500 pf)
Compatible with Motorola K1160 Series*
Frequency Range:
2.45 MHz to 12 MHz
Supply Voltage:
5.0V ±10%

CXO-55 SERIES

CMOS Compatible
Low Supply Current
Pin Connections:
Pin 1 Internal Connection
Pin 7 Ground
Pin 8 Output
Pin 14 + Supply Voltage
Frequency Range:
200 Hz to 12 MHz
Supply Voltage:
4.5 VDC to 15 VDC

EXO-55 SERIES

10K ECL Compatible
Pin Connections:
Pin 1 N/C
Pin 7 B—
Pin 8 Output
Pin 14 Ground
Frequency Range:
8 MHz to 115 MHz
Supply Voltage:
−5.2V ±10% or
−5.0V ±10%

MXO-35 SERIES

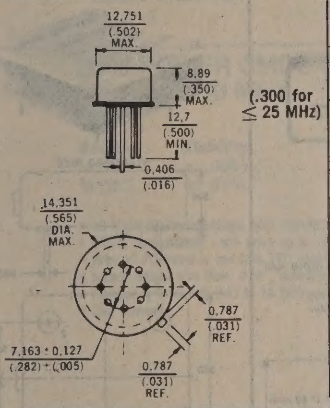
Programmable Baud Rate Generator
Resistance Weld Package
Compatible With Motorola K1135 Series*
Military Screening Available

* Motorola, K1160, K1135 are trademarks of Motorola, Inc.

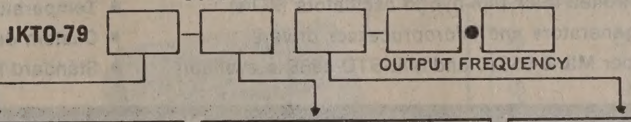
JKTO-79 SERIES

Electrically Similar to MXO-55
Fully Hermetic Welded TO-8 Style Package
Sine Wave Output Option

OUTLINE DIMENSIONS & PIN ASSIGNMENTS



ORDERING INFORMATION



FREQUENCY & MODEL and OPTION	CODE
8.0 MHz to 60.0 MHz Basic Oscillator No Enable	A
4.0 MHz to 8.0 MHz Oscillator with Divider No Enable	B
4.0 MHz to 12.0 MHz Oscillator with Complementary Output No Enable	C
Any of the Above with Enable Option (Note 4)	AE BE CE
1.0 MHz to 12.0 MHz Oscillator with Dual Divider Outputs & Enable Output A = ÷2 Output B = ÷8	D28E
1.0 MHz to 6.0 MHz Oscillator with Dual Divider Outputs & Enable Output A = ÷4 Output B = ÷8	D48E

FREQUENCY TOLERANCE (NOTE 1)	CODE
±.1% (1000 PPM)	1
±.01% (100 PPM)	2
±.005% (50 PPM)	3
±.05% (500 PPM)	4

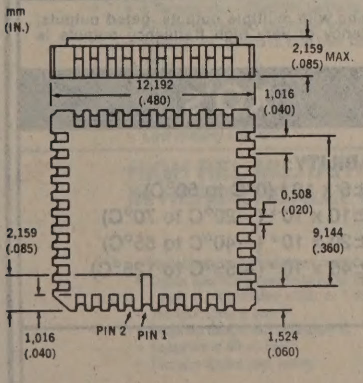
OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

PIN	CONNECTION
1	Enable/Disable Option (Otherwise NC)
2	Internal Connection
3	Output A (Q_A) (Otherwise NC)
4	Ground
5	Output B (Q_B)
6	Internal Connection
7	NC (Model A) Internal Connection (Model B, C, D) Crystal Frequency (Model C, D)
8	Vcc

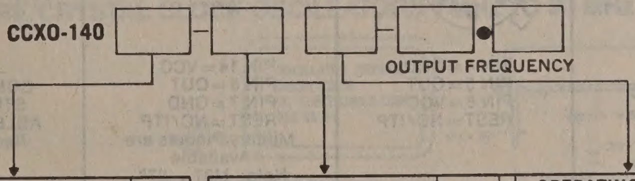
CCXO-140 SERIES

TTL oscillators in surface mount, hermetic chip carrier package
Frequency Range: 1.0 MHz to 30.0 MHz (CMOS and High Frequency TTL under development)

OUTLINE DIMENSIONS & PIN ASSIGNMENTS



ORDERING INFORMATION



FREQUENCY & MODEL	CODE
14.0 MHz to 30.0 MHz Basic Oscillator	A
1.0 MHz to <14.0 MHz Oscillator with Divider	B

FREQUENCY TOLERANCE (NOTE 1)	CODE
±.1% (1000 PPM)	1
±.01% (100 PPM)	2
±.005% (50 PPM)	3
±.05% (500 PPM)	4

OPERATING TEMPERATURE RANGE	CODE
0°C to +70°C	C
−40°C to +85°C	I
−55°C to +105°C	P
−55°C to +125°C	M

NOTES:

1. NC — internally connected. No external electrical connections.
2. All other pins may have external electrical connections. These pins may also be used as optional connections. Consult factory for possible pin connection options.

All part types are available with MIL-STD-883 screening. Consult factory or sales representatives for detailed data sheets and custom requirements.

STANDARD PIN CONNECTIONS

PIN	FUNCTION FOR FREQUENCY		
	1-7 MHz	7-14 MHz	14-30 MHz
1			OUTPUT
4	+5 VDC	+5 VDC	+5 VDC
5	NC	NC	NC
10	+5 VDC	+5 VDC	+5 VDC
15	NC	NC	NC
25	NC	NC	NC
31	GND	GND	GND
35	NC	NC	NC
37	GND	GND	GND
39	OUTPUT	NC	NC
40		OUTPUT	NC

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OSCILLATEK CORPORATION

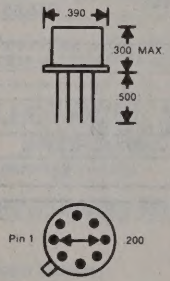
620 N. LINDENWOOD AVE., OLATHE, KANSAS 66062
TEL: (913) 829-1777 TELEX: 437045

CRYSTAL CLOCK OSCILLATORS

TCXO's

- Crystal controlled thick film hybrid oscillators (XO's).
- Baud rate generators and microprocessor drivers.
- Screening per MIL-0-55310 and MIL-STD-883B is available.
- Temperature compensated crystal oscillators (TCXO's).
- Custom designed oscillators to meet your specifications.
- Standard frequencies are available from stock.

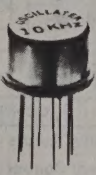
TO5

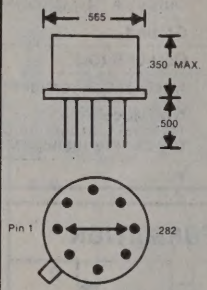

390
300 MAX
500
Pin 1
.200

PIN 4 = GND
PIN 5 = OUT
PIN 8 = VCC
REST = NC/ITP

NOTE:
QPL'd to MIL-O-55310/09

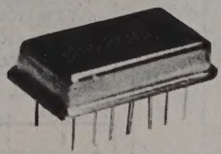
TO8



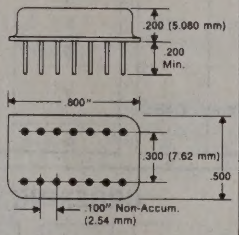

.565
.350 MAX
.500
Pin 1
.282

PIN 4 = GND
PIN 5 = OUT
PIN 8 = VCC
REST = NC/ITP

DIP M87/M80/M76

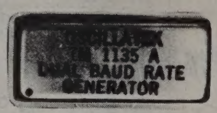


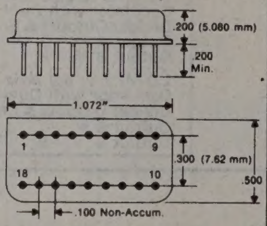
QPL'd to MIL-O-55310/16


.200 (5.080 mm)
.200 Min.
.800"
.300 (7.62 mm)
.500
.100" Non-Accum. (2.54 mm)

PIN 14 = VCC
PIN 8 = OUT
PIN 7 = GND
REST = NC/ITP
Military Pinouts are Available
Note: M87 = .87", M80 = .80", M76 = .76" Length

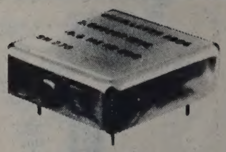
BAUD RATE GENERATORS

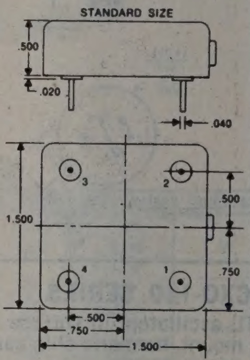

OSCILLATEK
1135 A
DUAL BAUD RATE
GENERATOR


.200 (5.080 mm)
.200 Min.
1.072"
1
9
18
10
.300 (7.62 mm)
.500
.100 Non-Accum.

PIN FOR PIN COMPATIBLE TO THE STD. PARTS AVAILABLE IN THE MARKET
Request Brochure for Details

TCXO




STANDARD SIZE
.500
.020
.040
1.500
3
2
4
1
.500
.750
.500
.750
1.500

PIN 1 = GND
PIN 2 = VCC
PIN 3 = OUT
PIN 4 = N-C
Non Std. Pinouts and Custom Designing is Available

NOTE:
(1) Very low current CMOS output at low frequency and at high frequency of up to 12 MHz is available specially at 5 Volts.
(2) Non-standard custom designing with multiple outputs, gated outputs, ECL outputs, very low frequency or very high frequency outputs is available. Consult factory.

TCXO's

STABILITY:
1. ±1 x 10^{-7} (0°C to 50°C)
2. ±2 x 10^{-7} (−20°C to 70°C)
3. ±5 x 10^{-7} (−40°C to 85°C)
4. ±1 x 10^{-6} (−55°C to 125°C)

VCXO's

STABILITY: ±.0001% to ±.01%
LINEARITY: ±1% to ±10%
DEVIATION: ±.001% to ±.1%

XO's

STABILITY:
1. ±5 x 10^{-6} (0°C to 50°C)
2. ±10 x 10^{-6} (−20°C to 70°C)
3. ±20 x 10^{-6} (−40°C to 85°C)
4. ±45 x 10^{-6} (−55°C to 125°C)

FREQUENCY RANGE: TTL = 1 Hz to 100 MHz; CMOS = .01 Hz to 30 MHz
ECL = 1 MHz to 100 MHz; SINEWAVE = 100 KHz to 100 MHz
SUPPLY: 5V to 30V (Current as low as 1.5 mA available)
STANDARD SIZES: 1" x 1" x .26", 1.5" x 1.5" x .5", 2" x 1" x .5", 2" x 2" x .5"
IN ADDITION TO OUR STANDARD PRODUCT LINE WE OFFER CUSTOM DESIGN CAPABILITY.

For More Information. Circle No. 129

MF DIP CRYSTAL OSCILLATORS

The MF Guarantee

MF Electronics warrants each of its oscillators to be free from defects for one year from date of purchase.

Any oscillator found to be defective during this period may be returned to the factory, postage paid, for repair or, at our option, replacement without charge.

MF Electronics limits its liability to the repair and/or replacement of the returned MF oscillator.

MF ELECTRONICS CORP.
10 Renewal Place, New Rochelle, N.Y. • 10801 • (914) 576-6570

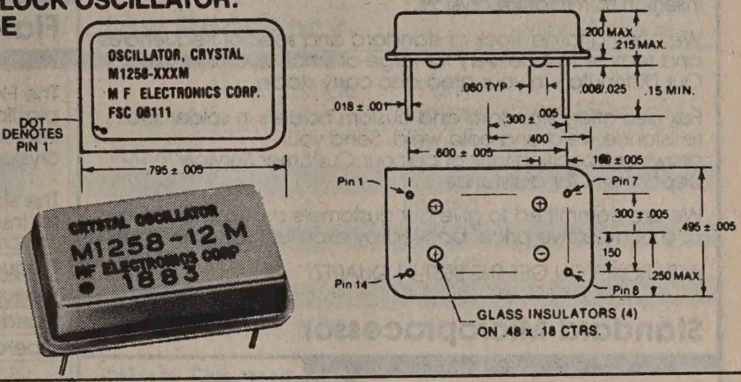
The Broadest line in the industry.

- Units use overtone crystals from 20 MHz to 100 MHz, very stable electrically and more reliable mechanically.
- All units guaranteed for one year to operate within specifications
- Units specified at temperatures exceeding 0 to 70°C are individually recorded 100% for freqency vs temperature insuring compliance.

EXTENDED TEMPERATURE RANGE CLOCK OSCILLATOR: 20 KHz TO 30 MHz IN ALL METAL CASE

Series	Stability	Temperature
M1258	± .01%	−40 to +85°C
M1256	± .0075%	−55 to +85°C

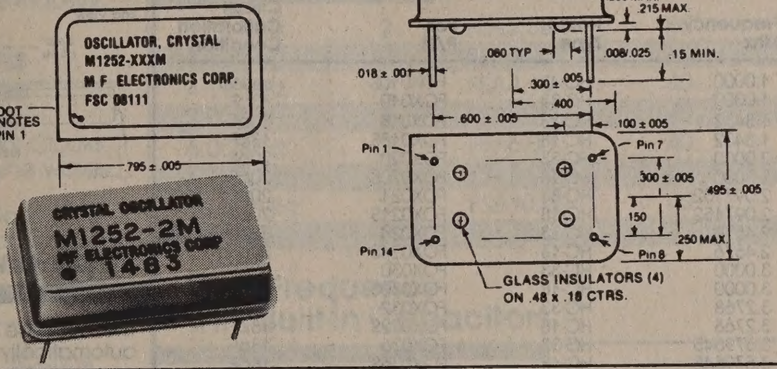
- **All-Metal welded package with Standoff Insulator design for for Extended Temperature industrial applications.**
- **Area on PC board is one true TTL space - .495" X .795" max.**
- **Seated height less than 0.215", including insulator.**
- **Frequency from 20Khz to 30 MHz.**
- **Start up time less than 10 ns.**
- **Stability options from 1.0% to .0025%.**
- **Units at 8MHz and higher are simple and reliable using the Exclusive MF Clock-Chip.™**


OSCILLATOR, CRYSTAL
M1258-XXXM
M F ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
.795 ± .005
CRYSTAL OSCILLATOR
M1258-12 M
MF ELECTRONICS CORP
1883
.200 MAX
.215 MAX
.060 TYP
.008/.025
.15 MIN.
.018 ± .001
.300 ± .005
.400
.600 ± .005
.100 ± .005
Pin 1
Pin 7
.300 ± .005
.495 ± .005
.150
.250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON .48 x .18 CTRS.

LOW POWER CMOS CRYSTAL CLOCK OSCILLATORS 825 Hz TO 10 MHz

Series	Stability
M1251	± .005%
M1252	± .01%

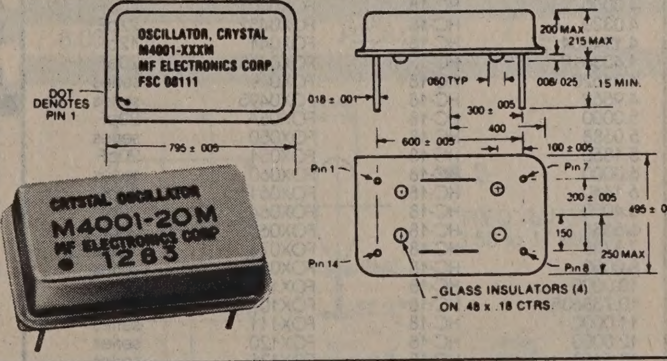
- **All-Metal Welded package with Standoff Insulator.**
- **CMOS compatibility - will drive up to 15pf.**
- **Area on PC board is one true TTL space - .495"X.795" max.**
- **Seated height less than .215", including insulator.**
- **Frequency from 825 KHz to 10 MHz.**
- **Low Current.**


OSCILLATOR, CRYSTAL
M1252-XXXM
M F ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
.795 ± .005
CRYSTAL OSCILLATOR
M1252-2M
MF ELECTRONICS CORP
1483
.200 MAX
.215 MAX
.060 TYP
.008/.025
.15 MIN.
.018 ± .001
.300 ± .005
.400
.600 ± .005
.100 ± .005
Pin 1
Pin 7
.300 ± .005
.495 ± .005
.150
.250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON .48 x .18 CTRS.

VERY HIGH/LOW TEMPERATURE/CRYSTAL CLOCK OSCILLATORS 1 MHz TO 30 MHz

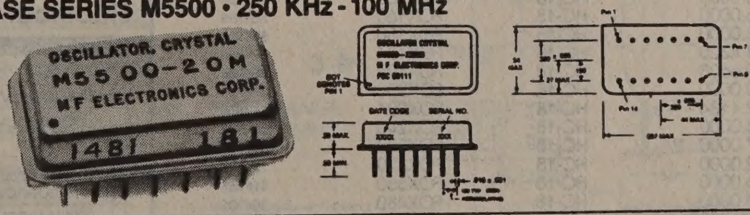
Series	Stability	Temperature
M4001	±.05%	−55 to 200°C
M4002	±.05%	0 to 200°C
M4003	±.025%	−55 to 200°C
M4004	±.025%	0 to 200°C
M4005	±.025%	−55 to 175°C
M4006	±.025%	0 to 175°C
M4007	±.015%	−55 to 175°C
M4008	±.015%	0 to 175°C

- For use in Harsh Environments and "Downhole" applications.
- 8 Temperatur - Stability options.
- All-Metal welded package with Standoff Insulator.
- Area on PC board is one true DIL space - .495" X .795" max.
- Seated height less than 0.215", including insulator.
- Frequency from 1 MHz to 30 MHz.
- TTL and 5 volt CMOS compatible.
- Low Supply Current.


OSCILLATOR, CRYSTAL
M4001-XXXM
MF ELECTRONICS CORP.
FSC 08111
DOT DENOTES PIN 1
.795 ± .005
CRYSTAL OSCILLATOR
M4001-20M
MF ELECTRONICS CORP
1283
.200 MAX
.215 MAX
.060 TYP
.008/.025
.15 MIN.
.018 ± .001
.300 ± .005
.400
.600 ± .005
.100 ± .005
Pin 1
Pin 7
.300 ± .005
.495 ± .005
.150
.250 MAX
Pin 14
Pin 8
GLASS INSULATORS (4)
ON .48 x .18 CTRS.

HIGH REL MILITARY CRYSTAL OSCILLATORS IN HERMETICALLY SEALED CASE SERIES M5500 • 250 KHz - 100 MHz

- Hermetically sealed resistance welded package
- Crystal specifically manufactured for oscillator with angle of cut controlled within ± 1 minute
- 168 hour Class B burn-in
- Simplified design with proprietary IC
- Capacitors to MIL-C-55681
- Extensive environment testing

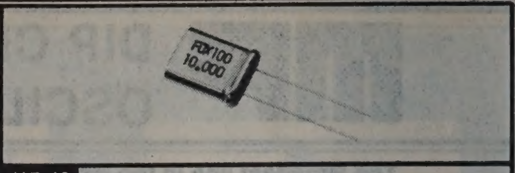

OSCILLATOR, CRYSTAL
M5500-20M
MF ELECTRONICS CORP.
1481
181
DOT DENOTES PIN 1
GATE CODE
SERIAL NO.
Pin 1
Pin 7
Pin 8
Pin 14

MF ELECTRONICS CORP.
10 Renewal Place, New Rochelle, N.Y. • 10801 • (914) 576-6570 • TWX: 710-563-0643

For More Information. Circle No. 130

FOX ELECTRONICS

Automatic Insertion Products



HC-18

Quartz Crystals

Fox offers the broadest line of crystal products in the industry: from standard products to volume automatic insertion to miniature crystals.

We carry a large stock of standard and special frequencies and feature fast delivery for large or small quantity orders. Our Distributors in your area also carry stock.

Fox also offers standard and custom holders in solder seal, resistance weld and cold weld. Send your drawings/specifications or call our Customer Service Department for assistance.

We are committed to give our customers a quality product at a competitive price, backed by excellent service.

WITH FOX, YOU GET THE BEST IN QUARTZ.

Standard Microprocessor

(Available from stock)

Frequency Mhz	Holder Type	Fox P/N	Circuit Calibration Condition
1.0000	HC-43	FOX010S	series
1.0000	HC-33	FOX010	13pF
1.8432	HC-33	FOX018	13pF
1.8432	HC-18	FOX018S	13pF
2.0000	HC-33	FOX020	20pF
2.0000	HC-18	FOX020S	20pF
2.097152	HC-33	FOX021	20pF
2.097152	HC-18	FOX021S	20pF
2.4576	HC-33	FOX024	32pF
2.4576	HC-18	FOX024S	32pF
3.0000	HC-33	FOX030	32pF
3.0000	HC-18	FOX030S	32pF
3.2768	HC-33	FOX032	18pF
3.2768	HC-18	FOX032S	18pF
3.579545	HC-33	FOX036	18pF
3.579545	HC-18	FOX036S	18pF
3.6864	HC-18	FOX0368S	series
4.0000	HC-18	FOX040A	series
4.0000	HC-18	FOX040	20pF
4.0320	HC-18	FOX0432	22pF
4.194304	HC-18	FOX041	12pF
4.433619	HC-18	FOX0443	20pF
4.91520	HC-18	FOX049	series
4.9562	HC-18	FOX0495	series
5.0000	HC-18	FOX05A	20pF
5.0688	HC-18	FOX050	series
5.1850	HC-18	FOX051	20pF
6.0000	HC-18	FOX060	series
6.1440	HC-18	FOX061	30pF
6.4000	HC-18	FOX064	20pF
6.5536	HC-18	FOX065	20pF
7.3728	HC-18	FOX073	series
8.0000	HC-18	FOX080	series
10.0000	HC-18	FOX100	series
10.738635	HC-18	FOX107	series
11.0000	HC-18	FOX111	series
12.0000	HC-18	FOX120	series
13.5168	HC-18	FOX135	series
14.31818	HC-18	FOX143	series
15.0000	HC-18	FOX150	series
16.0000	HC-18	FOX160	series
18.0000	HC-18	FOX180	series
18.4320	HC-18	FOX184	series
19.6608	HC-18	FOX196	series
20.0000	HC-18	FOX200	series
22.1184	HC-18	FOX221	series
24.0000	HC-18	FOX240	series
27.0000	HC-18	FOX270	series
32.0000	HC-18	FOX320	series
36.0000	HC-18	FOX360	series
48.0000	HC-18	FOX480	series
100.0000	HC-18	FOX1000	series

Automatic Insertion

Flat Pack

The FX-1 series line of low cost crystals feature a molded plastic package with dual in-line pin spacing for automatic insertion. The FX-1 utilizes a special crystal technology in crystal packaging while maintaining the FOX quality.

The standard plastic tube houses 25 crystals ready for insertion.

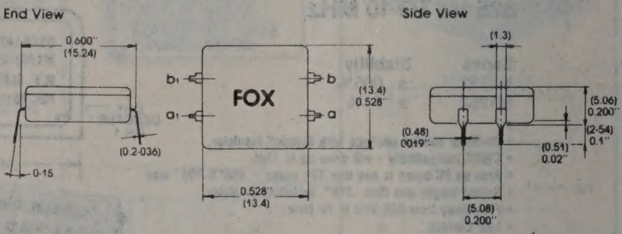
Frequency range ± 3.5 MHz to 15 MHz

Frequency tolerance ± 700ppm @ 25°C

Standard load capacitance 16pf.

Operating temperature range – 10 to +60@C

Package Dimensions



Tape and Reel

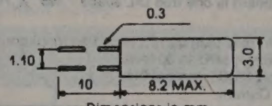
The Fox Tape and Reel crystals are the industry's First line of automatically insertable HC18 crystals for large volume applications.

Available in standard 12 inch reels with .200" pin spacing and up to 1500 crystals per reel of frequencies from 1MHz to 175MHz.

Miniatures

The Fox line of miniature crystals provides the designer with the ultimate in size, performance and economic trade offs. Featured are tuning fork and "AT" cut crystals packaged in a tubular cold weld metal design that features low power, long term stability, tight tolerances and low resistance.

Dimensions



Dimensions in mm

Electrical Specifications

	Part No.	Frequency
Low Frequency tuning forks	NC 38S —	16 KHz-163 KHz
Frequency stability		± 30 PPM
Watch crystal	NC 38 —	32.768 KHz
Frequency stability		± 20 PPM
High Frequency "AT" Cut	FX-3	4.19 MHz-18.0 MHz
Frequency stability		± 30 PPM

FOX ELECTRONICS ■ Sales Department ■ P.O. Box 1078 ■ Cape Coral, Florida 33910 ■ 813/482-7212 ■ TWX 510-951-7386

For More Information. Circle No. 131

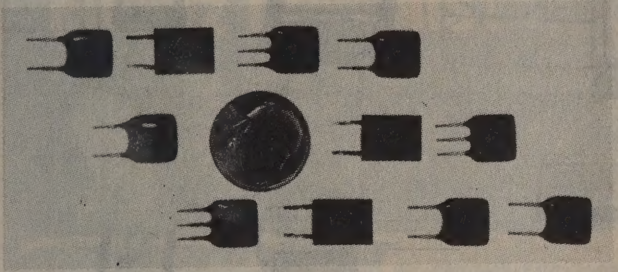
FOX ELECTRONICS

Low Frequency FSB

High Frequency FSA

High Frequency w/caps FSC

Ceramic Resonators



Ceramic Resonator

Fox Ceramic Resonators are frequency stable devices that offer a low cost option for use in oscillator circuits. The Fox resonator stability lies between quartz crystal and LC or RC oscillators. The Fox line includes a low frequency group and high frequency group which includes standard resonators and resonators with built in loading capacitors, a first in the industry.

Features

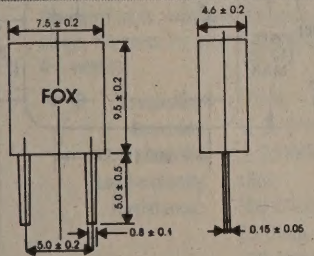
- ■ Low Cost
- ■ Compact & Lightweight
- ■ Stable oscillator
- ■ Built-in capacitors

Applications

- ■ Timing functions
- ■ Microprocessor Clocks
- ■ Square and sine wave oscillators
- ■ Communications & TV consumer products
- ■ Data transmission

Specifications

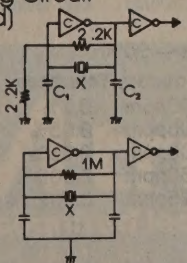
Type	FSA Type	FSB Type	FCA Type
Frequency Range	3.58 to 11 MHz	400 to 800 KHz	4.0 to 10 MHz
Frequency Tolerance	±0.5%	±0.5%	±0.5%
Temperature Stability (−20°C to +80°C)	±0.3%	±0.3%	±0.3%
Time Stability (10 years)	±0.5%	±0.5%	±0.5%
Equivalent Resistance	20 ohms max.	40 ohms max.	40 ohms max



◀ 1

FREQ. RANGE
400-800 KHz

Measuring Circuit (Standard)



TTL clock circuit

IC : 1/6 74LS04X2
Vcc : 5V (Supply voltage)
X : Resonator
$C_1 C_2$; Loading capacitors

CMOS clock circuit

IC : 1/6 CD4069BEX2
VDD : 12V (Supply voltage)
X : Resonator

Standard Products

Specifications subject to change without notice.

Low Frequency

Frequency	Package Type	Part Number	Max ESR ohms
400 KHz	1	FSB400	20
455 KHz	1	FSB455	20
480 KHz	1	FSB480	20
500 KHz	1	FSB500	20
600 KHz	1	FSB600	20
800 KHz	1	FSB800	20

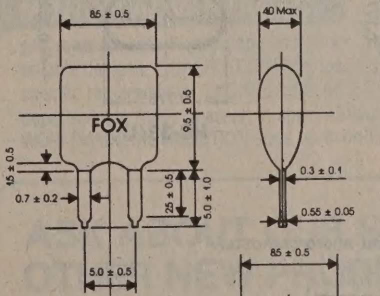
Typical Q value 1500

High Frequency

Frequency	Package Type	Part Number	Max ESR ohms
3.58 MHz	2	FSA3.58	40
4.00 MHz	2	FSA4.00	40
4.19 MHz	2	FSA4.19	40
5.00 MHz	2	FSA5.00	40
6.00 MHz	2	FSA6.00	40
8.00 MHz	2	FSA8.00	40
10.00 MHz	2	FSA10.00	40
11.00 MHz	2	FSA11.00	40

High Frequency with Built-In Capacitors

Frequency	Package Type	Part Number	Max ESR ohms
4.00 MHz	3	FSC4.00	40
6.00 MHz	3	FSC6.00	40
8.00 MHz	3	FSC8.00	40
10.00 MHz	3	FSC10.00	40

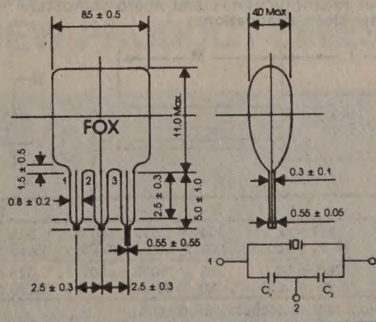


◀ 2

FREQ. RANGE
3.58 to 11 MHz

3 ▶

FREQ. RANGE
4 to 10 MHz



Ceramic Resonator with loading capacitors included in package

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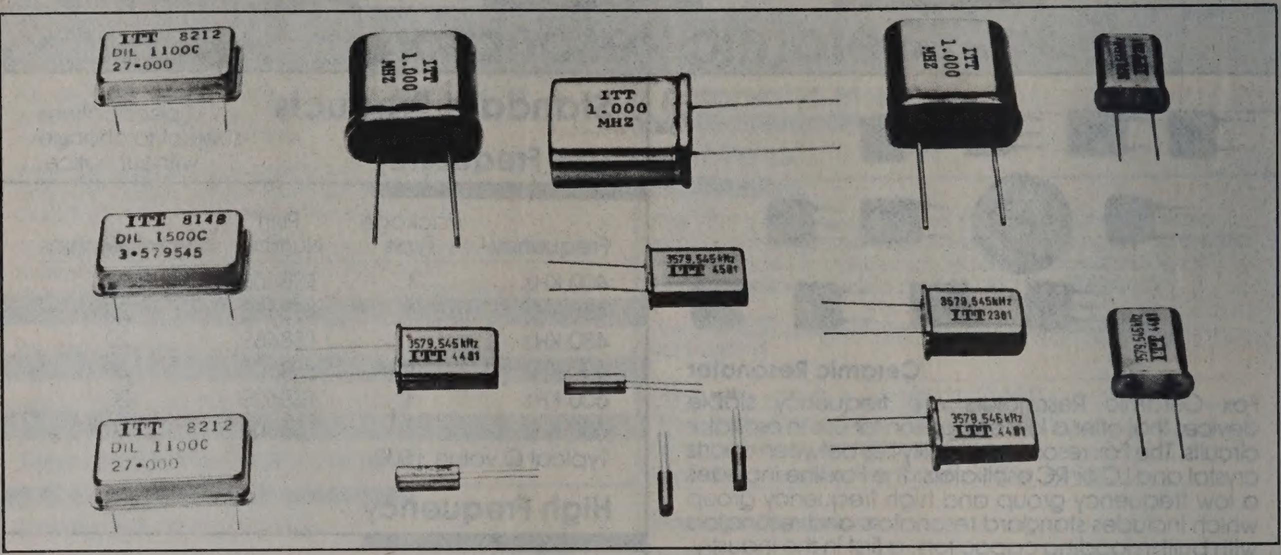
For More Information. Circle No. 131

ITT Components

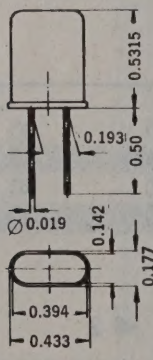
A Unit of ITT Corporation

Crystals and Oscillators

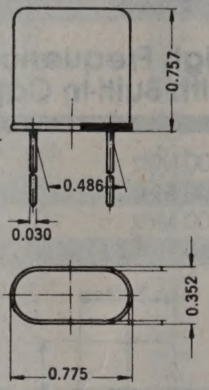

ITT 8212
DIL 1100C
27.000
ITT 8148
DIL 1500C
3.579545
ITT 8212
DIL 1100C
27.000
ITT 1.000 MHZ
ITT 1.000 MHZ
ITT 1.000 MHZ
3579.545kHz ITT 4581
3579,545 kHz ITT 4481
3579,545kHz ITT 2381
3579,545 kHz ITT 4481
3579,545kHz ITT 4481

Quartz Crystal Units

- Microprocessor clock type crystals covering a frequency spectrum from 1MHz to 200MHz.
- HC18 and HC33 type holders, resistance welded or solder cold weld or solder sealed.
- Frequency tolerance from .002% to .35%.


0.5315
0.193
0.50
∅0.019
0.142
0.177
0.394
0.433

HC-18/U

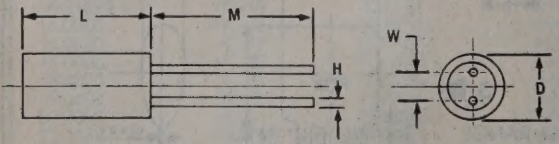

0.757
0.486
0.030
0.352
0.775

HC-33/U

ITT TF3 AND TF6

Tuning Fork Crystals

Used for microprocessors and micro computer real-time clock applications.



Type	L	M	H	W	D
TF3	.327 Max. (8.30 Max.)	.354 (9.00)	.012 ±.002 (0.30 ±0.05)	.043 ±.002 (1.10 ±0.05)	.118 ± .008 (3.00 ±0.08)
TF6	.260 ±.002 (6.70 ±0.05)	.295 (7.50)	.010 ±.001 (0.25 ±0.03)	.023 ±.004 (0.70 ±0.10)	.081 ±.002 (2.05 ±0.05)

Dimensions are in inches (millimeters)

Quartz Crystal Oscillators

The ITT DIL oscillator series are miniature, low-profile, dual-in-line quartz crystal oscillators in a hermetic package. They are designed primarily, to meet the needs of the fast growing minicomputer and microprocessor markets, but are suitable for many other applications where a reliable, accurate clock input is required.

Frequency tolerances ranging from 1000ppm to 25ppm are available.

FEATURES

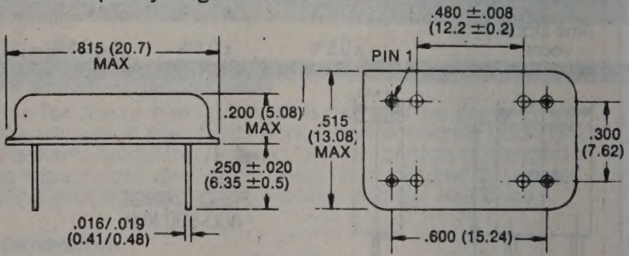
TTL compatible

Dual-in-Line pin spacing

Low profile — 5.8mm maximum seated height including insulating stand-offs

Hermetic welded metal package

Wide frequency range


.815 (20.7) MAX
.200 (5.08) MAX
.250 ±.020 (6.35 ±0.5)
.016/.019 (0.41/0.48)
.515 (13.08) MAX
.480 ±.008 (12.2 ±0.2)
PIN 1
.300 (7.62)
.600 (15.24)

Pin Connections
1 NC
7 Ground
8 Output
14 +5V

FREQUENCY RANGE: 250KHz — 90MHz

Family	Frequency Tolerance	
ITT 1000C	1000ppm	0.1%
ITT 1500C	500ppm	0.05%
ITT 1100C	100ppm	0.01%
ITT 1050C	50ppm	0.005%
ITT 1025C	25ppm	0.0025%

ITT COMPONENTS • 3201 South Standard Street • Santa Ana, California 92705 • Phone (714) 836-0351 • TWX 910-595-1744 • Telex 69-1389

M-tron—more than just a responsible source for quality clock oscillators and quartz crystals!

In addition to providing you with products produced under superb quality control — with in-house test instrumentation including state-of-the-art TC and analytical equipment — M-tron can offer you additional advantages: (1) provide engineering assistance with specifications to circuit applications . . . (2) make excellent delivery . . . (3) serve you anywhere in the world.

For OEMs, M-tron utilizes computer design for efficient turnaround on prototypes. And, M-tron can custom-produce clocks and AT-Cut crystals to your specifications.

CLOCK OSCILLATORS

We utilize high-quality crystals to provide highly stable TTL and CMOS compatible logic signal sources in true hermetic, all-metal resistance welded packages. Custom-design capability. If you want specials, just ask.

	TTL*	CMOS
Frequency range	250 KHz to 60 MHz	750 Hz to 12 MHz
Frequency stability	± .01%	± .01%
Temperature range	0 to 70°C	0 to 70°C
Input voltage	+ 5V ± 10% VDC	+ 5V to + 15 VDC

Z80/Z8000 compatible and dual phase also available

*Standard frequencies available from stock.

0.815 x 0.515 x 0.20
(20.7 x 13 x 5 mm).
Lead length 0.25 (6.3mm)

HI-LO MICROPROCESSOR CRYSTALS
Hi Volume, Lo Cost

Frequencies listed are standard and available from stock in holders indicated. Any frequency from 1MHz to 100 MHz may be provided. Std. stability specifications are ± .005% @ 25°C and ± .005% of the 25°C reading from 0°C to + 70°C.

Frequencies (MHz)

MP-2 (HC-33U)		**MP-1 (HC-18U)**							
1.000000	3.276800	3.276800	5.000000	5.714300	6.553600	14.318180	20.480000
1.843200	3.579545	3.579545	5.017600	5.990400	8.000000	16.000000	22.118400
2.000000	4.000000	4.000000	5.068800	6.000000	10.000000	18.000000	24.576000
2.097152	4.194304	4.194304	5.120000	6.144000	10.240000	18.432000	28.356900
2.457600		4.915200	5.185000	6.400000	11.000000	20.000000	48.000000

OEM CRYSTALS

M-tron has the high quality, high volume production capability to produce for annual customer requirements. This can result in cost savings to you. Also, you are assured of delivery consistent with your production requirements. Initial deliveries can begin 6 to 8 weeks after receipt of your order.

Standard units, in quantities up to 200 units, are delivered from stock. Samples for new product applications can be delivered in just 4-5 weeks.

Frequency	1 MHz – 170 MHz
Accuracy	± 20 PPM @25°C
Stability	± 25 PPM – 20°C to + 70°C
Load capacity	18pf
Resistance:	500 Ohms @1 MHz 25 Ohms @15 MHz 120 Ohms @170 MHz
Holder type	Standard resistance weld and solder seal

MILITARY CRYSTALS

M-tron has maintained its military qualification and offers many QPL listed products. Write the factory for lists.

M-TRON ADVANTAGES

COMPUTER DESIGN, with programs for both crystals and oscillators, assures consistent, reliable designs. QUALITY CONTROL insures that we meet your specific requirements. ENGINEERING ASSISTANCE – Our engineering department is ready to assist in specifications of circuit analysis. WORLDWIDE DISTRIBUTION adds up to on-time delivery everywhere!

ASK ABOUT OUR SMD AND OTHER NEW PRODUCT LINES

M-tron

a recognized leader in quality Clock Oscillators and Quartz Crystals.

M-TRON INDUSTRIES, INC., P.O. Box 630, Yankton, SD 57078 • Phone: (605) 665-9321 • TWX: 910-668-3603

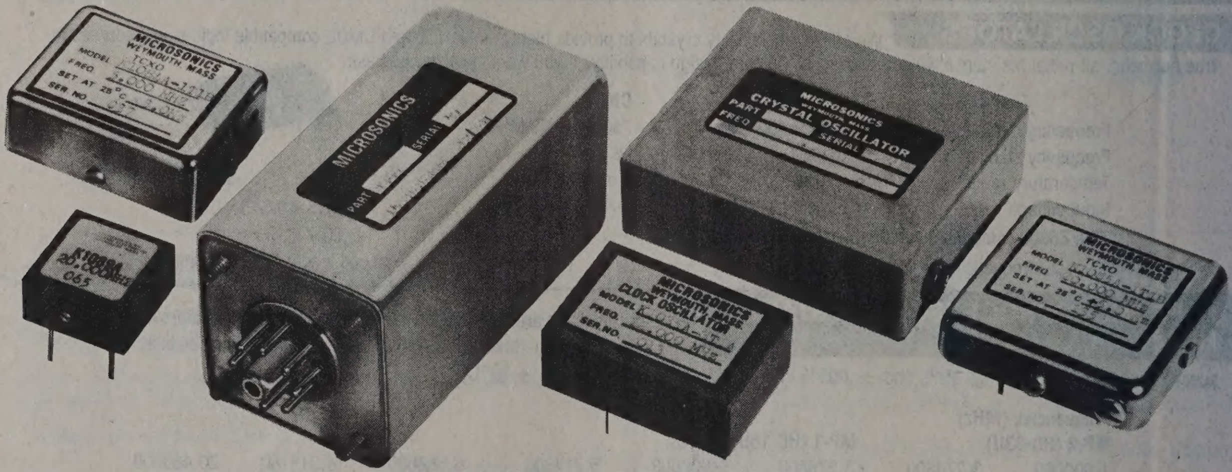
MI-14-2

SPECIFY MICROSONICS

Go with a company that does it all.

In-house crystal manufacturing, producing up to 41 MHz fundamental frequencies. Computer optimized designs. Automatic testing and modern manufacturing facilities.

Engineering assistance and liaison. Special packaging. Customized and state-of-the-art devices. Quality assurance to MIL-I-45208A or MIL-Q-9858A if required.


MICROSONICS WEYMOUTH MASS
MODEL
TCXO
FREQ.
SET AT 25°C
SER. NO.
MICROSONICS
PART
SERIAL
MICROSONICS WEYMOUTH MASS
CRYSTAL OSCILLATOR
PART
FREQ
SERIAL
MICROSONICS WEYMOUTH MASS
CLOCK OSCILLATOR
MODEL
FREQ.
SER. NO.
065

CRYSTAL OSCILLATORS

Ovenized (OC), clock (XO), temperature compensated (TCXO), and temperature compensated voltage controlled (TC/VCXO), crystal oscillators with sine wave, TTL, CMOS, and ECL compatibility. Many standard options available to insure fast delivery of quality oscillators to meet your large or small quantity needs. Plus, our ability to customize military and commercial designs provides you with the flexibility necessary to satisfy all your requirements

MICROSONICS WEYMOUTH MASS
CRYSTAL FILTER

FILTERS

Solving problems in the space, military, commercial and CATV fields. Filters available with center frequencies from 10 KHz to 200 MHz. Featuring wide bandwidths, phase matching, tracking and equalization. Call us for bandpass, band reject, comb, phase tracking and compensated Filters or Discriminators. Designs are available in L.C., or Crystal technologies.

We're available...

Microsonics' Sales and Engineering staff is available to assist you in your Delay Line, Filter and Oscillator requirements, covering the spectrum from high volume commercial production to high reliability space and military. We have the personnel, equipment and commitment to provide our customers with the products they need. Write or call now for bulletins and Engineering or Sales assistance.

LINE A
MICROSONICS WEYMOUTH, MASS.
PART
SERIAL
DELAY
MADE IN U.S.A.
LINE B

DELAY LINES

We have nearly 25 years experience in delay lines, providing the military and television broadcast equipment markets with quality, high technology delay lines. Delay lines with delays of .5 to 5000 usec with center frequencies from 5 MHz to 200 MHz depending on application. Designs are available utilizing bulkwave in quartz or Zero Temperature Coefficient glass. We can help you solve your delay line problems.

MICROSONICS
INCORPORATED

60 WINTER ST., WEYMOUTH, MA 02188
(617) 337-4200 TWX 710-388-6833

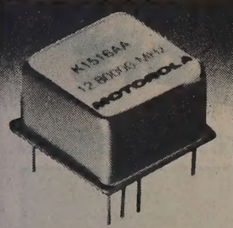
For More Information. Circle No. 134

MOTOROLA INC.

Components Division

2553 N. Edgington • Franklin Park, Ill. 60131
312/451-1000 TWX: 910-255-4619 Telex: 4990104

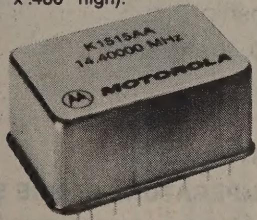
TCXOs,
Quartz Crystals
Monolithic Filters



MDO-2 Series

Inclusive ±2 ppm Stability, Full Hermetic Seal

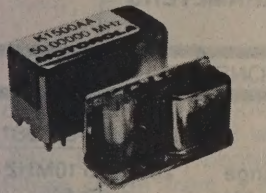
The ±2 ppm frequency stability of the MDO-2 oscillator series is inclusive of voltage and humidity variations while operating over a wide temperature range from −35°C to +85°c. The all-metal welded package offers a full hermetic seal which keeps the oscillator on frequency in environmental extremes of temperature and humidity — high performance with small size (0.8" x 0.8" x .480" high).



MDO-1 Series

±1 ppm Stability Full Hermetic Seal

The MDO-1 Series oscillator is an ideal substitute for an ovenized oscillator in many applications while using considerably less space. The ±1 ppm stability is maintained over the full temperature range of −30°C to +90°C. The MDO-1 is contained in an all-metal, welded package for full hermetic seal and for minimized RFI.



MTO-2 Series

Small Size Low Power Consumption

The MTO-2 oscillator series offers optimum performance in a package less than 0.16 cubic inches, making this oscillator ideal for those communication equipment applications in which low power consumption is required.

K1517AA
14.40000 MHz
MOTOROLA

MTO-1 Series

Inclusive ±5 ppm Stability

The ±5 ppm frequency stability including supply voltage and load variations over the full operating temperature range of −30°C to +85°C makes the MTO-1 oscillator series ideal for those low cost applications in which maximum reliability is needed over an extended temperature range. Optionally available with tighter stability and with frequency modulation.

MSO-1 & 2 Series

The MSO oscillator series, specially designed for communications equipment, is available over a wide frequency range. This standup version uses minimal boardspace area. Tight stability and frequency modulation are optionally available.

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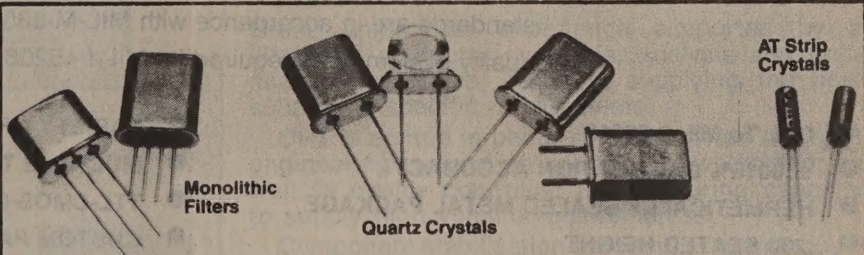
(c) 1984 by Motorola Inc.

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Specifications	MDO-1	MDO-2	MTO-1	MTO-2	MSO-1	MSO-2
Frequency (MHz)	10-20	10-20	10-20	45-60	10-20	44-88
Temp. Stability (ppm)	±1.0	±2	±5	±5	±2	±5
Temp. Range (°C)	−30 to +90	−35 to +85	−30 to +85	−30 to +60	−40 to +95	−30 to +70
Supply Voltage (Nom., Vdc)	10	10	10	8	10	5
Current Drain (Max., mA)	10	10	10	11	10	7
Dimensions (Inches) length width height	 1.780 1.170 0.790	 0.800 0.800 0.480	 1.160 0.860 0.560	 0.860 0.370 0.520	 0.755 0.365 0.953	 0.755 0.365 0.953
Freq. Adjust Range	Settable to 1 x 10^{-7}					
Aging Rate (Typical)	1 x 10^{-6}					

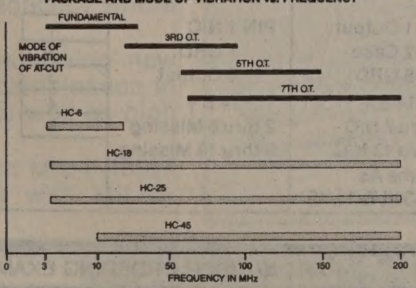


Quartz Crystals

Motorola is an integrated manufacturer of quartz frequency selectivity devices, with complete process control of all the manufacturing processes from growing of cultured quartz through sawing and lapping of the quartz plates to finishing the quartz into high quality crystals. Motorola quartz crystals are ideal for product applications that include FM radio communications equipment, microwave and satellite communications, as well as aerospace and military applications.

Freq. Stability: .0003% to .01%
Load Capacitance: series resonance 20 pF or 32 pF
Aging: ±2 ppm/year @ 25°C
Shock: meets or exceeds MIL C-3058 and MIL STD 883-B method 2002-2

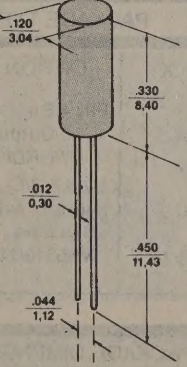
PACKAGE AND MODE OF VIBRATION vs. FREQUENCY



AT-Strip Resonator Crystals

The 3,0 x 8,4 mm AT strip resonator crystal package is volumetrically 75% smaller than the standard HC-45 package and 90% smaller than the HC-18, making the AT strip crystal well-suited for applications which require small size at low cost. It is available in the fundamental frequency range of 10 MHz to 20 MHz. Nominal aging characteristic at 25°C is ±2 ppm/yr.

Freq. Stability: .002% to .01%
Load Capacitance: 20 pF or 32 pF
Aging: ±2 ppm/year nominal
Shock: 5000g @.3 msec duration



Monolithic Crystal Filters

The disciplines of physics, electrical engineering, and material science are combined with computer-aided Monte Carlo design techniques to create optimum state-of-the-art monolithic crystal filters. Several patented techniques have thus been developed to improve spurious response, stop-band rejection, and intermodulation levels. A broad capability exists to design discrete filters and monolithic filters from two to twelve poles, with frequency capabilities from 5 MHz to 200 MHz.

Motorola offers a complete line of standard filter models designed for use in communications equipment requiring IF filtering. Some of the more popular frequencies at 10.7 MHz, 21.4 MHz, and 45.0 MHz are readily available in a variety of package styles. Contact Motorola Components Division for further information and for specifications.

For More Information. Circle No. 135

XSIS
ELECTRONICS

Advanced Design Microcircuit Crystal Oscillators

XSIS microcircuit crystal oscillators are not "JUST ANOTHER CLOCK OSCILLATOR" but are hi-rel devices using a premier design that is documented to be virtually without failure. Customers call it EXPERIENCED RELIABILITY.

XSIS microcircuit oscillators are manufactured to the electrical parameters of MIL-0-55310, workmanship standards are in accordance with MIL-M-38510, the quality system is as required by MIL-I-45208.

- **QPL To MIL-0-55310**
- **±.0015% CALIBRATION ACCURACY**
- **HERMETICALLY SEALED METAL PACKAGE**
- **.200 SEATED HEIGHT**
- **LOW POWER CONSUMPTION**
- **WIDE FREQUENCY RANGE**
- **VARIETY OF STABILITIES**
- **MULTIPLE TEMPERATURE RANGE SELECTION**
- **TTL-CMOS-GATED SCHOTTKY-ECL**
- **CUSTOM PACKAGE CONSIDERATIONS**
- **DUAL IN-LINE SPACING**
- **CUSTOM ELECTRICAL PARAMETERS**

XSIS IS A QPL SOURCE FOR MICROCIRCUIT CRYSTAL OSCILLATORS TO MIL-0-55310/8,/11,/14,/15,/16,/17,/18

TYPICAL SPECIFICATIONS AVAILABLE

100 Series-TTL		200 Series-CMOS**
100Hz to 70MHz	Frequency Range	250Hz to 10MHZ
±.0015%	Frequency @ +25°c	±.0015%

**Specify supply voltage when ordering

PACKAGE TYPE + PIN CONNECTIONS

OPTION 'X'	OPTION 'E'	OPTION 'M'	OPTION 'T' (4 PIN)
PIN 7 GRD 8 Output 14 B+ 1 thru 6 N/C 9 thru 13 N/C Same As M55310/16/18	PIN 4 B+ 5 Output 7 GRD/Case 1,2,3,6 N/C 8 thru 14 N/C Same As M55310/14	PIN 1 Output 2 Case 8 GRD 14 B+ 3 thru 7 N/C 9 thru 13 N/C Same As M55310/8/11/15	PIN 1 N/C 7 GRD 8 Output 14 B+ 2 thru 6 Missing 9 thru 13 Missing

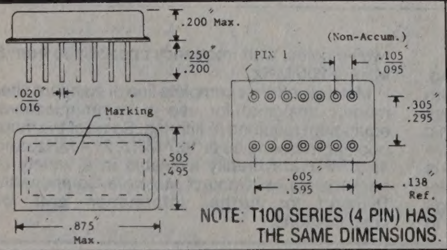
STABILITIES AVAILABLE

P/N	
1	±.1%
2	±.05%
3	±.01%
4	±.005%
5	±.0025% not available with -55 to +125°c

TEMPERATURE RANGES

P/N	
1	0° to 70°c
2	-30° to +85°c
3	-55° to +125°c

PACKAGE DIMENSIONS



NOTE: T100 SERIES (4 PIN) HAS THE SAME DIMENSIONS.

PART NUMBER ORDERING EXAMPLE

X143 - 20.0 MHz
14 PIN with Option 'X' PINOUT
TTL Compatible
± .005% Stability
-55° to +125° c Temperature Range

XSIS
ELECTRONICS

12620 W. 63rd St.
Shawnee, Kansas 66216
913-631-0448
Telex: 437227

For More Information. Circle No. 136

opt INDUSTRIES INC.

300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

CUSTOM FILTERS

Engineering & Manufacturing

DISCRETE CRYSTAL FILTERS • LC FILTERS AND NETWORKS • MONOLITHIC CRYSTAL FILTERS

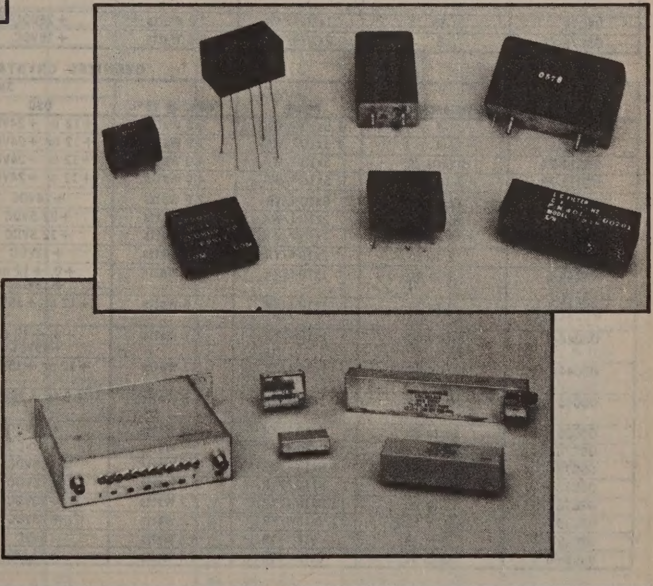
OPT is at the forefront of filter engineering as a result of company sponsored research and development in addition to the technology gained thru the acquisition of all engineering drawings and manufacturing rights from the following companies:

- Bulova Filter Co.
- Burnell & Co.
- Filtech
- Nytronics
- Omnitec
- Ortho Filter

Broad application experience supported by a library of computer synthesis, analysis and optimization programs, assist in supplying the best solution to specific requirements.

OPT is unique in being able to provide in depth engineering support on prototype development as well as quality controlled manufacturing capacity to supply high volume requirements.

Component stabilization procedures permit guaranteeing maximum stability with operating life. Areas of specialization include delay correction, phase matching and time domain synthesis.

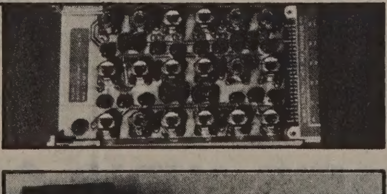


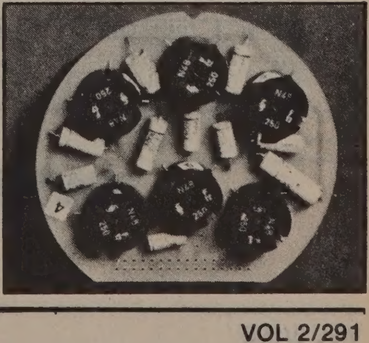
OPT's custom engineering and manufacturing capabilities for monolithic crystal filters range from 4.0 MHz to 30 MHz with relative bandwidths from .04% to .3% of center frequency. Discrete crystal filters range from 1 KHz to 70 MHz with relative bandwidths upwards from .005% of center frequency.

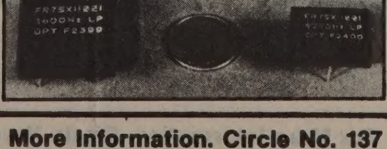
LC Filters and networks include low pass, band pass, high pass, band reject, amplitude and delay correcting, impedance matching in frequencies ranging from DC to 400 MHz with relative bandwidths higher than .2% of center frequency where design permits.

OPT's success in meeting and achieving new goals is reflected in our continued participation in many advanced military programs as well as high quality communication systems.

OPT, in addition to complying with MIL-F-18327 has on certain programs complied with MIL-Q-9858A requirements.







(Above) NASA high reliability bandpass filters for use in space shuttle telemetry system. Built to MIL-STD-810C, method 514.2, proc. 5, part 2, curve AH; shock MIL-STD-202, method 213B, cond. k; temp. −30°C to +75°C.

(Top Right) Phase and amplitude matched filters for sonobuoys and phased array sonars. Temp. −20°C to +65°C. Phase is matched over temperature to <3° for any number of channels.

(Bottom Right) Ultraminiature passive low pass filters stable over temperature. Used in codec inputs and secure communications CVDT's.

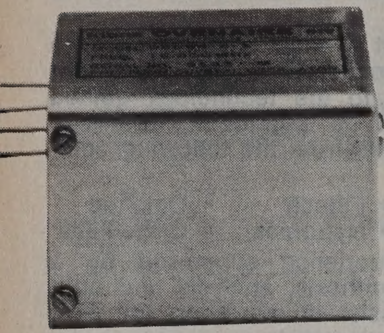
For More Information. Circle No. 137

ovenaire oscillators

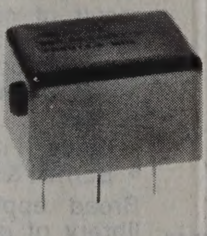
Ovenaire has the capabilities, experience and production techniques to meet the most exacting crystal oscillator requirements — from State-Of-The-Art Precision Crystal Oscillators to high volume, low cost TCXO's.

The following tables list condensed specifications on regular production models. For additional information on these and other crystal oscillators, call the Ovenaire factory.

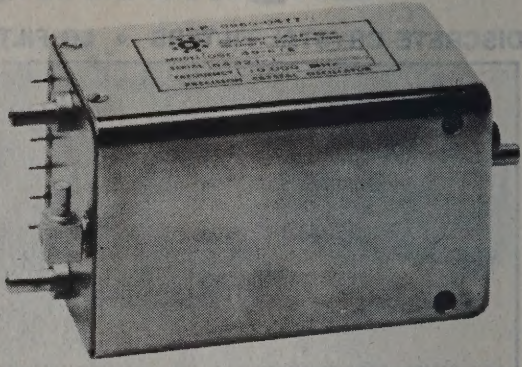
PRECISION AND OVENIZED CRYSTAL OSCILLATORS



OSC 85-6 SERIES



OSC 85-1 SERIES



OSC 49 SERIES

PRECISION CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power @ 25°C	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC46-1A	1	2x10^{-8}/WK	2.2 Watts	+25VDC	Sine	75x75x93	−10°C to +60°C	2x10^{-10}/°C
OSC46-2A	1	2x10^{-8}/WK	2.2 Watts	+30VDC	Sine	75x75x93	−10°C to +60°C	2x10^{-10}/°C
OSC49-3	3 or 10	1x10^{-8}/WK	2.2 Watts	+28VDC	Sine	41x114x53	−15°C to +60°C	±7.5x10^{-9}
OSC49-5	10	4x10^{-9}/WK	2.2 Watts	+20VDC	Optional	(A) 51x51x84 (B) 49x75x54	0°C to +60°C	7x10^{-9}
OSC58-1	8 to 12	1×10-8/wk	2.0 watts	+13.2VDC ±15%	TTL or C'MOS	69×48×41	-10°C to +60°C	±1×10-8
OSC74	7.5 to 15	1.5x10^{-8}/WK	2.0 Watts	+15VDC	TTL	(A) 64x81x32 (B) 51x51x79	−15°C to +60°C	3x10^{-10}/°C
OSC75	10	1x10^{-8}/WK	2.2 Watts	+28VDC	TTL	37x44x90	−40°C to +70°C	3x10^{-10}/°C
OSC78-12	5	2x10^{-8}/WK	0.6 Watts	+15VDC	TTL	65x75x114	0°C to +50°C	5x10^{-10}/°C

OVENIZED CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power @ 25°C	Supply Voltage		Max. Size mm	Ambient Range	Ambient Stability
				OSC	Oven			
OSC11-3	1	1.5x10^{-7}/WK	3.5 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	5x10^{-9}/°C
OSC11-5	1	1.5x10^{-7}/WK	1.9 Watts	+12 or +24VDC	+12 or +24VDC	57x57x93	−30°C to +60°C	5x10^{-9}/°C
OSC11-7A	1 thru 20	5x10^{-7}/WK	4.0 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	8x10^{-9}/°C
OSC11-7B	3 thru 8	5x10^{-8}/WK	4.0 Watts	+12 or +24VDC	115VAC	38x38x84	−20°C to +60°C	5x10^{-9}/°C
OSC29-32	12 to 22	8x10^{-7}/YR	2.5 Watts	+24VDC	+24VDC	37x48x90	−20°C to +60°C	±1x10^{-7}
OSC29-1	10 to 25	2x10^{-7}/WK	2.2 Watts	+22.5VDC	+28VDC	37x48x83	−20°C to +60°C	5x10^{-9}/°C
OSC29-2	2 to 10	1x10^{-7}/WK	2.7 Watts	+22.5VDC	+28VDC	37x48x83	−20°C to +60°C	2.5x10^{-9}/°C
OSC32-1	2 to 10	2x10^{-6}/YR	.54 Watts	+12VDC	+24VDC	51x51x70	0°C to +55°C	±2x10^{-8}
OSC44-1	2 to 40	1x10^{-6}/YR	1.6 Watts	+9, +12 or +15VDC	+15, +20, +24 or +28VDC	Choice of 3 Compact Packages, Octal or Solder Pin Mounting	−20°C to +60°C	±4x10^{-7}
OSC44-2	2 to 40	1x10^{-6}/YR	1.6 Watts	+12 or +15VDC	+15, +20, +24 or +28VDC		−10°C to +60°C	±4x10^{-7}
OSC44-3	2 to 40	1x10^{-6}/YR	1.1 Watts	+9, +12 or +15VDC	+15, +20, +24 or +28VDC		−20°C to +55°C	±3x10^{-7}
OSC44-4	2 to 40	1x10^{-6}/YR	1.1 Watts	+12 or +15VDC	+15, +20, +24 or +28VDC		−20°C to +55°C	±3x10^{-7}
OSC45	2 to 12	1x10^{-6}/YR	1.8 Watts	+9 to +28VDC	+9 to +28VDC	(A) 43x64x33 (B) 32x44x70	0°C to +55°C	±1x10^{-7}
OSC55	10 to 55	1x10^{-6}/YR	1.4 Watts	+28VDC	+28VDC	33x67x49	−20°C to +50°C	±1x10^{-6}
OSC70	22 to 120	2x10^{-6}/YR	2.2 Watts	+28VDC	+28VDC	37x48x90	−20°C to +60°C	±5x10^{-8}
OSC73-1	9 to 15	3.5x10^{-7}/YR	2.0 Watts	+15VDC	+15VDC	33x79x54	−30°C to +65°C	±7.5x10^{-8}
OSC73-2	2 to 6	5x10^{-7}/YR	2.0 Watts	+15VDC	+15VDC	47x68x35	−10°C to +65°C	±5x10^{-8}
OSC73-3	12 to 25	1.5x10^{-6}/YR	2.3 Watts	+20VDC	+20VDC	36x75x41	−30°C to +65°C	±1x10^{-7}
OSC83	7.2 to 13.2	1.5x10^{-6}/YR	2.2 Watts	+28VDC	+28VDC	37x48x84	−10°C to +55°C	±2x10^{-7}
OSC85-1-1	1 to 16	1x10^{-6}/YR	1.8 Watts	+5VDC	+24VDC	27x32x45	0°C to +60°C	±1x10^{-7}
OSC85-6-1	10 to 40	8x10^{-7}/YR	1.1 Watts	+12.6VDC	+12.6VDC	37x48x54	0°C to +65°C	±1x10^{-7}

PCB MOUNT CRYSTAL OSCILLATORS

Model Series	Frequency MHz	Aging	Power	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC51	1 to 60	N/S	300MW	+12VDC	Optional	38x38x13	0°C to +60°C	±1x10^{-5}
OSC52	10 to 150	N/S	300MW	+12VDC	Sine	38x38x25	0°C to +60°C	±1x10^{-5}
OSC69-2	5 to 20	1x10^{-5}/YR	75MW	+5VDC	TTL	25x38x13	−30°C to +85°C	±5x10^{-5}
OSC69-3	6 to 22	8x10^{-6}/YR	75MW	+5VDC	TTL	25x38x13	−30°C to +85°C	±3.5x10^{-5}

OVENAIRE-AUDIO-CARPENTER

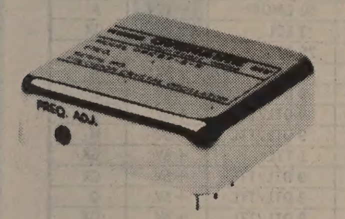
A Division of Electronic Technologies Inc.

706 FORREST STREET — CHARLOTTESVILLE, VIRGINIA 22901
TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

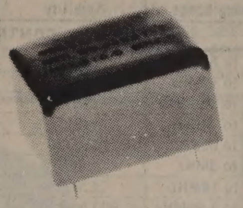
For More Information. Circle No. 138

ovenaire oscillators

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

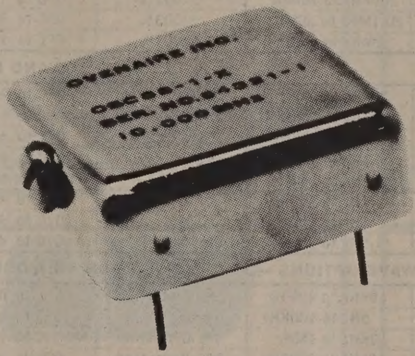


OSC27 SERIES

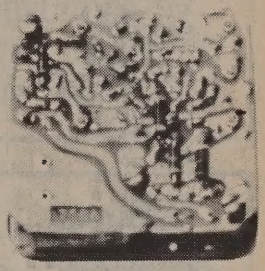


OSC61 SERIES

ovenaire
MODEL OSC 34-2
SERIAL 76543-1
FREQUENCY 20 000 MHz
PRECISION CRYSTAL OSCILLAT



OSC88 SERIES



OSC34 SERIES

Model Series	Frequency MHz	Aging	Power	Supply Voltage	Output	Max. Size mm	Ambient Range	Ambient Stability
OSC20-1	10 to 15	3x10^{-6}/YR	135MW	5 or 9VDC	Sine	26x15x54	−30°C to +75°C	±5x10^{-6}
OSC20-2	10 to 15	3x10^{-6}/YR	135MW	5 or 9VDC	Sine	26x15x54	0°C to +50°C	±2x10^{-6}
OSC27-5-1	2 to 12	1x10^{-6}/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	±1x10^{-6}
OSC27-5-2	2 to 12	1x10^{-6}/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	±5x10^{-7}
OSC27-5-3	2 to 5	5x10^{-6}/YR	300MW	+12VDC	TTL	51x51x15	0°C to +55°C	±3x10^{-7}
OSC27-6-1	2 to 12	1x10^{-6}/YR	360MW	+12VDC	TTL	51x51x15	−40°C to +85°C	±1.5x10^{-6}
OSC27-6-2	2 to 12	1x10^{-6}/YR	360MW	+12VDC	TTL	51x51x15	−30°C to +75°C	±1x10^{-6}
OSC27-6-3	2 to 6	5x10^{-7}/YR	360MW	+12VDC	TTL	51x51x15	−15°C to +70°C	±5x10^{-7}
OSC34-2	10 to 20	7.5x10^{-7}/YR	240MW	+12VDC	Sine	45x45x15	0°C to +50°C	±1x10^{-6}
OSC35-1-1	2.5 to 12	1x10^{-6}/YR	300MW	+12VDC	TTL	51x51x13	−5°C to +60°C	±1x10^{-6}
OSC35-1-2	2.5 to 12	1x10^{-6}/YR	300MW	+12VDC	TTL	51x51x13	−5°C to +60°C	±5x10^{-7}
OSC35-1-3	2.5 to 6	5x10^{-7}/YR	300MW	+12VDC	TTL	51x51x13	0°C to +55°C	±3x10^{-7}
OSC37-1-1	1 to 5	1x10^{-6}/YR	180MW	+12VDC	TTL	44x44x19	0°C to +55°C	±2x10^{-6}
OSC37-2-1	5.01 to 10	2.5x10^{-6}/YR	180MW	+12VDC	TTL	44x44x19	0°C to +55°C	±2x10^{-6}
OSC37-3-1	1 to 5	1x10^{-6}/YR	216MW	+12VDC	TTL	44x44x19	−5°C to +60°C	±1x10^{-6}
OSC37-1-2	1 to 5	1x10^{-6}/YR	180MW	+12VDC	TTL	44x44x19	−10°C to +65°C	±1.5x10^{-6}
OSC37-2-2	5.01 to 10	2.5x10^{-6}/YR	180MW	+12VDC	TTL	44x44x19	−10°C to +65°C	±1.5x10^{-6}
OSC39-1	2.5 to 12	1x10^{-6}/YR	125MW	+5VDC	TTL	48x31x17	0°C to +60°C	±1x10^{-6}
OSC40-1	4KHz to 1MHz	1x10^{-6}/YR	504MW	−18VDC	AC Square	57x51x21	0°C to +55°C	±8x10^{-6}
OSC61-2-2	6 to 16	1x10^{-6}/YR	180MW	+12VDC	Clipped Sine	37x28x19	−20°C to +70°C	±2x10^{-6}
OSC67-1-1	2 to 8	1x10^{-6}/YR	275MW	+12 & +5VDC	TTL	51x41x17	0°C to +55°C	±2x10^{-6}
OSC67-1-2	2 to 8	1x10^{-6}/YR	275MW	+12 & +5VDC	TTL	51x41x17	0°C to +55°C	±1x10^{-6}
OSC88-1-1	10	.75 x 10^{-6}/YR	230MW	+ 12VDC	TTL	38 x 38 x 14	0°C to + 55°C	±3 x 10^{-6}
OSC8888-1-2	10	.75 x 10^{-6}/YR	230MW	+ 12VDC	TTL	38 x 38 x 14	0°C to + 55°C	±1 x 10^{-6}
OSC88-1-3	10	.75 x 10^{-6}/YR	230MW	+ VDC	TTL	38 x 38 x 14	0°C to 55°C	±5 x 10^{-6}
OSC88-1-4	10	.75 x 10^{-6}/YR	230MW	+ 12VDC	TTL	38 x 38 x 14	-5°C to + 70°C	±3 x 10^{-6}
OSC88-1-5	10	.75 x 10^{-6}YR	230MW	+ 12VDC	TTL	38 x 38 x 14	-5°C to + 70°C	±1 x 10^{-6}
OSC88-1-6	10	.75 x 10^{-6}/YR	230MW	+ 12VDC	TTL	38 x 38 x 14	-5°C to + 70°C	±5 x 10^{-7}
OSC88-2-1	10	.75 x 10^{-6}/YR	230MW	+ 12VDC	TTL	38 x 38 x 14	-40°C to + 75°C	±2 x 10^{-6}
OSC88-2-2	10	.75 x 10^{-6}/YR	230MW	+ 12VDC	TTL	38 x 38 x 14	-40°C to + 75°C	±1 x 10^{-6}
OSC88-2-3	10	.75 x 10^{-6}/YR	230MW	+ 12VDC	TTL	38 x 38 x 14	-55°C to + 105°C	±5 x 10^{-6}
TCX0101	.0075Hz to 10MHz	±2 x 10^{-8}/DAY	FREQ DEP	+ 12VDC	12V SQUARE	PKG B	0°C to + 50°C	±1 x 10^{-6}
TCX0101A	.0075Hz to 10MHz	±2 x 10^{-8}/DAY	FREQ DEP	+ 12VDC	12V SQUARE	PKG B	-55°C to + 75°C	±5 x 10^{-6}
TCX034	.0005Hz to 40MHz	±2 x 10^{-8}/DAY	FREQ DEP	+ 5VDC	4V SQUARE	PKG B	0°C to + 50°C	±1 x 10^{-6}
TCX056	100KHz to 30MHz	±2 x 10^{-8}/DAY	FREQ DEP	+ 5VDC	4VSQUARE	PKG A	0°C to +50°C	±1 x 10^{-6}
TCX0152	200Hz to 10MHz	±1 x 10^{-8}/DAY	FREQ DEP	+15VDC	10V SQUARE	PKG OA	0°C to +50°C	±1 x 19^{-7}
TCX0152A	200Hz to 10MHz	1 x 10^{-6}/YR	FREQ DEP	+15VDC	10V SQUARE	PKG OA	-40°C to +70°C	±1 x 10^{-6}

OVENAIRE-AUDIO-CARPENTER

A Division of Electronic Technologies Inc.

706 FORREST STREET — CHARLOTTESVILLE, VIRGINIA 22901
TELEPHONE 804-977-8050 TWX 510-587-5461 CABLE "OVENS"

For More Information. Circle No. 138

ovenaire oscillators

PKG STYLE A
Printed ckt mount
Encapsulated
1.5" x 2.0" x .56"
(**AX**: Without mtg. hole)
(**AC**: 7 pin plug-in; stud mt.)

PKG STYLE B
Printed ckt mount
Encapsulated
1.9" x 2.5" x .5"
(**BY**: 1.9" x 2.5" x 1.0")
(**BZ**: 1.9" x 2.5" x .375")

PKG STYLE F & Q
Printed ckt mount
Encapsulated
F: 1.0" x 1.25" x .5"
Q: 2" x 2" x .6"

PKG STYLE G
I.C. plug-in
Encapsulated
.78" x 1.125" x .5"
(**GX**: .75" x 1.5" x .5")

PKG STYLE H
Printed ckt mount
Encapsulated
.875" x .875" x .5"

PKG STYLE J
Printed ckt mount
Encapsulated
1.25" x 1.25" x .5"
(**JX**: 1.25" x 1.25" x .32")

PKG STYLE L
Octal plug-in
Stud mount
Metal can
2" x 2" x .75"

PKG STYLE P
Special plug-in
Encapsulated metal can
.7" x 1.3" x 1.7"

PKG STYLE M, N, & O
Printed ckt mount
Encapsulated metal can
M: 2.5" x 2.5" x .625"
N: 2" x 2" x .75"
O: 2" x 2.5" x .75" (stud mount)
OA: 2" x 2.5" x .65"

Model Series	Frequency Range	Stability	Temperature Range	PK-to-PK Output	Load	Supply Voltage	Pkg. Style
CRYSTAL CONTROLLED OSCILLATORS — NO OVEN REQUIRED							
X0128	7.5KHz to 85KHz	±.02%	0°C to +70°C	6.7V Sine	10K ohms	+15V	Q
X0110	4MHz to 10MHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	F
X0111	250KHz to 3.99MHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	J
X0112	63Hz to 249KHz	±.01%	0°C to +70°C	4V Square	10 TTL	+5V	AX
X0123	7.5KHz to 60KHz	±.01%	0°C to +50°C	1.5V Sine	10K ohms	+5V	A
X0100	.005Hz to 3MHz	±.007%	−40°C to +85°C[2]	12V Square[5]	50 CMOS[5]	+12V	A
X096	5MHz to 16MHz	±.005%	0°C to +70°C	1V Square	3 ECL	−5V	JX
X032	12.5KHz to 5.99MHz	±.003 to ±.01%[4]	0°C to +75°C[2]	4V Square[3]	25 DTL	+5V	A
X032C	6MHz to 40MHz	±.003%	0°C to +75°C[2]	4V Square[3]	9 TTL	+5V	A
X033	.001Hz to 30MHz	±.003%	0°C to +75°C[2]	4V Square[3]	9 DTL/TTL	+5V	B
X082	190KHz to 30MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	F
X094	190KHz to 16MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	H
X0181	12Hz to 12.49KHz	±.003%	0°C to +75°C[2]	4V Square	1 TTL	+5V	GX
X081	12.5KHz to 199KHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	GX
X071	200KHz to 20MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	G
X081	20.1MHz to 30MHz	±.003%	0°C to +75°C[2]	4V Square	9 DTL/TTL	+5V	GX
X045	1MHz to 5MHz	±.001%	+10°C to +50°C	.63V Sine	50 ohms	+15V	AC
LC AND RC OSCILLATORS							
LC035	70KHz to 5MHz	±.5%	0°C to +85°C	2V Sine	10K ohms	+12V	A
LC01028	733KHz to 5MHz	±1%	−50°C to +100°C	2V Sine	1K ohms	+12V	J
PS057	10Hz to 40KHz	±1%/±2%[4]	0°C to +50°C	6V Sine	10K ohms	+12V	A
RC036A	1Hz to 1MHz	±2%	−20°C to +85°C	4V Square[3]	9 DTL/TTL	+5V	A
RC036B	1Hz to 1MHz	±1%	0°C to +75°C	4V Square[3]	9 DTL/TTL	+5V	A
UJ039A	.1Hz to 100Hz	±2%	0°C to +50°C	3V Square	1.5K ohms	+12V	A
RC0109	1Hz to 1MHz	±1%	0°C to +50°C	2.5V Sine	600 ohms	+15V	B
RC0168	1.5Hz to 30KHz	±.5%	0°C to +75°C	4V Square[3]	9 DTL/TTL	+10V	B
SINE WAVE OPTIONS — ADD "S" VERSION TO MODEL NUMBER (MAY REQUIRE LARGER PACKAGE[4])							
S11/12[4]	10KHz to 40MHz	5% Distortion	0°C to +75°C	1 mw into 50 ohms		+12V	May be Combined with Oscillator Voltage[4]
S13	5Hz to 100KHz	5% Distortion	−55°C to +75°C	1.75V RMS into 600 ohms		+15V	
S14	10KHz to 1MHz	3% Distortion	−55°C to +125°C	2V pk-to-pk into 10K ohms		None	
S17	20Hz to 200KHz	5% Distortion	0°C to +50°C	3V pk-to-pk into 10K ohms		+5V	
S18	5Hz to 100KHz	3% Distortion	−55°C to +75°C	2.5V pk-to-pk into 600 ohms		+15V	
S19/20[4]	10KHz to 40MHz	5% Distortion	0°C to +75°C	2mw into 50 ohms		+15V	
S21	20Hz to 200KHz	5% Distortion	0°C to +50°C	3V RMS into 10K ohms		+15V	
S23	10KHz to 1MHz	1% Distortion	0°C to +75°C	8V pk-to-pk into 10K ohms		+12V	
S24	100KHz to 15MHz	5% Distortion	0°C to +75°C	.5V RMS into 5K ohms		None	

VOLTAGE CONTROLLED OSCILLATORS — CRYSTAL AND NON-CRYSTAL TYPES

Model Series	Center Frequency Range	Minimum Deviation	Input[6]	Linearity	Stability	Temperature Range	PK-to-PK Output	Load	Voltage Supply	Pkg. Style
VC0114	300Hz to 10KHz	±60%	+1.5V to +9V	±10%	±5%	+10°C to +44°C	3V Sine	125 ohms	+6V	B
VC0137	1Hz to 30MHz	±10%	−5V to +5V	±10%	±.5%	0°C to +50°C	4V Square[3]	9 TTL	+5V	B
VC047	1Hz to 75MHz	±10%	0V to −7V	±10%	±3%	0°C to +75°C	4V Square[3]	9 TTL	+5V	B
VC068	5Hz to 15KHz	±10%	0V to −7V	±1%	±.5%	0°C to +75°C	4V Square[3]	9 TTL	+15V	B
VC01019	.5MHz to 5MHz	±2%	+5V to −5V	±5% to ±10%[4]	±.5%	+55°F to +95°F	4V Square	5 TTL	+12V	A
VC01160	100KHz to 30MHz	±1.25%	−5V to +5V	±5%	±.5%	0°C to +50°C	.8V Sine	50 ohms	+12V	BM
VCX01095B	35MHz to 85MHz	±0.03%	−5V to +5V	±5%	±.01%	−40°C to +90°C	1V Square	3 ECL	+5V & −5.2V	BY
VCX0103	1Hz to 20MHz	±.01% to ±10%	±3V or 0V to +6V	±5% to ±10%	±.0001% to ±1%	0°C to +50°C	4V Square[3]	5 TTL	+5V	BY
VCX0255	1Hz to 40MHz	±.005%	0V to +6V	±5%	±.003%	0°C to +75°C	4V Square[3]	9 TTL	+5V	B

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[2] For ±.01% over −55°C to +125°C add "A" to Model Number

[3] Sine wave options listed above. S11/12/19/20 not available for voltage control ranges greater than ±1%.

[4] Depending on frequency.

[5] TTL option available.

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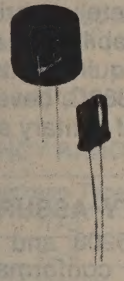
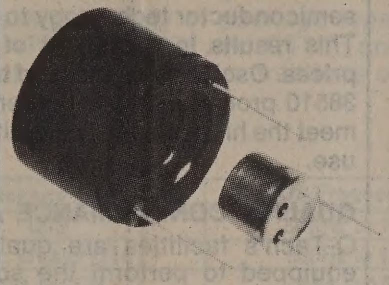
ovenaire ovens

Ovenaire's Circuit Design Technology is providing State-Of-The-Art Electronic Proportional Control Miniature Crystal and Component Ovens. Space-saving packages for PCB mount, low power consumption, low cost. A representative few of many available designs are shown. Most models are available with temperature setting from +35°C to +95°C, voltage from 5VDC to 36VDC. Ovenaire also offers a complete range of other ovens for commercial and military applications.



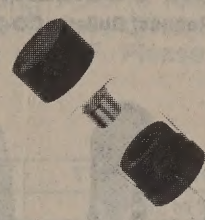
MODEL PCL1-43

For HC-18/U, HC-25/U, HC-42/U or HC-43/U crystals. 0.750" dia., 0.562" high. Temperature stability ±3°C over −30°C to +60°C typical. Also available with temperature adjustability of ±5°C of nominal.



MODEL TO5P

For TO5 crystal, transistor or IC. 0.750" dia., 0.500" high. Temperature stability ±3°C over −30°C to +60°C ambient typical. Available with temperature adjustability of ±5°C nominal.

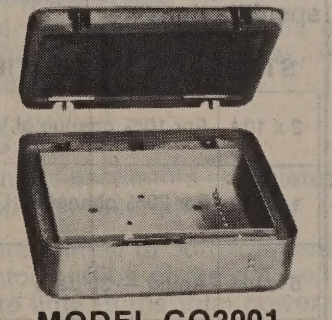


MODEL TO5C

For crystal, transistor or IC with TO5 case. Access to cavity by removing top cover. .750" Dia., .550" high. Temperature stability ±3.0°C over −30°C to +60°C ambient typical.

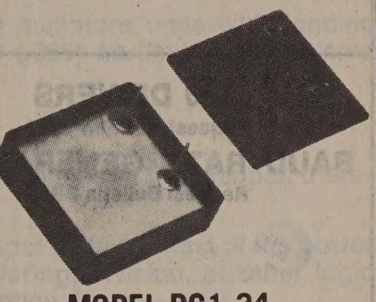
MODEL PC1-25

For 14 pin or 16 pin DIP IC or .375" x .875" x .156" component. Overall size .312" x 1" x 1". Temperature stability ±4°C over −30°C to +60°C ambient typical.



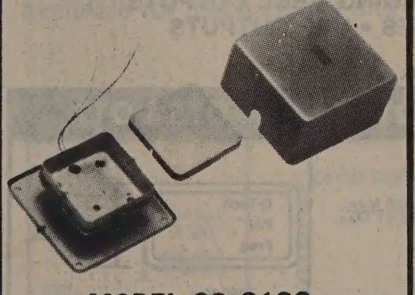
MODEL CO2001

High stability proportional control component oven. Temperature stability ±1°C over 0 to +60°C ambient. Cavity area 2.75"×3.93"×.78" high. Feed-thru pins for internal connections. O.D. 3.94"×4.63"×1.25" high. 24 VDC.



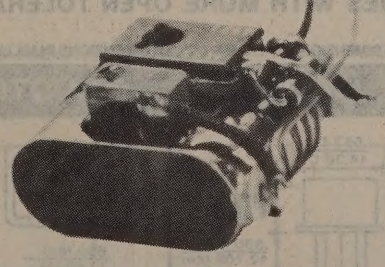
MODEL PC1-34

For 1 or 2 DIP's. Component area 1.45" Sq. X .250" tall. Overall dimensions 1.5" Sq. X .50" tall. Temperature stability is ±3°C over an ambient range of −30°C to within 10°C of the set-point. Various combinations of set-point temperature and DC operating voltage are available.



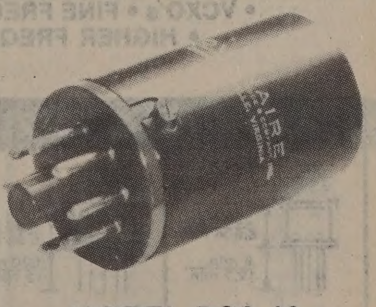
MODEL CO 2106

Component oven with customer-adjustable set-point from 50°C to 90°C. Nominal operating voltage is 19-24 VDC. Heated cavity sizes available from 2" Sq. X .75" tall to 6" Sq. X 1.75" tall. Control is solid-state, proportional.



MODEL PCL1-21

Slip-on oven for HC-6U crystal. Size .97"×.53"×.83" high. Temperature stability ±3°C over -30°C to +60°C ambient typical. Models also available for HC-25/U crystal.



MODEL PC2-10

Low cost proportional control oven for 2 HC-6/U crystals. Temperature stability +2°C over -30°C to +60°C ambient. Size 1.25" dia. × 1.75" seated height. Octal plug base. DC voltages only.

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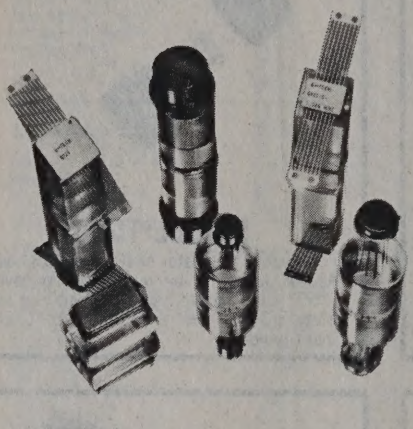
Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

MINIATURE CRYSTAL CLOCK OSCILLATORS QPL-MIL-O-55310

CLOCK OSCILLATORS

Request Bulletin CO-3

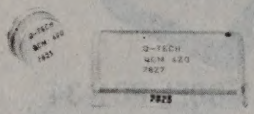


Z80 DRIVERS

Request Bulletin ZD-3

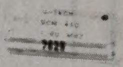
BAUD RATE GENERATORS

Request Bulletin BR-1



6800 CLOCKS

2 PHASE DRIVER



Q-Tech crystal controlled clock oscillators integrate crystal and semiconductor technology to produce a completely hybrid device. This results in a product of the highest reliability at attractive prices. Oscillators produced to MIL-O-55310 requirements, MIL-M-38510 procedures and screened to MIL-STD-883C, Level S or B, meet the highest high reliability requirements of military and space use.

QUALITY CONFORMANCE AND RELIABILITY ASSURANCE

Q-Tech's facilities are qualified to MIL-i-45208 and are well equipped to perform the screening, quality conformance and reliability assurance requirements of MIL-M-38510A and MIL-STD-883. Q-Tech is a QPL source for all hybrid MIL-O-55310 oscillators.

Z80 DRIVERS

Z80 drivers and other microprocessor drivers are available for a variety of other applications and can operate to full MIL specifications.

STANDARD STABILITIES

2 x 10^{-6}	For 10% change of Vcc
1 x 10^{-6}	For 20% change of Load
5 x 10^{-6}	Aging — 30 days
1 x 10^{-5}	Aging — 1 year

TYPICAL TOLERANCES

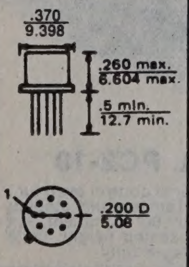
±.005% *±.0005%	0 to 50°C
*External Trimmer Required	
±.005% ±.01%	0 to 70°C
±.0025%	−20 to +70°C
±.005%	−55 to +105°C
±.005% ±.01%	−55 to +125°C

OPTIONS AVAILABLE

• GATED OUTPUT • MULTIPHASE OUTPUTS • MULTIPLE OUTPUTS • PRECISE PROGRAMMED OUTPUTS • VCXO's • FINE FREQUENCY ADJUSTMENT • SPECIAL PACKAGING • ECL OUTPUTS • HIGHER FREQUENCIES WITH MORE OPEN TOLERANCES • UHF OUTPUTS

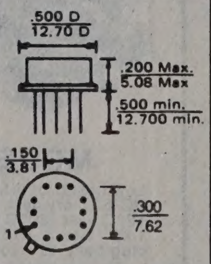
UPPER DIMENSIONS IN INCHES, LOWER DIMENSIONS IN MILLIMETERS.

QT1


.370
9.398
.260 max.
6.604 max.
.5 min.
12.7 min.
1
.200 D
5.08

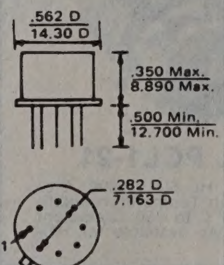
1, 2 & 6	ITP
4	GND
5	OUT
8	VCC/VDD

QT2


.500 D
12.70 D
.200 Max.
5.08 Max
.500 min.
12.700 min.
.150
3.81
1
.300
7.62

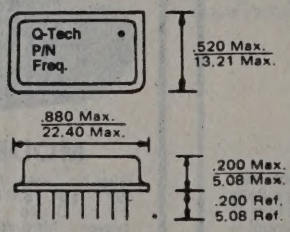
3, 9 & 10	ITP
5	OUT
6	GND
12	VCC/VDD

QT3


.562 D
14.30 D
.350 Max.
8.890 Max.
.500 Min.
12.700 Min.
.282 D
7.163 D
1

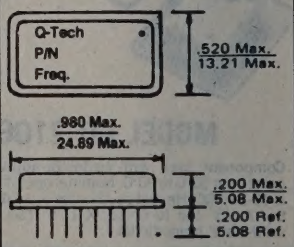
2, 6 & 7	ITP
4	GND
5	OUT
8	VCC/VDD

QT4, QT6 & QT10


Q-Tech
P/N
Freq.
.520 Max.
13.21 Max.
.880 Max.
22.40 Max.
.200 Max.
5.08 Max.
.200 Ref.
5.08 Ref.

QT4		QT6		QT10	
3, 11, 12	ITP	4, 10, 11	ITP	1	OUTPUT
4	VCC/VDD	7	GND	2	CASE
5	OUT	8	OUT	8	GND
7	GND	14	VCC/VDD	14	VCC/VDD

QT5 & QT7


Q-Tech
P/N
Freq.
.520 Max.
13.21 Max.
.980 Max.
24.89 Max.
.200 Max.
5.08 Max.
.200 Ref.
5.08 Ref.

QT5		QT7	
3, 13, 14	ITP	4	OUT
4	VCC/VDD	5, 6, 11	ITP
5	OUT	8	GND
8	GND	16	VCC/VDD

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Q-Tech Corporation

PIONEERS IN HYBRID TECHNOLOGY
STATE OF THE ART DEVELOPMENT

MINIATURE CRYSTAL CLOCK OSCILLATORS

STANDARD PACKAGES AND FREQUENCIES

Q-TECH can supply oscillators in a wide variety of package types, including TO-5 (8 lead), TO-8 (8 or 12 lead), DIP (14 or 16 lead), FLATPACK (QT21 and QT22), and LCC (QT61 and QT66). These are available over a very wide range of frequencies from fractions of a Hertz to UHF. Please consult us for your custom requirements.

FREQUENCY RANGES AVAILABLE

Package Type	Package Size	C-MOS Frequency Range	TTL Frequency Range
TO-5	QT1	50KHz to 15MHz	20KHz to 30MHz
TO-8	QT2, QT3 or QT8	300Hz to 15MHz	100Hz to 25MHz
14 Pin DIP	QT4 or QT6	.1Hz to 15MHz	.1 Hz to 60MHz
16 Pin DIP	QT5 or QT7	.1Hz to 15MHz	.1 Hz to 60MHz
20 Lead Flat Pack	QT21, QT23	1.0Hz to 15MHz	1Hz to 60MHz
16 Lead Flat Pack	QT22	50KHz to 15MHz	25KHz to 30MHz
Leadless Chip Carrier	QT61 & QT66	30KHz to 15 MHz	20KHz to 60MHz

SPECIAL PACKAGES AND ENCLOSURES

Q-TECH can provide units to unusual package requirements including miniature units withstanding 10,000 PSI and Flat Packs with less than .100 inch thickness. Ultra-thin (.065) ceramic leadless chip carrier packages available with frequencies to 60 MHz.

C-MOS CLOCK OSCILLATORS

Frequencies available in the C-MOS line of oscillators are related to input voltage. It is essential, therefore, when ordering a C-MOS unit to specify the input voltage.

Power requirements of C-MOS units are related to both frequency and input voltage. Most of the power is dissipated within the crystal oscillator portion of the device, and buffering, division, or other logic requirements within the unit contribute little to the total power consumption.

ECL/VHF/UHF CLOCKS AND SOURCES

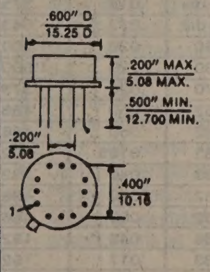
ECL and sine wave clocks and sources are available to 400 MHz.

Q-Tech can work with you to hybridize high stability and synthesized sources up to 3gHz.

Phase noise and G-Sensitivity data are taken when required. Full temperature range, −55°C to +125°C, available for these clocks and sources.

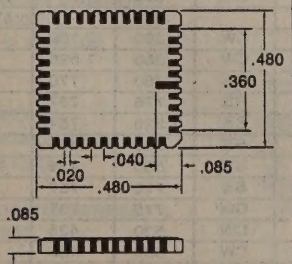
UPPER DIMENSIONS IN INCHES, LOWER DIMENSIONS IN MILLIMETERS.

QT8



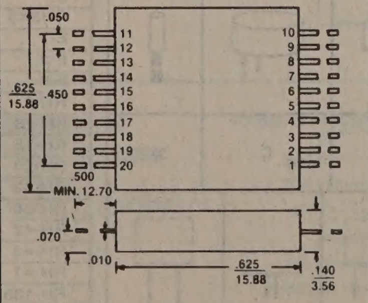
3.9 & 10	ITP
5	OUT
6	GND
12	VCC/VDD

QT66



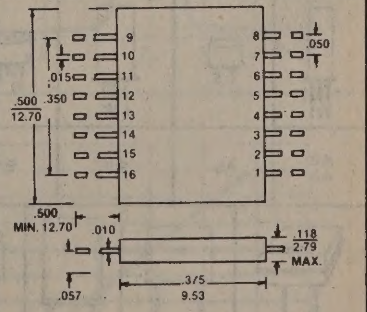
4, 10	Vcc
31, 37	GND
39	OUTPUT

QT21



7 & 16	ITP	10	GND
11	OUT	13	VCC/VDD

QT22



4 & 13	ITP	10	OUT
9	GND	8	VCC/VDD

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REEVES-HOFFMAN
Division, Dynamics Corporation of America
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

Crystal Products

Crystals of proven reliability for military and industrial applications

For 40 years, Reeves-Hoffman has been a leader in the design and manufacture of quartz crystals for government and industry. We are the only company offering the improved stability of coldweld sealing at a lower cost than conventional solder-sealed units.

All Reeves-Hoffman crystals are cut, ground, polished, plated, and mounted at the factory to exacting specifications. Shock, vibration, and hermeticity characteristics all exceed Mil-Spec C-3098. Crystals for oscillator and filter applications are available from 1 kHz to 200 MHz, with varying temperature coefficients, effective resistance, electrical equivalents, and Q values dependent on physical limitations and circuit requirements.

The staff of crystal engineers at Reeves-Hoffman welcomes the opportunity to quote on and discuss your particular application.

Ask for our free booklet, "A Specifier's Guide to Quartz Crystals," written to reduce your design problems.

Low-Frequency Crystals

1.0 to 1200 kHz in standard and miniature holders

Throughout our long history as a quality supplier of low-frequency crystals, Reeves-Hoffman has dedicated our efforts towards responding to the changing needs of the electronics industry. As miniaturization reduced the size of electronic equipment, the traditionally large low-frequency crystal became one of the largest components in the system. To respond to this, Reeves-Hoffman worked closely with the crystal users. As a result, miniature crystal holders such as the RH135, RH170, RH605, and RH3X8 were developed. This is just one example of Reeves-Hoffman's ingenuity and responsiveness to the needs of our most important asset...our customers.

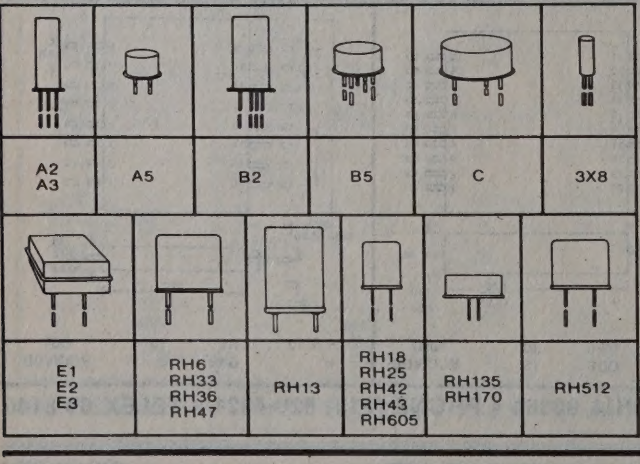
Recommended Element for Frequency Range

Frequency Range	Element
1-10 kHz	J
10-100 kHz	NT, XY
100-250 kHz	5° X
250-500 kHz	DT
500-1000 kHz	SL

The choice of element will vary. However, Reeves-Hoffman will choose the best element for your specific requirements based on cost and performance considerations.

Holder Style vs. Frequency

Frequency	Holder
1-1.4 kHz	RH13
1.4-1.8 kHz	RH13, E1, E2
1.8-20 kHz	RH13, E1, E2, B2
20-86 kHz	RH13, E1, E2, B2, RH170, RH135, A2, A3
86-150 kHz	RH36, RH47, E1, E2, RH13, B2, A2, A3, RH6, RH33, RH170
150-300 kHz	RH36, RH47, A3, E2, RH13, A2, RH6, RH33, B2, E1, E3
300-450 kHz	RH36, RH47, RH6, RH33, RH512, E3
450-900 kHz	RH42, RH43, RH18, RH25, RH36, RH47, RH512, RH6, RH33, E3
900 kHz-1.2 MHz	RH42, RH43, A5, RH18, RH25, RH36, RH47, RH512, RH6, RH33, E3, RH605



When specifying crystals, please supply the following:	Crystal Categories
1. Frequency required 2. Holder style 3. Calibration temperature/ tolerance 4. Oscillator load capacitance 5. Temperature range 6. Maximum series resistance 7. Stability over temperature	**Oscillator Crystals** • **Industrial** Aging: 5 to 25 x 10−⁶ per year • **Precision** Aging: Less than 5 x 10−⁶ per year or less than 5 x 10−⁸ per day after first 30 days. • **Military** (per Mil C-3098) **Filter Crystals** See facing page

High-Frequency Crystals

1.0 to 200.0 MHz

The use of high-frequency crystals has grown continually over the years as timing rates, tranmission frequencies, and data-processing speeds increased. Fortunately, Reeves-Hoffman is continually involved in this evolution to the extent that we possess the capabilities to respond to just about any requirement for high-frequency AT-cut crystals. In the past, many challenges have been presented to our engineering and manufacturing personnel. We are extremely proud of their response record, and look forward to working with you to continue this trend.

Frequency	Recommended overtone
1-30 MHz	AT, fundamental
20-60 MHz	AT, third overtone
60-125 MHz	AT, fifth overtone
125-160 MHz	AT, seventh overtone
160-200 MHz	AT, ninth overtone

Holder Style vs. Frequency

Frequency	Holder
1.0-2.5 MHz	RH36, RH47, E3, RH6, RH33, RH512, C
2.5-10 MHz	RH36, RH47, RH42*, RH43*, RH18*, RH25*, A5*, RH6, RH33, E3, RH512, B5, C
10-100 MHz	RH42, RH43, RH18, RH25, A5, B5, E3, RH512
100-200 MHz	RH42, RH43, RH18, RH25, A5, E3, RH512

*Contact factory for details.

Holder Specifications

Holder Type	Seal*	Max. Height	Max. Length	Max. Width	Pin Dimensions Dia.	Pin Dimensions Spacing
A-2	CW	1.550		.400 dia.	.0185	.200
A-3	CW	1.000		.400 dia.	.0185	.200
A-5	CW	.260		.400 dia.	.0185	.200
B-2	CW	1.550		.600 dia.	.0185	.282
B-5	CW	.260		.600 dia.	.0185	.282
C	CW	.350		.830 dia.	.0185	.375
RH3X8		.327		.118 dia.	.012	.043
E-1	CW	.360	2.100	..730	.020	1.000
E-2	CW	.360	1.595	.730	.020	1.000
E-3	CW	.360	.770	.770	.020	.375
RH-6	SS	.775	.757	.352	.050	.486
RH-13	SS	1.526	.757	.352	.050	.486
RH-18	SS	.530	.435	.183	.0185	.192
RH-25	SS	.530	.435	.183	.040	.192
RH-33	SS	.775	.757	.352	.030	.486
RH-36	CW	.775	.757	.352	.050	.486
RH-42	CW	.530	.435	.183	.040	.192
RH-43	CW	.530	.435	.183	.017	.192
RH-47	CW	.775	.757	.352	.030	.486
RH-135	CW	.135	.500	.135	.010	.080
RH-170	CW	.170	.500	.135	.010	.080
RH-512	SS	.650	.564	.234	.030	.275
RH-605	CW	.261	.435	.183	.017	.192

*CW=coldweld
SS=solder seal

Alternate pin configurations and locations are available.

For More Information. Circle No. 140

REEVES-HOFFMAN

Division, Dynamics Corporation of America
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

Crystal Filters

Reeves-Hoffman custom designs and manufactures passive quartz crystal filters to meet the exacting specifications of companies at the leading edge of technology.

By utilizing computer-aided design and analysis, our staff of professionals can solve your most perplexing problems. Computer controlled frequency synthesis and network analysis provide accurate testing of amplitude, phase, and delay to assure precise filter performance. Image parameter, modern network theory (Butterworth, Chebyshev, Bessel, Gaussian, Cauer) and Lerner synthesis techniques are employed to obtain the desired frequency response.

Because of Reeves-Hoffman's military approved crystal manufacturing capability, we are able to produce quartz crystals which will satisfy the demands of the filter design. The high standards of our Quality Control Department assure that both crystals and filters are manufactured and tested to applicable military specifications.

Contact our sales or engineering department; we welcome the opportunity to review your requirements.

Applications:

- Missile Guidance
- Fire Control
- Doppler Radar
- ECM/ECCM
- Satellite Communication
- Telecommunications
- Military Radios

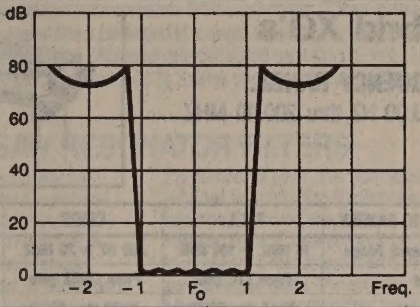
To order filters, please specify:

1. Center frequency and tolerance.
2. 3 or 6 dB bandwidth.
3. 40 or 60 dB bandwidth and frequencies at these points if asymmetric.
4. Minimum attenuation in stopband.
5. Passband ripple.
6. Insertion loss.
7. Phase or delay requirements.
8. Input and output impedance (tolerance).
9. Operating temperature range.
10. Packaging details.
11. Additional electrical and environmental specifications as required.

BAND PASS

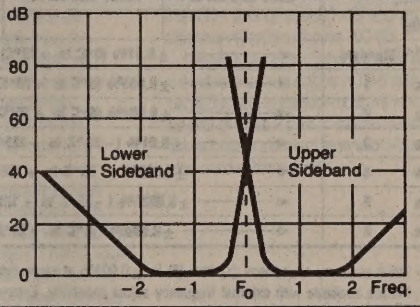
F_0: 10 KHZ to 200 MHZ
Designs:

Chebyshev	Bessel
Butterworth	Gaussian



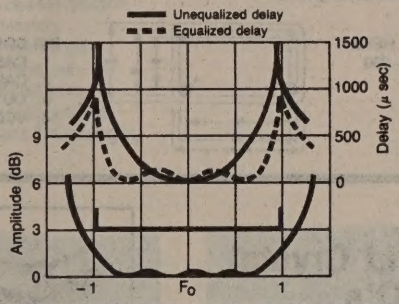
SIDE BAND

F_0: 10 KHZ to 30 MHZ
Carrier Attenuation:
According to specifications



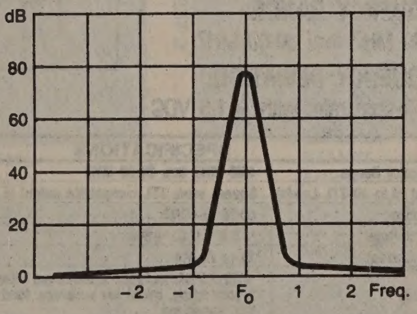
EQUALIZED DELAY FILTERS

F_0: 100 KHZ to 30 MHZ
Delay:
Equalized to specifications



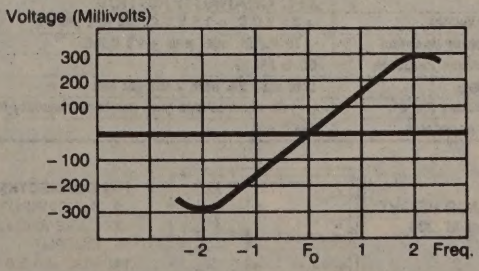
BAND REJECT

F_0: 50 KHZ to 100 MHZ
Rejection Band:
According to specifications



DISCRIMINATOR

F_0: 100 KHZ to 30 MHZ
Discrimination:
According to specifications

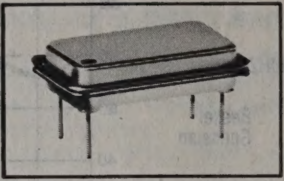


REEVES-HOFFMAN

Division, Dynamics Corporation of America
400 West North St., Carlisle, PA 17013 U.S.A.
Phone: 717-243-5929/TWX: 510-650-3510

Crystal Oscillators Hybrid

Hybrid XO's

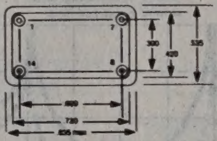


FREQUENCY RANGE:
200.00 HZ thru 200.00 MHZ

LOGIC FAMILY	T.T.L.	CMOS	ECL
Frequency Range	16 MHZ to 100 MHZ	200 HZ to 20 MHZ	3 MHZ to 200 MHZ
Output	From TTL gate	From CMOS gate	From ECL gate
Symmetry	45/55 thru 55/45	40/60 thru 60/40	45/55 thru 55/45
Stability			
△f/△T Standard	← ±0.01% (0°C to +70°C) →		
Option 1	← ±0.005% (0°C to +70°C) →		
Option 2	← ±0.001% (0°C to +70°C) →		
Option 3	← ±0.01% (−55°C to +125°C) →		
Option 4	← ±0.005% (−55°C to +125°C) →		
Option 5	← ±0.0025% (−55°C to +125°C) →		
Option 6	← ±0.0005% (0°C to +50°C) →		

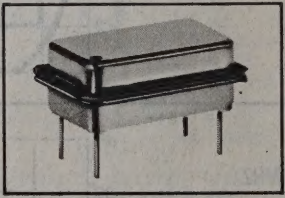
Notes: Initial accuracy on options (1) thru (6) is ±0.001% at room temp.
Models available with external frequency adjust capability. External capacitor between pin (1) and circuit ground.

PACKAGE HEIGHT
MAXIMUM .200



PIN CONNECTIONS
1. CASE & CIRCUIT GND.
7. CASE & CIRCUIT GND.
8. OUTPUT
14. VCC = +5.0 V.D.C.

TTL Hybrid Crystal VCXO's

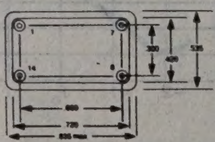


FREQUENCY RANGE:
4.00 MHZ thru 30.00 MHZ

FREQUENCY DEVIATION:
±75ppm min. with ±1.5 VDG

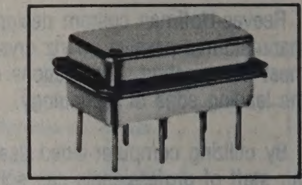
SPECIFICATIONS	
Frequency Range	4.00 MHZ thru 30.00 MHZ
Output (0 to 10 TTL Loads)	Square wave TTL compatible output is from a TTL gate
Symmetry	40/60 to 60/40
Input Voltage	+5.0 V.D.C. ±5%
Input Current	15 to 75 MA
Stability	±25 P.P.M. includes a combined effect of temperature, 1 year aging, initial set accuracy, load variations, and VCC variations.
Temperature Range	0°C to +70°C
AFC CHARACTERISTICS	
Input Voltage	+2.5 V.D.C. ±1.5 V.D.C. (On AFC pin #1)
Frequency Deviation	±75 P.P.M. min. with ±1.5 V.D.C.
Modulation Response	DC to 20KHZ
Linearity	Less than 5% from a straight line
Modulation Slope	(+) As input voltage goes positive, frequency increases
Input Impedance	50KΩ min.

PACKAGE HEIGHT
MAXIMUM .335



PIN CONNECTIONS
1. A.F.C. INPUT
7. CASE AND CIRCUIT GND.
8. OUTPUT
14. VCC = +5.0 V.D.C.

TTL Hybrid Crystal TCXO's

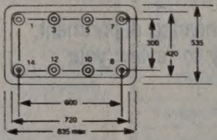


FREQUENCY RANGE:
12.50 MHZ thru 25.00 MHZ

STABILITIES: To ± 5 x 10^{-7}

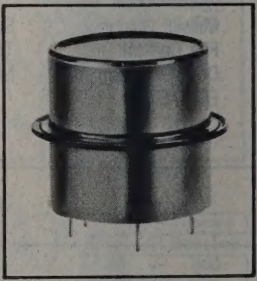
SPECIFICATIONS	
Frequency Range	12.50 MHZ thru 25.00 MHZ
Calibration	External 10K Potentiometer, ±7.0 P.P.M. Min.
Frequency Stability	
Option	△f / △Temp.
1	±2.5 P.P.M./(−35°C to +75°C)
2	±1.5 P.P.M./(−35°C to +75°C)
3	±1.0 P.P.M./(−35°C to +75°C)
4	±1.0 P.P.M./(0°C to +75°C)
5	±1.0 P.P.M./(0°C to +50°C)
6	±0.5 P.P.M./(0°C to +50°C)
△f / △B+	±0.01 P.P.M./(+10.0 ±1.0 V.D.C.)
△f / △Rl	±0.05 P.P.M./(50Ω ± 5Ω any angle)
△f / △Time	±1.0 P.P.M./year @ 40°C average
(£)	−130 dbc @ 25 KHZ
INPUT	+10.0 V.D.C. ±1.0 V.D.C./5 MA max.
OUTPUT	
Wave Shape	A-C coupled negative pulse
Amplitude	1.0 V.P.P. min. → 50Ω 3 V.P.P. max.

PACKAGE HEIGHT
MAXIMUM .335



PIN CONNECTIONS
1. REGULATED D.C.
3. ELECTRONIC FREQ. ADJ.
5. N.C. INTERNAL USE ONLY
7. CASE & CKT GROUND
8. OUTPUT
10. N.C. INTERNAL USE ONLY
12. N.C. INTERNAL USE ONLY
14. +10 V.D.C.

Hybrid OCXO's

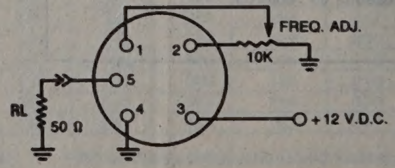


FREQUENCY RANGE:
8.00 MHZ thru 12.00 MHZ

VOLUME:
Less than 0.8 cu. in.

Frequency Range:	8.00 MHZ thru 12 MHZ.	
Output Voltage:	0dbm → 50Ω.	
Harmonic Distortion:	10% maximum.	
Stability:	△f/△Temp:	±1 x 10^{-7}/(0°C to +70°C)
	△f/△Power:	±1 x 10^{-8}/ ±10%
	△f/△RL:	±1 x 10^{-8}/ ±10%
	△f/△Time:	±1 x 10^{-8}/year after 30 days, continuous operation
Input Voltage:	+12 V.D.C. ±10%.	
Input Power:	.8W maximum at turn on. .5 watts typ at +25C after warm-up.	
Warm-Up:	30 min. max. to within ±1 x 10^{-7} of 24 hr. frequency.	
External Frequency Adj.:	External 10K potentiometer. A regulated voltage is provided for the external frequency adjustment potentiometer.	
Size:	1.00" dia. x 1.00" high (dia. at sealing ring 1.2")	

Notes: Fast warm-up units available to 3 min.
Frequency range can be extended to 20 MHZ at relaxed aging specifications.



SAW Resonator Products

Surface Acoustic Wave Technology provides performance advantages and design flexibility that has proven to be invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, low shape factor and excellent rejection. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance resonators, resonator filters, oscillators, and other state-of-the-art signal processing components such as pulse compressors, delay lines, and bandpass filter products. In addition to this broad product line, Sawtek provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other signal processing applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements at frequencies from 10 MHz to more than 1 GHz. Sawtek also designs and produces custom subsystems which incorporate SAW components. These include filter banks comprised of cascaded filters packaged in a single assembly, amplifier-filter modules with adjustable gain, and SAW resonator-controlled oscillators. Some of the common SAW resonator products produced by Sawtek and their characteristics are summarized below.

SAW RESONATORS

Sawtek offers SAW resonators at fundamental frequencies from 100 MHz to more than 1000 MHz. These are high Q components which are primarily intended to be used in oscillators and are also used for both bandpass and notch filters. Sawtek resonators are inherently spur free in oscillator applications, exhibit low motional resistance, and have a pulling range comparable to a 3rd overtone bulk wave crystal. Typical values of R_s range from 15 Ω to 150 Ω and capacitance ratios are nominally 2000:1. Incorporation of special metalization improves oscillator noise performance by permitting drive levels up to +20 dBm. These quartz devices can achieve temperature stability of less than 50 PPM from 0°C to 60°C. Both one-port and two-port configurations are available.

Sawtek maintains a large inventory of pre-tooled SAW resonator crystals including many frequencies for CATV convertor applications. New designs can also be tooled rapidly to meet custom requirements. The 668 MHz resonator shown below is representative of Sawtek's low-cost standard products.

SAW OSCILLATORS

SAW resonator-controlled oscillators are currently produced by Sawtek for military and aerospace systems. Because they are able to operate at fundamentals of over 1000 MHz, SAW oscillators simplify design, reduce cost, and improve noise performance through the elimination of multiplier stages. In many applications it is also possible to achieve adequate power in one stage to directly drive a mixer and thereby eliminate the need for a buffer/amplifier stage.

Typical of the company's oscillator products is a fixed frequency, oven stabilized SAW resonator oscillator at 740 MHz. All spurious and harmonics are down 60 dB; the short-term stability is $\pm 2.5 \times 10^{-10}$ for 1.0 to 25 second averaging times and the phase noise is 120 dBc/Hz for a 2.5 kHz offset. The frequency versus temperature stability of this miniature ovenized unit is ±2 PPM from −15° to +60°C. A maximum power consumption of only 1.75 watts at −15°C ambient is achieved. Sawtek also offers assistance in oscillator design for low-cost consumer and commercial applications and is prepared to help evaluate the suitability of SAW oscillators for each new application.

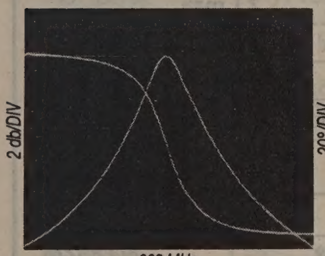
SAW RESONATOR FILTERS

SAW resonator filters provide high rejection and low loss for narrowband applications requiring 0.01% to 0.25% fractional bandwidths. This family of Sawtek's resonator filters is characterized by a "new shape" in narrowband filter technology. The unique shape demonstrated in the performance photographs below arises from the combination of transversal filter and resonator characteristics: the narrowband response produced by the resonant cavity emerges from the broader passband of the input and output transducers.

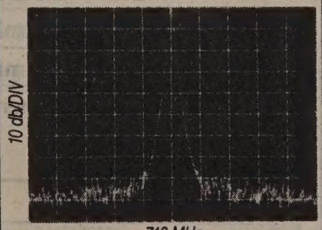
Two pole versions typically exhibit from 2 dB to 5 dB insertion loss with 15 dB to 20 dB near-in rejection and 55 dB to 75 dB ultimate rejection. The two-pole 537 MHz resonator filter shown on the left below has a matched insertion loss of only 4.5 dB, 18 dB close-in rejection, and 60 dB ultimate rejection.

Rejection which is beyond the measurable range of most test instruments can be achieved by cascading these two-pole units into multipole configurations. Depending on the number of poles, this technique provides from 20 dB to 60 dB of near-in rejection, improved shape factor and reduced flyback. Insertion loss generally increases at a rate of less than 1 dB per pole for these filters. The six pole 149.3 MHz filter on the bottom right has an insertion loss of only 5.7 dB and an ultimate rejection of over 100 dB.

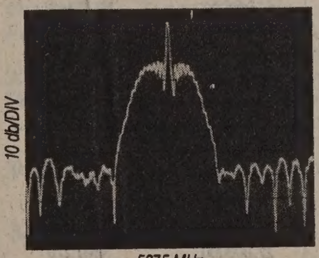
Sawtek's resonator filters are provided in individual two-pole stages in TO-8 and TO-5 packages and in custom modules when several of these 2 pole units are cascaded. Sawtek offers standard resonator filters and also rapid custom design.



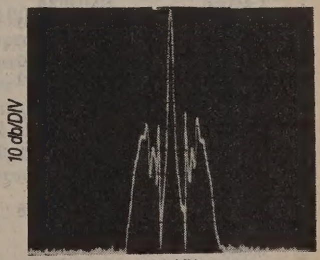
668 MHz
85 KHz/DIV



740 MHz
1 KHz/DIV



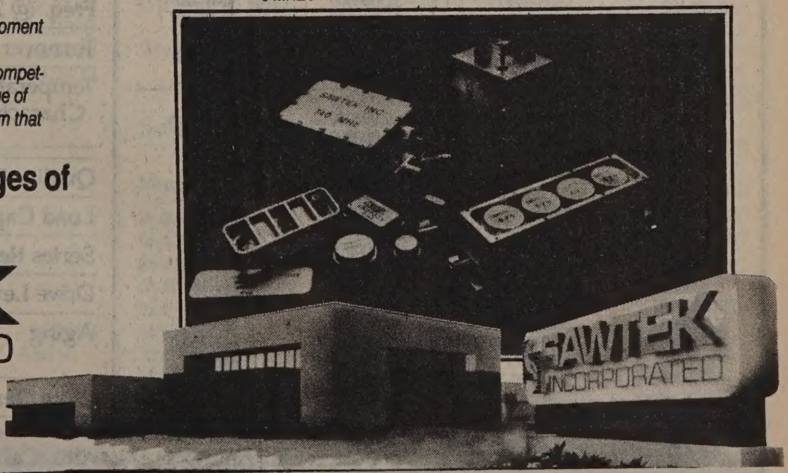
537.5 MHz
5 MHz/DIV



149.3 MHz
1.5 MHz/DIV

Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price in production quantities. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.

When your system demands the advantages of SAW Technology . . . Demand Sawtek.



SAWTEK
INCORPORATED

P.O. Box 18000, Dept. GB, Orlando, FL 32860, (305) 886-8860

..SaRonix....

NYMPH™

Quartz Crystal Units
- Microprocessors
- Communications
- Telecommunications
- Toys & games
- Computers & peripherals
- Instruments

Tuning Fork Crystals
- Clocks & watches
- Computer circuits
- Timers
- Pacemakers

Quartz Crystals

SaRonix offers a broad line of crystal products with the best combination of price, quality, delivery, and service available. We carry a large stock of commonly used crystals, and feature rapid turnaround time on special units and large production runs.

In addition to the industry standard holders, many special configurations and a wide range of miniature units are available. We provide back-up stock for all scheduled orders.

Send your drawings and specifications, or call our Customer Service Department for ordering assistance and availability. Toll free (800) 227-8974

Standard Microprocessor

The accompanying selection chart lists NYMPH AT-cut quartz crystals for most common microprocessor applications. Frequencies, configurations, and circuit calibration conditions shown are those in general industry usage or are as recommended by the various microprocessor manufacturers.

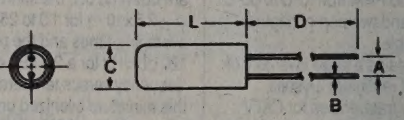
FREQUENCY MHZ	NYMPH PART NUMBER
HC-33/U	
1.000000	NYP010-13
1.000000	NMP010
1.843200	NYP018-13
1.843200	NMP018
2.000000	NYP020-20
2.000000	NMP020
2.097152	NYP021-20
2.457600	NYP024-32
2.457600	NMP024
3.579545	NYP035-18
3.579545	NYP035-18S*
HC-18/U	
1.000000	NMP010A
1.843200	NMP018A
2.000000	NYP020A-20
2.000000	NMP020A
2.097152	NYP021A-20
2.457600	NYP024A-20
2.457600	NMP024A
3.000000	NYP030A-30
3.000000	NMP030A
3.276800	NYP032A-15
3.276800	NMP032A
3.330000	NMP033A
3.579545	NYP035A-18
3.579545	NMP035A
3.600000	NYP036-30
3.600000	NMP036
3.686400	NYP037-20
3.686400	NMP037
3.932160	NYP039-12
3.932160	NMP039
4.000000	NYP040-20
4.000000	NMP040
4.194303	NYP041-12
4.433619	NYP044-20
4.915200	NMP049
5.000000	NYP050-20
5.068800	NMP051
5.185000	NYP052-20
5.714300	NMP057
5.990400	NMP059
6.000000	NMP060
6.144000	NYP061-30
6.400000	NYP064-20
6.553600	NMP065
7.000000	NMP070
7.159090	NYP071-20
7.372800	NMP073
8.000000	NYP080-18
HC-18/U	
8.000000	NMP080
9.216000	NMP092
9.830400	NMP098
10.000000	NMP100
10.738635	NYP107-32
10.738635	NMP107
11.000000	NMP110
11.059200	NMP111
12.000000	NMP120
12.288000	NMP122
13.516800	NMP135
14.318180	NMP143
14.745600	NMP147
15.000000	NMP150
16.000000	NMP160
16.384000	NMP163
17.360000	NMP173
18.000000	NMP180
18.432000	NMP184
19.354000	NMP193
19.660800	NMP196
20.000000	NMP200
22.118400	NMP221
23.400000	NMP234
24.000000	NMP240
24.576000	NYP245-18
25.000000	NMP250
27.000000	NMP270
30.000000	NMP300
32.000000	NMP320
36.000000	NMP360
40.000000	NMP400
48.000000	NMP480
HC-44/U	
6.000000	44N060
8.000000	44N080
10.000000	44N100
12.000000	44N120
12.500000	44N125
14.318180	44N143
14.400000	44N144
15.000000	44N150
16.000000	44N160
18.000000	44N180
18.432000	44N184
19.354000	44N193
19.660800	44N196
20.000000	44N200
22.118400	44N221
24.000000	44N240
25.000000	44N250

*Special .375" lead spacing

Tuning Forks

The NYMPH tuning fork type quartz crystal provides the circuit designer with the ultimate in size, performance, and economic trade-offs. This highly reliable, stable, and accurate device is available in two micro-miniature sizes for time base applications operating from a 32.768 KHz reference frequency.

Dimensions



	Part Number	
	NTF3238	**NTF3226**
A	1.1±0.2	0.8±0.1
B	0.3±0.07	0.2±0.05
C	3.1 max	2.1 max
L	8.3 max	7.0 max
D	9.0 min	5.0 min

Dimensions in mm

Electrical Specifications

	Part Number	
	NTF3238	**NTF3226**
Freq. @ 25°C	32.768 KHz ± 20 ppm	
Turnover Temp.	25°C±5°C	
Temperature Characteristic-K	−0.038 ppm/°C² Typical ($\Delta f/f=K(T_o-T)^2$ where T=pt. of temperature comparison)	
Quality Factor	100,000, Typical	90,000 Typical
Load Cap.	9.5 to 15pF, Typical	
Series Resist.	30 K ohms max.	40 K ohms max.
Drive Level	10 μW Max	
Aging	First 30 Days: 3.0 ppm First Year: 5.0 ppm	
Optg. Temp.	−10 to +60°C	

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..SaRonix....

NYMPH™

Crystal Clock Oscillators

- TTL
- CMOS
- Baud Rate Generator
- MPU Clock Driver
- Special Output Characteristics
- Selectable Frequency Outputs

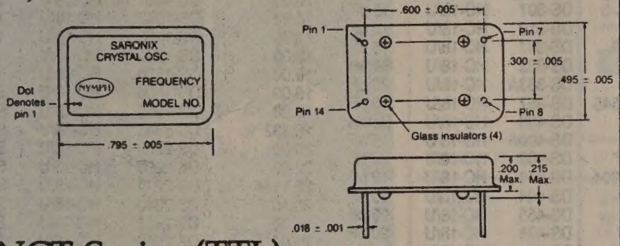
Physically and functionally interchangeable with all major manufacturers' devices.

Crystal Clock Oscillators

Fixed Frequency

The SaRonix NYMPH crystal clock oscillator family includes a wide variety of state-of-the-art thick film hybrid devices for generating TTL, CMOS, Baud Rates, and special output characteristics.

These devices are packaged in a 14 pin DIP compatible, all metal, resistance welded, hermetic unit. They are physically and functionally interchangeable with all major manufacturer's devices.



NCT Series (TTL)

Freq. Range:	250 kHz – 60 MHz
Freq. Stability:	±0.0025 to ±1.00% over optg. temp. & voltage
Optg. Temp. Range:	0 to +70°C
Input Voltage:	+5 VDC ± 0.5 V
TTL Output:	
Symmetry:	60/40 to 40/60 @1.4 VDC Level
Rise & Fall Times:	15 ns Max. for 250 kHz to 25 MHz, 7 ns Max. for 25 MHz to 60 MHz
"O" Level:	+0.4 Volts
"I" Level:	+2.4 Volts
Output Load:	1 to 10 TTL gates

Standard TTL Frequencies (Available from stock)

Part No.	Freq. (MHz)	Part No.	Freq. (MHz)
NCT040C	1.0000	NCT050C	10.0000
NCT040C	1.8432	NCT050C	12.0000
NCT040C	2.0000	NCT050C	16.0000
NCT040C	2.4576	NCT050C	18.4320
NCT050C	4.0000	NCT050C	19.6608
NCT050C	5.0000	NCT050C	20.0000
NCT050C	5.0688	NCT070C	22.1184
NCT050C	6.0000	NCT070C	24.0000
NCT050C	6.1440	NCT070C	32.0000
NCT050C	8.0000	NCT070C	40.0000

NCC Series (CMOS)

Freq. Range:	600 Hz – 8 MHz
Freq. Stability:	±0.0025 to ±1.00% over optg. temp. & voltage
Optg. Temp. Range:	0 to +70°C
Input Voltage:	(V_{DD}) +4.5 VDC to +12 VDC
CMOS Output:	
Symmetry:	60/40 to 40/60 @ ½V_{cc}
Fall:	140 ns max. @ V_{DD} = +5 VDC $\}$ R_L +200 KΩ 50 ns max. @ V_{DD} = +12 VDC $\}$ C_L +50 pf
"O" Level:	+0.2 V 50 KΩ load to V_{DD}
"I" Level:	(V_{DD}−0.2)V 50 KΩ load to com.

Selectable Frequency

The 8600 Series is a unique family of hybrid oscillators which combines a quartz crystal unit with CMOS circuitry in a 16 pin DIP package. By appropriate selection of six leads, 57 different output frequencies may be generated from the base frequency of the crystal.

8640 Series

Frequency Characteristics

Output Freq. Range:	1 MHz ~ 0.0042 Hz
Freq. Tolerance:	±100 ppm
Aging:	±10 ppm/year
Volt. Coefficient:	Typical 10, max. 40 ppm/V
Turnover Temp.:	Min. 15, typical 30, max. 45°C
Temp. Coefficient:	Typical 0.03, max. 0.05 ppm/°C

Maximum Ratings

Supply Voltage:	−0.3 to +10 V
Operating Temp.:	−10 to +70°C
Storage Temp.:	−30 to +85°C

8650/8651 Series

Frequency Characteristics

Output Freq. Range:	130 KHz ~ 0.00025 Hz
Freq. Tolerance:	8650: ± 50 ppm 8651: ± 5 ppm
Aging:	± 3 ppm/year
Volt. Coefficient:	Typical 2 ppm/V
Turnover Temp.:	8650: Typical 25°C 8651: Min. 20, typical 25, max. 30°C
Temp. Coefficient:	Min. 0.03, typical 0.035, max. 0.04 ppm/°C²

Maximum Ratings

Supply Voltage:	−0.3 to +8 V
Operating Temp.:	8650: −10 to +70°C 8651: −10 to +60°C
Storage Temp.:	8650: −30 to +80°C 8651: −10 to +70°C

Selection Chart

Model	Output Frequency Range	Frequency Tolerance
8640-A	600 KHz — 0.005 Hz	± 100 ppm
8640-B	1 MHz — 0.0083 Hz	± 100 ppm
8640-C	768 KHz — 0.0064 Hz	± 100 ppm
8640-O	Dividing IC Only	
8640-P	50,60 Hz Only	± 100 ppm
8650-A	60 KHz — 0.0005 Hz	± 50 ppm
8650-B	100 KHz — 0.00083 Hz	± 50 ppm
8651-A	60KHz — 0.0005 Hz	± 5 ppm
8651-B	100 KHz — 0.00083 Hz	± 5 ppm

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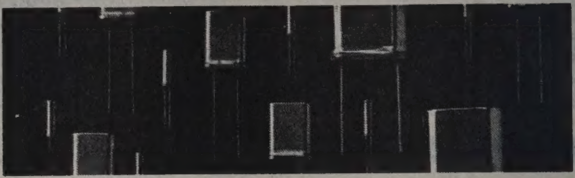
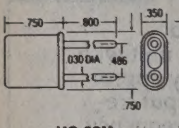
SEIKO INSTRUMENTS

STANDARD CRYSTALS/OSCILLATORS

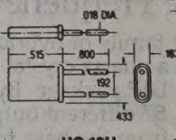
QUARTZ CRYSTALS

Seiko Instruments offers a wide range of high quality, competitively priced quartz crystals. These units are particularly well suited for microprocessors, peripherals, clocks, and other time-based applications where small size, temperature stability, and high reliability are required.

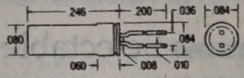




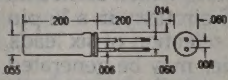
HC-33U
1.0 ~ 10.0 MHz



HC-18U
1.2 ~ 120.0 MHz



DS-VT-200
32.768 KHz



DS-VT-150
32.768 KHz

QUARTZ CRYSTAL SPECIFICATIONS

	HC-33U	HC-18U	DS-VT-150	DS-VT-200
Frequency Range	1—3 MHz	3—120 MHz	32.768 KHz	
Frequency Tolerance	±.002% at 25°C			
Temp. Stability	±.005%			
Temp. Range	0°C to 70°C		−10°C to +60°C	
ES Resistance	1 MHz Range 500Ω 2 MHz Range 300Ω	3 MHz Range 250Ω 4 MHz & above. 100Ω	30KΩ	50KΩ
Drive Level	50μW to 5mW		1.0μW Max.	0.4μW Max.
Shunt-Capacitance	7 pF Max.		0.86 pF Max.	
Storage Temp.	−55°C to 105°C		−30°C to +70°C	

STANDARD FREQUENCY LIST

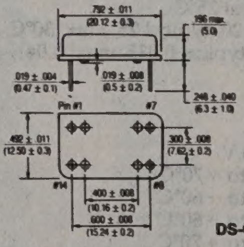
FREQ.	PART #	CASE	LOAD CAP.
1.000 MHz	DS-100	HC-33/U	16 pF
1.73	DS-173	IC-33/U	Series
1.8432	DS-184	HC-33/U	16 pF
2.00	DS-200	HC-33/U	16 pF
2.097152	DS-209	HC-33/U	16 pF
2.4576	DS-245	HC-33/U	32 pF
2.50	DS-250	HC-33/U	Series
3.00	DS-300	HC-18/U	16 pF
3.072	DS-307	HC-18/U	18 pF
3.12	DS-312	HC-18/U	12 pF
3.2768	DS-327	HC-18/U	16 pF
3.330	DS-333	HC-18/U	Series
3.330	DS-333A	HC-18/U	20 pF
3.579545	DS-357	HC-18/U	16 pF
4.00	DS-400	HC-18/U	Series
4.00	DS-400A	HC-18/U	16 pF
4.032*	DS-403	HC-18/U	22 pF
4.194304	DS-419	HC-18/U	16 pF
4.440	DS-444	HC-18/U	20 pF
4.550	DS-455	HC-18/U	20 pF
4.750	DS-475	HC-18/U	20 pF
4.9152	DS-491	HC-18/U	Series
4.9562	DS-495	HC-18/U	Series
5.000	DS-500	HC-18/U	20 pF
5.0688	DS-506	HC-18/U	Series
5.120	DS-512	HC-18/U	Series
5.1850	DS-518	HC-18/U	20 pF
5.5850	DS-558	HC-18/U	Series
5.5870	DS-558A	HC-18/U	20 pF

*Special Spec.

FREQ.	PART #	CASE	LOAD CAP.
6.00 MHz	DS-600	HC-18/U	Series
6.144	DS-614	HC-18/U	30 pF
6.250	DS-625	HC-18/U	16 pF
6.400	DS-640	HC-18/U	16 pF
6.5536	DS-655	HC-18/U	16 pF
8.00	DS-800	HC-18/U	Series
8.00	DS-800A	HC-18/U	18 pF
8.33	DS-833	HC-18/U	Series
10.00	DS-1000	HC-18/U	Series
10.92	DS-1092	HC-18/U	10 pF
11.00	DS-1100	HC-18/U	10 pF
12.00	DS-1200	HC-18/U	10 pF
15.00	DS-1500	HC-18/U	10 pF
16.00	DS-1600	HC-18/U	Series
18.00	DS-1800	HC-18/U	Series
18.432	DS-1843	HC-18/U	Series
20.00	DS-2000	HC-18/U	Series
22.00	DS-2200	HC-18/U	Series
22.1184	DS-2211	HC-18/U	Series
23.40	DS-2340	HC-18/U	Series
24.00	DS-2400	HC-18/U	Series
25.00	DS-2500	HC-18/U	Series
27.00	DS-2700	HC-18/U	Series
32.00	DS-3200	HC-18/U	Series
36.00	DS-3600	HC-18/U	Series
48.00	DS-4800	HC-18/U	Series
32.768 KHz	DS-VT-200	6.2 x 2.0 mm (cylindrical)	6 pF
32.768 KHz	DS-VT-150	5.1 x 1.5 mm (cylindrical)	6 pF

CRYSTAL OSCILLATORS

Seiko Instruments clock oscillators provide all metal, hermetically sealed cases; notably low power consumption; and tight frequency stability for the most demanding applications and reliability. Units are TTL or CMOS compatible.



DS-C304A

SPECIFICATIONS

STANDARD	DS-C304A
Frequency Range	250 KHz to 50 MHz
Frequency Stability	±.007% @ 25°C
Temperature Stability	±.001%
Temperature Range	0°C to 70°C
Storage Temperature	−55°C to +125°C
Input Voltage	+5.0 ±0.5V dc
Input Current	90mA over temp. range
Symmetry	60/40% @ 1.4V dc
Rise and fall time	15 ns maximum (250 KHz–8.999 MHz) 10 ns maximum (9.0 MHz–31.999 MHz) 6 ns maximum (32 MHz–50 MHz)
Output Load	1 to 10 TTL gates

STANDARD FREQUENCY LIST

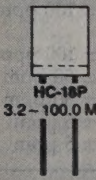
FREQ.	* STOCK #	FREQ.	* STOCK #
1.0	DSC100	10.000	DSC1000
1.2288	DSC122	12.000	DSC1200
1.8432	DSC184	16.000	DSC1600
2.0	DSC200	16.384	DSC1638
2.4576	DSC245	18.432	DSC1843
4.0	DSC400	19.6608	DSC1966
4.9152	DSC491	20.000	DSC2000
5.000	DSC500	22.1184	DSC2211
5.0688	DSC506	24.000	DSC2400
6.00	DSC600	25.000	DSC2500
6.144	DSC614	32.000	DSC3200
7.3728	DSC737	40.000	DSC4000
8.000	DSC800		

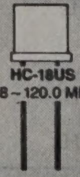
* Part No. DS-C304A.

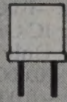
CUSTOM CRYSTALS/OSCILLATORS

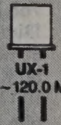
QUARTZ CRYSTALS

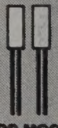
Seiko Instruments also offers the following custom cases for your special quartz crystal engineering needs. Plus, the smallest MHz quartz crystal units in the world…the DS-MGQ series with a frequency range of 1 to 3 MHz, and a temperature stability of ±5 ppm from −30 to +70°C.


HC-18P
3.2 ~ 100.0 MHz


HC-18US
1.8 ~ 120.0 MHz


HC-25US
1.8 ~ 120.0 MHz


UX-1
1.8 ~ 120.0 MHz


DS-MGQ
1.0 ~ 3.0 MHz

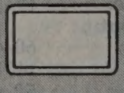
38C/39C
3.2 ~ 10.0 MHz

43U
3.0 ~ 20.0 MHz

CRYSTAL OSCILLATORS

Seiko Instruments also offers tight tolerance oscillators in the cases shown below. Call for complete details.

DS-C308
0.5 ~ 64.0 Hz
3.0 ~ 16.0 MHz


DS-C304
250KHz ~ 50.0 MHz

DS-C303
3.0 ~ 24.0 MHz

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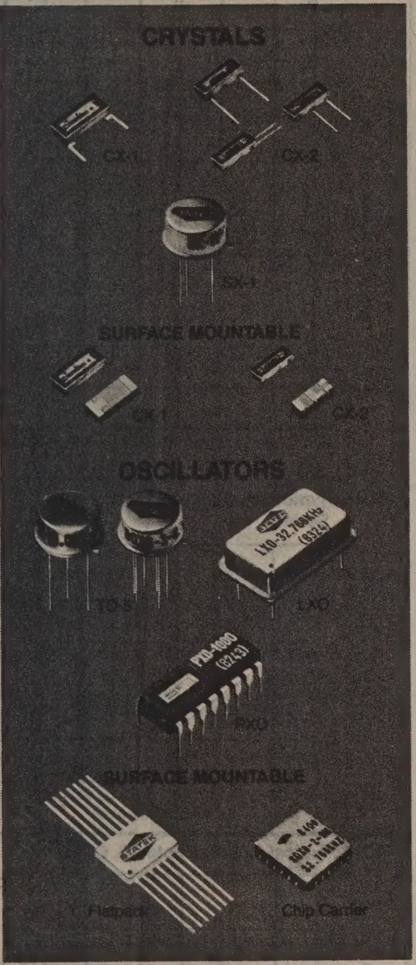
STATEK



Statek has the most complete line of miniature, low-frequency quartz crystals and crystal oscillators in the world!

0.0006 Hz to 2 MHz

Quartz Crystals: 10 kHz to 2 MHz • High accuracy • Produced in volume by photolithography • Low aging • High Q • Rugged, hermetically sealed ceramic package • Designed for hybrid or PC board packaging.

Quartz Crystal Oscillators: Miniature (TO-5) series • Low power series • Programmable, multi-frequency series • CMOS/TTL compatible series • Very low frequency series.

Miniature Quartz Crystals
CX Series

SHORT FORM CATALOG

10 kHz to 2 MHz

Statek's CX Series crystals consist of a miniature quartz resonator, hermetically sealed in a rugged, ceramic package.

Types Available (See Table 1)

The CX Series is available in two case sizes: CX-1 and CX-2. The CX-1 is available from 10 kHz to 2 MHz and the CX-2 is available from 16 kHz to 2 MHz.

"H" models are designed for series (two cascaded inverters) oscillators. "V" models are designed for Pierce (single inverter) oscillator applications. See Table 1 for case size and configuration options and other special features.

TABLE 1: Miniature Low-Frequency Crystal Selection Chart: CX Series

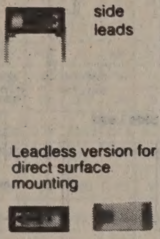
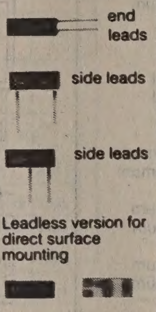
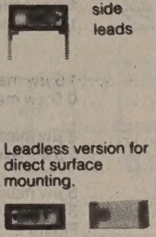
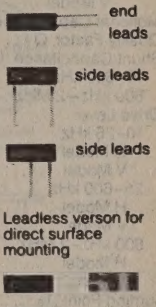
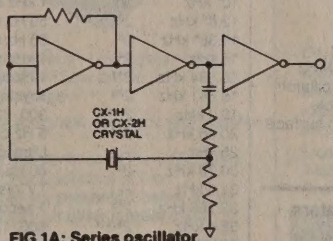
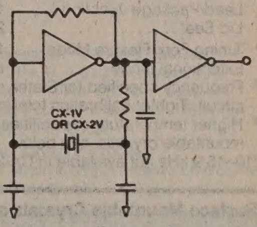
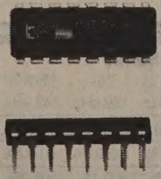
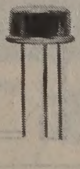
SERIES	CX-1H SERIES	CX-2H SERIES	CX-1V SERIES	CX-2V SERIES
PACKAGE AND LEAD CONFIGURATIONS AVAILABLE. (Photos are actual size.)	 side leads Leadless version for direct surface mounting top bottom	 end leads side leads side leads Leadless version for direct surface mounting top bottom	 side leads Leadless version for direct surface mounting. top bottom	 end leads side leads side leads Leadless version for direct surface mounting top bottom
FREQUENCY RANGE	10 kHz to 2 MHz	16 kHz to 2 MHz	10 kHz to 2 MHz	16 kHz to 2 MHz
PRINCIPAL FEATURES	Standard IC lead spacing: 0.300 in. (7.62mm)	Smallest possible size for dense PC board or hybrid packaging	Standard IC lead spacing: 0.300 in. (7.62mm)	Smallest possible size for dense PC board or hybrid packaging.
OTHER SPECIAL FEATURES	• H Series designed for long service/ storage life • High reliability		• V Series designed for lowest possible power consumption • High stability • Ideal for battery-operated applications	
OSCILLATOR CIRCUIT	 CX-1H OR CX-2H CRYSTAL FIG 1A: Series oscillator with CX-1H or CX-2H		 CX-1V OR CX-2V FIG 1B: Pierce oscillator with CX-1V or CX-2V	

TABLE 2: Low Frequency Crystal Oscillator Selection Chart

SERIES	PXO SERIES	LXO SERIES	SQXO-2 SERIES	LQXO-4 SERIES	DQXO-3 SERIES
PRINCIPAL FEATURES	Generates 57 discrete, programmable frequencies from one crystal	• High accuracy • Low aging • Low power	• TTL and CMOS compatible • TO-5 package	• Low power • CMOS compatible • TO-5 package	• Low frequency oscillator/timer • TO-5 package
PACKAGE STYLE (Photos are actual size.)	 16-pin DIP	 4-pin metal case—pins on 14-pin DIP centers	 TO-5	 TO-5	 TO-5
FREQUENCY RANGE	0.002 Hz to 2 MHz	10 kHz to 2 MHz	10 kHz to 2 MHz	10 kHz to 2 MHz	0.0006 Hz to 10 kHz

MORE

STATEK CORPORATION 512 N. Main, Orange, CA 92668 Telephone (714) 639-7810 Telex 67 8394 TWX 910-593-1355

STATEK Miniature Low-Frequency Quartz Crystals

TABLE 3: CX Series Specifications 10 kHz to 2 MHz

Specifications are typical at 25°C unless otherwise noted. Specifications subject to change without notice.

Frequency (see Table 4)[1]	10 kHz to 2 MHz*
Calibration Tolerance[2] (see Table 5)	A, B or C Tolerance
Motional Resistance, R_1	Figure 4
Maximum:	
10–169 kHz	2 x typical
170–600 kHz	2.5 x typical
600 kHz–2 MHz	
H Model	5 KΩ maximum
V Model	3 KΩ maximum
Motional Capacitance, C_1	Figure 5
Quality Factor, Q	Figure 6
Shunt Capacitance, C_0	
10–600 kHz	1.4 pf typical
600 kHz–2 MHz	1.0 pf typical
Drive Level	
10–25 kHz	
H Model	1.5 μw maximum
V Model	0.5 μw maximum
25–600 kHz	
H Model	3 μw maximum
V Model	1 μw maximum
600 kHz–2 MHz	
H Model	5 μw maximum
V Model	3 μw maximum
Turning Point, T_0	Figure 7
Temperature Coefficient, K	−0.035 (ppm/°C²)
Aging, first year	
10–600 kHz	5ppm maximum
600 kHz–2 MHz	10ppm maximum
Shock Survival	
10–600 kHz	1000g, 1ms, ½ sine
600 kHz–2 MHz	750g, 1ms, ½ sine
Vibration Survival	
10–600 kHz	20g rms, 10–2000 Hz
600 kHz–2 MHz	10g rms, 10–2000 Hz
Operating Temperature	
Industrial	−40 to +85°C
Military	−55 to +125°C
Storage Temperature	−55 to +125°C
Maximum Temperature[3]	
Lead/Package Junction	175°C
Lid Seal	210°C

[1] Tuning Fork Flexure Mode .... 10–600 kHz
Extentional Mode .... 600 kHz–2 MHz

[2] Frequency specified for Statek standard oscillator circuit. Tighter calibration tolerances available.

[3] Higher temperature capabilities available in surface mountable crystals, see below.

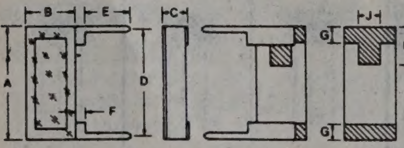
*10–15.9 kHz not available in CX-2 case size.

Surface Mountable Crystals and Oscillators

CX-1 and CX-2 Series crystals are available in higher-temperature leadless versions for surface mounting. SQXO-2 Series oscillators are available in a 24-pin leadless ceramic chip carrier for surface mounting. Surface-mountable crystals are designated CX-1 (H or V)-SM or CX-2 (H or V)-SM, and surface-mountable oscillators are designated SQXO-2-SM.

All Statek surface-mountable devices are designed for use with vapor phase solder reflow processes and wave solder processes up to 260°C. See individual data sheets for specifications.

FIG 2A: Dimensions and case styles— CX-1 Series



DIM.	IN.	MM	NOTES
A	0.330	8.38	Max
B	0.155	3.94	Max
C	0.080	2.03	Max
D	0.300 ± 0.01	7.62 ± 0.25	
E	0.125	3.23	Min
F	0.040	1.02	Max
G	0.045	1.14	Nom
H	0.105	2.67	Nom
J	0.060	1.52	Nom

Leads 0.010″ x 0.018″ (0.25 x 0.46 mm) nom.

FIG 2B: Dimensions and case styles— CX-2 Series

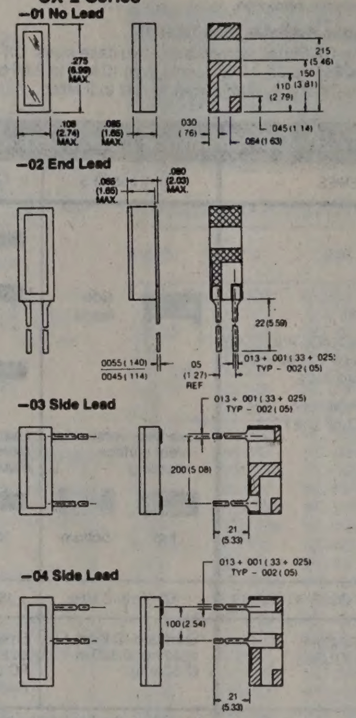


TABLE 4: Standard Frequencies, CX Series

FREQUENCY	COMMON DIVISION	APPLICATION
10* kHz	10	1 kHz audio
12.8* kHz	2^8	50 Hz time base
15.36* kHz	2^8	60 Hz time base
16 kHz	2^4	1 kHz audio
16.384 kHz	2^{14}	1 Hz time base
18.641 kHz	2^{26}	1cycle per hour
19.2 kHz	$2^{6,5,4}$	300, 600, 1200 baud modem
20.48 kHz	2^{12}	5 Hz clock motor
25 kHz	–	Ultrasonic alarm transducer
30.72 kHz	2^9	60 Hz time base
31.5 kHz	–	T.V. raster
32.768 kHz	2^{15}	1 second time base
38.4 kHz	$2^{6,5,4}$	600, 1200, 2400 baud modem
40 kHz	–	Ultrasonic alarm transducer
40.96 kHz	2^{12}	10 Hz clock motor
60 kHz	–	WWVB PLL
76.8 kHz	$2^{6,5,4}$	1200, 2400, 4800 baud modem
100 kHz	–	Calibrator
153.6 kHz	$2^{6,5,4}$	2400, 4800, 9600 baud modem
240 kHz	2^7	Motor control
307.2 kHz	$2^{7,6,5}$	2400, 4800, 9600 baud modem
500 kHz	–	Microprocessor
1 MHz	–	Microprocessor
1.048576 MHz	2^{20}	Microprocessor, real time clock
1.2288 MHz	–	Microprocessor, baud rate generator

*CX-1 only

TABLE 5: Calibration tolerances at 25°, CX Series

CALI-BRATION	10–74.9 kHz	75–169 kHz	170–249 kHz	250–600 kHz	600 kHz–2 MHz
A	±0.003%	±0.005%	±0.01%	±0.02%	±0.05%
B	±0.01%	±0.01%	±0.02%	±0.05%	±0.1%
C	±0.1%	±0.1%	±0.2%	±0.5%	±1.0%

FIG 3: Equivalent circuit, CX Series

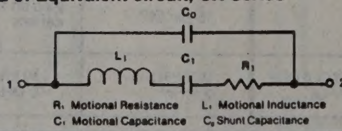

C_0
L_1
C_1
R_1
1
2
R_1 Motional Resistance
L_1 Motional Inductance
C_1 Motional Capacitance
C_0 Shunt Capacitance

FIG. 4: Typical Motional Resistance R_1, CX Series

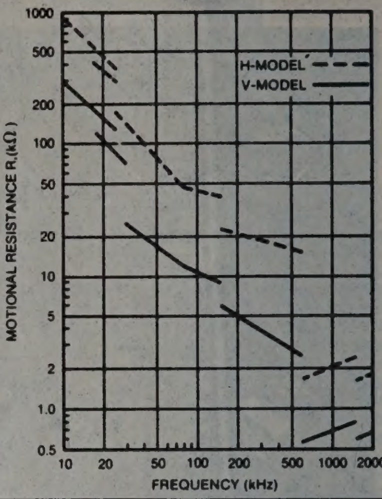


FIG. 5: Typical Motional Capacitance C_1, CX Series

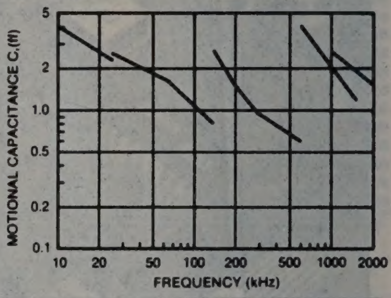


FIG. 6: Typical Quality Factor Q, CX Series

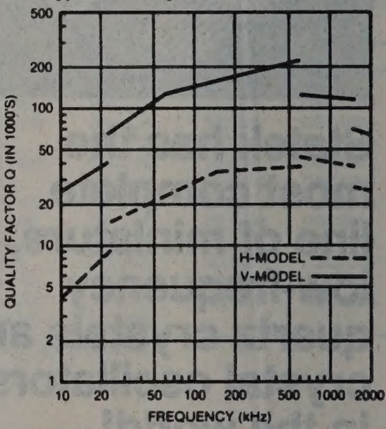
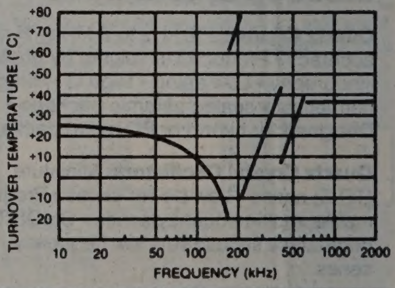


FIG. 7: Typical Turning Point Temperature, CX Series.



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and Quartz Crystal Oscillators

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Low-Frequency Quartz Crystal Oscillators

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PXO Series

0.002 Hz to 2 MHz

PXO-768

Generates 57 discrete, programmable frequencies from a single crystal • Packaged in standard 16-pin DIP • Low power • Low aging • TTL compatible.
All frequencies generated are derived from a single built-in quartz crystal oscillator and exhibit the same high levels of accuracy and stability as those of the base frequency.

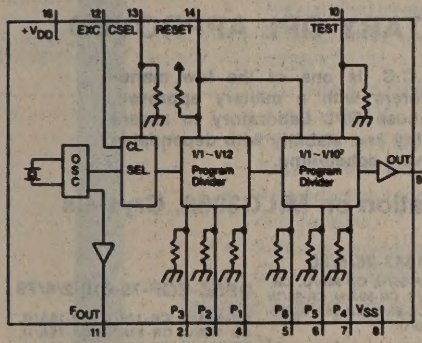
Standard calibration tolerance for PXO 32768.A: ±10 ppm, All others ±100 ppm. Tighter tolerances available • Frequency stability: ±0.015%*, −10 to +70°C • Supply voltage 4-6V • Supply current 1 mA max • Rise time: 70 nsec typ • Fall time: 30 nsec typ • Aging: 10 ppm max first year.
*Does not include calibration tolerance

Standard Frequency Ranges, PXO Series*

MODEL	BASE FREQUENCY	OUTPUT FREQUENCY RANGE
PXO-32768	327.68 kHz	0.00273 Hz to 327.68 kHz
PXO-600	600 kHz	0.005 Hz to 600 kHz
PXO-768	768 kHz	0.0064 Hz to 768 kHz
PXO-1000	1 MHz	0.0083 Hz to 1 MHz

*Other frequencies available. Consult factory.

Block Diagram, PXO Series



Pin Functions, PXO Series

Prog 1 through Prog 6 control divide ratio of base frequency.

P_1	P_2	P_3	DIVIDING RATIO	P_4	P_5	P_6	DIVIDING RATIO
0	0	0	1/1	0	0	0	1/1
0	0	1	1/10	0	0	1	1/10
0	1	0	1/2	0	1	0	$1/10^2$
0	1	1	1/3	0	1	1	$1/10^3$
1	0	0	1/4	1	0	0	$1/10^4$
1	0	1	1/5	1	0	1	$1/10^5$
1	1	0	1/6	1	1	0	$1/10^6$
1	1	1	1/12	1	1	1	$1/10^7$

OUT:	Supplies programmed output frequency with rectangular pulse shape (50% duty cycle).
TEST:	Setting this terminal Hi multiplies programmed output frequency by 1,000, except when programmed divide ratio is less than 1/1000.
F_{OUT}:	Supplies base frequency of internal crystal oscillator.
EXC:	Input for counting external clock instead of internal clock.
CSEL:	Clock select. Setting this terminal Hi causes the divider to count the frequency of an external clock instead of the internal clock.
RESET:	Setting this terminal Lo resets all counters and sets output switches to Lo.

(All inputs except EXC and RESET have internal pull-down resistor. RESET has pull-up resistor.)

Output Frequencies, PXO Series

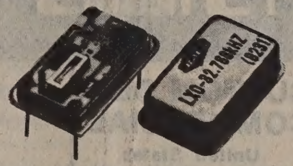
Example—Model PXO-1000
UNIT: Hz

PROGRAM PIN SETTINGS		P4	0	0	0	0	1	1	1	1
		P5	0	0	1	1	0	0	1	1
		P6	0	1	0	1	0	1	0	1
P1	P2	P3								
0	0	0	1M	100K	10K	1K	100	10	1	0.1
0	0	1	100K	10K	1K	100	10	1	0.1	0.01
0	1	0	500K	50K	5K	500	50	5	0.5	0.05
0	1	1	*333.$\dot{3}$K	33.$\dot{3}$K	3.$\dot{3}$K	333.$\dot{3}$	33.$\dot{3}$	3.$\dot{3}$	0.3$\dot{3}$	0.03$\dot{3}$
1	0	0	250K	25K	2.5K	250	25	2.5	0.25	0.025
1	0	1	**200K	20K	2K	200	20	2	0.2	0.02
1	1	0	166.$\dot{6}$K	16.$\dot{6}$K	1.$\dot{6}$K	166.$\dot{6}$	16.$\dot{6}$	1.6$\dot{6}$	0.1$\dot{6}$	0.01$\dot{6}$
1	1	1	83.$\dot{3}$K	8.$\dot{3}$K	833.$\dot{3}$	83.$\dot{3}$	8.$\dot{3}$	0.8$\dot{3}$	0.08$\dot{3}$	0.008$\dot{3}$

*33% duty cycle **40% duty cycle

High Accuracy Crystal Oscillators
LXO Series

10 kHz to 2 MHz

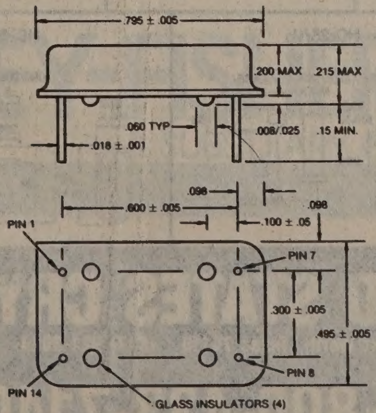


Laser tuned for high accuracy • Low aging • Low power • CMOS compatible • Low profile, hermetically-sealed package.

The LXO Series has the highest accuracy and stability of all Statek oscillators.
Specifications and characteristics of the LXO Series vary with frequency. Characteristics of the LXO-32.768 kHz model are presented below as an example. Contact factory for other frequencies.

Standard calibration tolerances: A: ±10 ppm; B: ±25 ppm; C: ±200 ppm. Tighter tolerances available • Frequency stability: −0.012%, −20 to +70°C* • Supply voltage: 3-6V • Rise time: 1.0 µsec max • Fall time: 1.0 µsec max • Supply current: 50 µA typical at 5V, 20 µA typical at 3V • Aging: 1 ppm/yr typical, 3 ppm max.
*Does not include calibration tolerance.

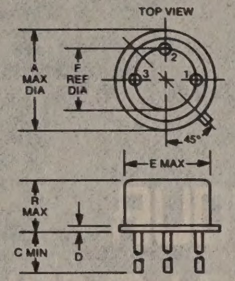
Package Dimensions (inches), LXO Series



Miniature Quartz Crystal Oscillators

Statek manufactures three series of oscillators in TO-5 packages: SQXO-2 Series, LQXO-4 Series and DQXO-3 Series. They all have these features in common:
Laser tuning for high accuracy • hybrid construction • low aging • operating temperature: industrial: −40 to +85°C; military: −55 to +125°C • Shock (survival): 1000g. 1msec., ½ sine • vibration (survival): 10g rms, 10-2000 Hz.

TO-5 Dimensions



PIN	CONNECTION	DIM	INCHES	MILLIMETERS
1	V_{CD}	A	0.362	9.19
2	Output	B	0.185	4.70
3	Gnd.	C	0.500	12.70
		D	0.029	0.74
		E	0.326	8.28
		F	0.200	5.08

1. All metal parts are gold plated.
2. Leads are 0.019" (0.48mm) dia. max.

Miniature Quartz Crystal Oscillators
SQXO-2 Series

10 kHz to 2 MHz

TTL and CMOS compatible • Standard calibration tolerances: A: ±0.01%, B: ±0.03% • Frequency stability: ±0.02% typ., −40 to +85°C* • Supply voltage: 4-6V • Supply current: 200µA-3mA • Standard frequencies: same as CX-1 crystal.

*Does not include calibration tolerance
Also available in 24-pin leadless ceramic chip carrier. See SQXO-2-SM Data Sheet.

Miniature Quartz Crystal Oscillators: Low Power
LQXO-4 Series

10 kHz to 2 MHz

Low power • CMOS compatible • Standard calibration tolerance: A: ±0.01%, B: ±0.03%, • Frequency stability: ±0.02% typ., −40 to +85°C* • Supply voltage: 4-6V • Supply current: 25µA-1.5mA • Standard frequencies: same as CX-1 crystal.

*Does not include calibration tolerance

Miniature Quartz Crystal Oscillators Timers: Low Frequency
DQXO-3 Series

2 pulses/hr to 10 kHz*

CMOS compatible • Low power • Standard calibration tolerances: A: ±0.01%; B: 0.03% • Frequency stability: ±0.02% typ., −40 to +85°C** • Supply voltage: 4-6V • Supply current: 50 µA-3mA.
*Lower frequencies available
**Does not include calibration tolerance.
Also available in 24-pin leadless ceramic chip carrier. See DQXO-3-SM Data Sheet.

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The frequencies listed are only a few of the popular frequencies carried in stock. Typical specifications:

Frequency range 1.000 to 100.000 Mhz
Frequency tolerance ± .002% @ 25° C
Holder size: 1.000 to 3.999 Mhz HC33/u
Holder size: 4.000 to 100 Mhz....... HC18/u
All made at series resonant unless otherwise specified.

IN STOCK FREQUENCIES

1.000, 1.8432, 2.0000, 2.0100, 2.097152, 2.4576, 2.667, 3.0000, 3.2000, 3.2768, 3.5795, 4.0000, 4.1943, 4.9152, 5.0000, 5.0688, 5.1850, 5.7143, 6.0000, 6.144, 6.400, 6.5536, 8.0000, 10.0000, 14.318, 14.391, 18.0000, 18.4320, 20.0000, 22.1184, 27.0000, 32.0000, 36.0000, 48.0000

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United States Crystal Corp. has the largest inventories in the U.S. on A.T. cut semi-finish blanks from 1.000 Mhz to 250 Mhz, from fundamental mode to 9th overtone polished crystals, non-oven and oven types. Over 250,000 Crystals Finished and Semi - finished in Stock.

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PTSS (C. Wright, 513-255-2579)

CR-148/U,CR-52A/U,CR-65/U

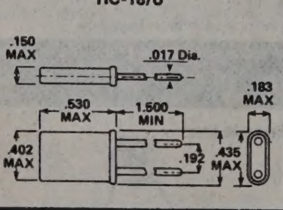
PTESS (C. Wright, 513-255-2579)

CR-116/U, CR-110A/U, CR-98/U, CR-107/U, CR-123/U, CR-122/U, CR-105/U, CR-149/U, CR-151/U

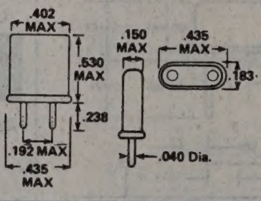
DESC-EQP-79-610-2/4/79

CR-69A/U, CR-106/U, CR-18A/U, CR-140/U, CR-36A/U, CR-76A/U, CR-78A/U, CR-139/U, CR-58A/U, CR-89/U, CR-27A/U, CR-77/U, CR-64/U, CR-85/U, CR-19A/U, CR-6A/U, CR-35A/U, CR-67A/U, CR-79/U, CR-130/U, CR-117/U, CR-5A/U, CR-28A/U, CR-81/U, CR-97/U, CR-125/U, CR-55A/U, CR-8A/U, CR-131/U, CR-84/U, CR-60A/U, CR-119/U, CR-72/U, CR-62/U, CR-61/U

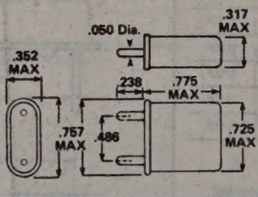
HC-18/U


.150 MAX
.017 Dia.
.183 MAX
.530 MAX
1.500 MIN
.402 MAX
.192
.435 MAX

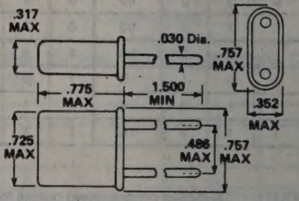
HC-25/U


.402 MAX
.150 MAX
.435 MAX
.530 MAX
.183
.238
.192 MAX
.435 MAX
.040 Dia.

HC-6/U


.050 Dia.
.317 MAX
.352 MAX
.238
.775 MAX
.757 MAX
.486
.725 MAX

HC-33/U


.317 MAX
.030 Dia.
.757 MAX
.775 MAX
1.500 MIN
.352 MAX
.725 MAX
.486 MAX
.757 MAX

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- ***Microprocessor Crystals*** from 1.0 to 48.0 MHz for all applications in the miniature HC-18/U holder and larger HC-33/U holder. Low effective series resistance, calibrated at series or parallel, with frequency tolerance of ± 0.005% @ +25°C, stability tolerance of ± .01% from −20°C to +70°C, and static capacitance, C_o, of 7.0pf maximum. Third lead optional.
- ***Hi-Reliability Crystals*** for use in sophisticated communication systems, advanced military and space applications, and high performance commercial oscillators, TCXO, VCXO, and OXO. Cold weld vacuum sealed with a maximum leak rate of 5×10^{-9} atmos, cc/sec of helium. Superior thermal aging 3 or 4 point crystal mounts for shock resistance. Setting tolerances as low as 1PPM for A-T cut. Also available in low frequencies from 15 KHz to 1.0 MHz using NT, 5°, X, DT, CT, or SL cuts.
- ***Filter Crystals*** to eliminate unwanted spurious responses. Typically to −45db minimum in the fundamental mode, −35db in the third overtone mode, and −25db in the fifth overtone mode. Up to 120,000 Q maximum. Frequencies from 5 to 150 MHz in resistance or cold weld sealed packages.

HYBRID CLOCK OSCILLATORS

- Frequencies from 0.25 to 70.0 MHz
- Space saving miniature DIP package (0.8″ × 0.5″ × 0.2″). Resistance welded.
- Five standard frequency stabilities: ± 0.0025%, ± 0.005%, ± 0.01%, ± 0.05%, ± 0.25%.
- Three standard operating temperature ranges: 0°C to 70°C, −40°C to +85°C, −55°C to +125°C.
- TTL output to drive 1 to 10 gates. 60/40 to 40/60 symmetry @ 1.4 VDC level. Input voltage of +5 volts DC ± 10%.
- TTL/TTL or TTL/CMOS dual output.
- Available with pin 7 grounded to case or full 14 pin utilization.
- All production processes, including the manufacture of the thick film substrate, controlled in our own facilities.
- In-house environmental, mechanical, and electrical testing to MIL-STD-883B and MIL-STD-202 available.

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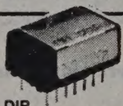
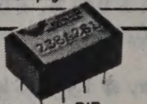
VECTRON TTL Clock Oscillators

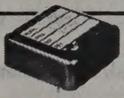
QPL'd to MIL-O-55310/16

	PCB MOUNT	DIP COMPATIBLE	
Series	CO-231 CO-231H	CO-238 CO-234	CO-401 (4 pins) CO-402 (14 pins)
Features	*Broadest range of frequencies & options*	*Vectron's lowest price DIP clocks*	*0.2" high, full MIL CO-402 is QPL'd*
Frequency	CO-231: 1 Hz-75 MHz CO-231H: 75.1-100 MHz	CO-238: 16 KHz-100 MHz CO-234: 16 KHz-30 MHz	16 KHz-100 MHz
Output	Drives 10 TTL loads (above 50 MHz, drives 2 Schottky loads).		
Supply	5VDC ± 5% at 30-90 ma depending upon frequency.		
Accuracy (at 25°C)	CO-231: ± 10 ppm *CO-231T: ± 1 ppm CO-231H: ± 10 ppm *CO-231HT: ± 1 ppm	CO-23□A: ± 50 ppm CO-23□C: ± 25 ppm CO-23□D: ± 15 ppm CO-23□B: ± 10 ppm *CO-23□T: ± 1 ppm height: 8 = 0.35" 4 = 0.28"	CO-40□A: ± 50 ppm CO-40□C: ± 25 ppm CO-40□D: ± 15 ppm CO-40□B: ± 10 ppm **CO-40□E: ± 1 ppm 1 = 4 pin base 2 = 14 pin base **Set to ± 1 ppm via external capacitor (< 20 MHz only)
	*Tuning settable to ± 1 ppm; available only in CO-238T to 30 MHz, and CO-231T to 100 MHz.		
Stability	STANDARD: 0°C to + 70°C: ± 25ppm Option 1: − 55°C to + 85°C: ± 50ppm Option 2: − 55°C to + 125°C: ± 50ppm (N/A > 70MHz, except for CO-231) Option 3: 0°C to + 50°C: ± 3ppm (N/A in CO-401 or CO-402) Option 4: 0°C to + 50°C: ± 1ppm (only for CO-231, 12KHz-20MHz) Option 5: 0°C to + 50°C: ± 5ppm Option 6: 0°C to + 50°C: ± 10ppm Option 7: − 55°C to + 125°C: ± 100ppm (N/A > 70 MHz, except for CO-231) ***Option 8: 0°C to + 70°C: ± 100ppm (N/A in CO-401 or CO-402) ***Option 9: − 55°C to + 200°C: ± 300ppm (only for CO-401/402 in 4-20MHz range) Option Y: Aging improved from 5 to 1 ppm/yr typical (CO-231/CO-238 only). ***Includes initial accuracy; do not specify A, B, C, D, E or T accuracy.		
Size	1½" x 1½" x ½"	CO-238: 0.5" x 0.8" x 0.35" CO-234: 0.5" x 0.8" x 0.28"	0.5" x 0.8" x 0.2"
Package	metal can, epoxy base Option C: solder sealed case, ⅝" high	epoxy case Option C: solder sealed case	resistance welded metal case
Environment	See chart on next page		

CO-400 SERIES


DIP epoxy case


DIP solder sealed case "C"


PCB MOUNT

VECTRON ECL Clock Oscillators

	PCB MOUNT		DIP COMPATIBLE	
Series	CO-233ME CO-233MEH	CO-533KE CO-533ME	CO-633	CO-431 (4 pins) CO-432 (14 pins)
Features	*Wide range of options*	*Sub-nanosecond 100K ECL*	*DIP to 200 MHz*	*Lowest profile (0.2") MIL design*
Frequency	ME: 5-149.9 MHz MEH: 150-200 MHz	150-500 MHz	5-200 MHz	5-150 MHz
Output	ECL	100K ECL	ECL	ECL
Supply	− 5.2V	CO-533KE: − 4.5V CO-533ME: − 5.2V	− 5.2V	− 5.2V
Accuracy (at 25°C)	CO-233ME: ± 10 ppm *CO-233MET: ± 1 ppm CO-233MEHA: ± 50 ppm CO-233MEHB: ± 10 ppm	CO-533ME: ± 10 ppm CO-533KE: ± 10 ppm *CO-533MET: ± 1 ppm *CO-533KET: ± 1 ppm	CO-633A: ± 50 ppm CO-633C: ± 25 ppm CO-633D: ± 15 ppm CO-633B: ± 10 ppm	CO-43□A: ± 50 ppm CO-43□C: ± 25 ppm CO-43□D: ± 15 ppm CO-43□B: ± 10 ppm 1 for 4 pins 2 for 14 pins
	*Tuning settable to ± 1 ppm			
Stability	STANDARD: 0°C to + 70°C: ± 25ppm Option 1: − 55°C to + 85°C: ± 50ppm (− 30/ + 85°C above 110 MHz; 0/85°C for 100K ECL) Option 2: − 55°C to + 125°C: ± 50ppm (N/A above 110 MHz) Option 3: 0°C to + 50°C: ± 3ppm (N/A in CO-431/432 or above 150 MHz) Option 5: 0°C to + 50°C: ± 5ppm Option 6: 0°C to + 50°C: ± 10ppm Option 7: − 55°C to + 125°C: ± 100ppm (N/A above 110 MHz) **Option 8: 0°C to + 70°C: ± 100ppm (N/A in CO-431/432) Option Y: Aging improved from 5 to 1 ppm/yr typical (N/A in CO-431/432, or above 125 MHz in CO-233/CO-633) **Includes initial accuracy; do not specify A, B, C, D or T accuracy.			
Size	1½" x 1½" x ⅝"	2" x 3" x ¾"	.5" x .8" x .42"	.5" x .8" x .2"
Package	metal case "C" option for fully sealed	fully sealed metal case	epoxy case "C" option for fully sealed	resistance welded case
Environment	See chart on next page			

VECTRON CMOS Clock Oscillators

	PCB MOUNT	LOW PROFILE DIP PACKAGE		
Series	CO-236	CO-411 (4 pins) CO-412 (14 pins)	CO-421 (4 pins) CO-422 (14 pins)	CO-441 (4 pins) CO-442 (14 pins)
		QPL'd to MIL-O-55310/18		
Features	*Broadest range of options*	*Standard CMOS 8-15V supply*	*Standard CMOS 5V supply*	*High Speed CMOS 5V supply*
Frequency	.01 Hz-15 MHz	1 Hz-15 MHz	1 Hz-8 MHz	1 Hz-50 MHz
Output	Standard CMOS	Standard CMOS	Standard CMOS	High Speed CMOS
Supply	5-15VDC	8-15VDC	5VDC	5VDC (3VDC optional to 20 MHz)
Accuracy (at 25°C)	CO-236: ± 10 ppm *CO-236T: ± 1 ppm *Tuning settable to ± 1 ppm	CO-41□A: ± 50 ppm CO-41□C: ± 25 ppm CO-41□D: ± 15 ppm CO-41□B: ± 10 ppm **CO-41□E: ± 1 ppm	CO-42□A: ± 50 ppm CO-42□C: ± 25 ppm CO-42□D: ± 15 ppm CO-42□B: ± 10 ppm **CO-42□E: ± 1 ppm	CO-44□A: ± 50 ppm CO-44□C: ± 25 ppm CO-44□D: ± 15 ppm CO-44□B: ± 10 ppm **CO-44□E: ± 1 ppm
		1 for 4 pin base, 2 for 14 pin base **E option allows setting via external capacitor (≤ 20 MHz only)		
Stability	STANDARD: 0°C to + 70°C: ± 25ppm Option 1: − 55°C to + 85°C: ± 50ppm Option 2: − 55°C to + 125°C: ± 50ppm Option 3: 0°C to + 50°C: ± 3ppm (only available in CO-236) Option 4: 0°C to + 50°C: ± 1ppm (only available in CO-236, specify supply voltage) Option 5: 0°C to + 50°C: ± 5ppm Option 6: 0°C to + 50°C: ± 10ppm Option 7: − 55°C to + 125°C: ± 100ppm ***Option 8: 0°C to + 70°C: ± 100ppm (only available in CO-236) ***Option 9: − 55°C to + 200°C: ± 300ppm (N/A in CO-236 or above 20 MHz in CO-441/442) Option Y: Aging improved from 5 to 1 ppm/yr typical (CO-236 only). ***Includes initial accuracy; do not specify A, B, C, D, E or T accuracy.			
Size	1½" x 1½" x ½"	0.5" x 0.8" x 0.2"		
Package	Metal can epoxy base. Option C: solder sealed case, .68" high	resistance welded metal case		
Environment	See chart on next page			

HOW TO ORDER VECTRON CLOCK OSCILLATORS

CO-400 SERIES

CO-4□□□ – □□ at □

TTL; 5V = 0
Standard CMOS; 8-15V = 1
Standard CMOS; 5V = 2
ECL; − 5.2V = 3
Hi-Speed CMOS; 5V = 4

4 pin base = 1
14 pin base = 2

Initial accuracy at 25°C (A, B, C, D, or E)

Temperature stability (0 for standard, or option 1, 2, 5, 6, 7 or 9)

*Screen test option (X, B, C, or D)

Frequency

*SCREEN TEST	MIL STD 883 METHOD	Standard LEVEL X	Options LEVEL C	LEVEL D	LEVEL B
Internal Visual	2017	X	X	X	X
Stabilization Bake (24 Hours @ 150°C)	1008, Cond C	X	X	X	X
Seal Test (Gross and Fine)	1014	X	X	X	X
Temperature Cycling (Thermal shock)	1010, Cond B		X	X	X
Burn-in, operating 168 hours @ 125°C	—			X	X
Acceleration (5000g in Y_1 axis)	2001, Cond A				X
			Complies with Class C Screen Test requirements of MIL-O-55310/16 & MIL-O-55310/18		Complies with Class B Screen Test requirements of MIL-O-55310/16 & MIL-O-55310/18

All other clock oscillator types

CO-□ □ – □□□ at □

Basic Model

*Accuracy/tuning (A, B, C, D or T)

*Stability option (1, 2, 3, 4, 5, 6, 7 or 8)

*Y for improved aging

*C for solder sealed case

Frequency

*leave blank if not applicable to your requirement

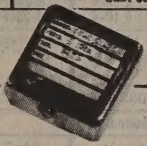
VECTRON

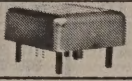
Sinewave Oscillators

50 Hz — 1 GHz

(for higher stability see TCXO and Oven Sections)

	Low Frequency CO-281	VHF CO-233 SERIES	UHF CO-283W	VHF High Power CO-284W
Frequency:	50 Hz-4 MHz	4 MHz-500 MHz	500.1-1000 MHz	4-500 MHz
Output Level:	Std: 1 vrms/1KΩ Opt: 0.5 vrms/50Ω above 10 KHz	Standard: 0.5 vrms/50Ω (+ 7 dBm) Option R: 1 vrms/50Ω (+13 dBm)	Standard: 0.5 vrms/50Ω (+ 7 dBm) Option R: 1 vrms/50Ω (+13 dBm)	1 watt/50Ω (+30 dBm) to 250 MHz 0.5 watt/50Ω (+27 dBm), 250-500 MHz
Supply:	+15 VDC. Any supply in 15-28 VDC range optional; supply less than 15 VDC subject to reduced output level			+15 VDC (+24 VDC optional to 300 MHz)
Accuracy:	±10 ppm at 25°C. Add "T" to model number for tuning adjustment with setability of ±1 ppm			
Stability:	**Standard:** 0°C to + 70°C: ±.0025% Option 1: −55°C to + 85°C: ±.005% Option 2: −55°C to +125°C: ±.005% (N/A for CO-283W or CO-284W) Option 3: 0°C to + 50°C: ±.0003% (N/A for CO-284W) Option 4: 0°C to + 50°C: ±.0001% (only for CO-281) Option 5: 0°C to + 50°C: ±.0005% Option 6: 0°C to + 50°C: ±.001% Option Y: Aging improved from 5 ppm/year typical to 2 ppm/year			
Noise:		−125 dB/Hz at 1 KHz and −150 dB/Hz at 50 KHz, typical to 100 MHz. 6 dB degradation per octave above 100 MHz		
Size:	2" x 2" x ¾" 51 x 51 x 19 mm pins for pcb mount	CO-233: 5-149 MHz, 1½" x ½" x ⅝", pins for pcb mount CO-233H: 150-300 MHz, 1½" x ½" x ⅝", pins for pcb mount CO-233FW: 4-500 MHz, 2" x 2" x ¾", chassis mount with SMA output connector (SMC or BNC optional)	2" x 3" x ¾" (51 x 76 x 19 mm) Chassis mount with SMA output connector For SMC connector, replace "W" with "U" For BNC connector, replace "W" with "X"	2" x 3" x ¾" (51 x 76 x 19 mm) Chassis mount with SMA output connector For SMC connector, replace "W" with "U" For BNC connector, replace "W" with "X"





Environmental Characteristics of Vectron Oscillators

	CO-400 SERIES LOW PROFILE CLOCKS	ALL OTHER MODELS
Operating Temperature	Per temperature stability specification (from +15/+35°C to −55/+200°C depending upon model and option selected)	
Storage Temperature	−55°C to +125°C	−55°C to +85°C (+125°C optional)
Shock	100g 6msec per MIL-STD-202 Method 213, Condition C	Standard: MIL-STD-202, Method 213, Condition J (30g, 11msec) Optional: same as left column for most types
Vibration	sine—20g to 2 KHz per MIL-STD-202 Method 204, Condition D . . . and random—20grms to 2 KHz per MIL-STD-202 Method 214, Condition I-F	Standard: MIL-STD-202, Method 201A plus 5g to 500 Hz Optional: same as left column for most types
Humidity	100% per MIL-STD-202, Method 103, Condition B	All models: 95%, no condensation Sealed models: same as left column
Seal	Hermetic per MIL-STD-883, Method 1014, 10^{-8} atm cc/second	Sealed models: MIL-STD-202, Method 112, Condition D N/A to non-sealed models
Altitude	Sea level to space	Sea level to space

NOTE: Vectron has produced oscillators for airborne, shipboard, manpack, mobile, spacecraft, rocket and missile applications.

About Vectron . . .

Facility

Vectron is housed in a new 60,000 square foot facility in which engineering, manufacturing and quality control have at their disposal the most advanced equipment and instrumentation available, including:

- Hybrid manufacturing and clean room facilities.
- Master frequency standard, internally calibrated to the National Bureau of Standards, from which reference signals are distributed to every test station.
- Automated test system comprised of a network of more than 70 temperature chambers controlled by a series of central computers.
- Scientific computer for engineering circuit design, analysis and data reduction.
- Environmental test laboratory including humidity, acceleration, shock, sinusoidal vibration, and random vibration equipment.

Military and Space Programs

Military and space applications represent approximately forty percent of Vectron's business. A few among the many vehicles and programs for which Vectron has delivered oscillators are the following:

Shipboard:	AEGIS, MARISAT, OMEGA, TERRIER M, NAVSTAR, TRIDENT, MARK-48 TORPEDO.
Aircraft:	F14, F16, P2V, P3V, B52, E2C, P3C.
Missile:	ATHENA H., PAVE-STRIKE
Spacecraft:	SKYLAB, SPACE SHUTTLE, GPS.
Manpack:	PRC-70, PRC-104, PRC-113.

Our quality control program meets the requirements of MIL-I-45208 and MIL-Q-9858 and our equipment calibration program conforms to MIL-C-45662.

VECTRON

VECTRON LABORATORIES, INC. The CRYSTAL OSCILLATOR COMPANY

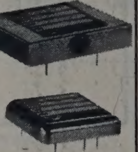
166 Glover Avenue, Norwalk, CT 06850 • Telephone: 203/853-4433 • TWX: 710/468-3796

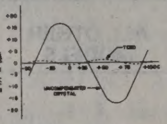
For More Information, Circle No. 147

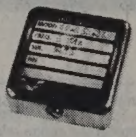
VECTRON TCXOs Temperature Compensated Crystal Oscillators

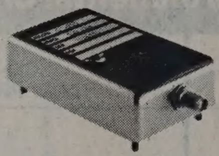
	50 Hz to 20 MHz		20+ MHz to 140 MHz	140 MHz to 420 MHz	420 MHz to 600 MHz
Temperature Stability:	**CO-251 SERIES** Moderate Stability Lower Cost	**CO-252 SERIES** High Stability	**CO-254 SERIES**	**CO-255 SERIES**	**CO-256 SERIES**
(Temp. Range **A**) +15°C to +35°C:	**CO-251A57:** ±5 x 10-7 **CO-251A27:** ±2 x 10-7	**CO-252A17:** ±1 x 10-7 **CO-252A58:** ±5 x 10-8	**CO-254A57:** ±5 x 10-7 **CO-254A17:** ±1 x 10-7	**CO-255A57:** ±5 x 10-7 **CO-255A17:** ±1 x 10-7	**CO-256A57:** ±5 x 10-7 **CO-256A17:** ±1 x 10-7
(Temp. Range **B**) 0°C to +50°C:	**CO-251B16:** ±1 x 10-6	**CO-252B57:** ±5 x 10-7 **CO-252B27:** ±2 x 10-7 **CO-252B17:** ±1 x 10-7	**CO-254B16:** ±1 x 10-6 **CO-254B57:** ±5 x 10-7 **CO-254B27:** ±2 x 10-7	**CO-255B16:** ±1 x 10-6 **CO-255B57:** ±5 x 10-7 **CO-255B27:** ±2 x 10-7	**CO-256B16:** ±1 x 10-6 **CO-256B57:** ±5 x 10-7 **CO-256B27:** ±2 x 10-7
(Temp. Range **C**) 0°C to +70°C:	**CO-251C36:** ±3 x 10-6	**CO-252C16:** ±1 x 10-6 **CO-252C57:** ±5 x 10-7 **CO-252C37:** ±3 x 10-7	**CO-254C36:** ±3 x 10-6 **CO-254C16:** ±1 x 10-6 **CO-254C37:** ±3 x 10-7	**CO-255C36:** ±3 x 10-6 **CO-255C16:** ±1 x 10-6 **CO-255C37:** ±3 x 10-7	**CO-256C36:** ±3 x 10-6 **CO-256C16:** ±1 x 10-6 **CO-256C37:** ±3 x 10-7
(Temp. Range **D**) −20°C to +70°C:	**CO-251D56:** ±5 x 10-6	**CO-252D16:** ±1 x 10-6 **CO-252D57:** ±5 x 10-7	**CO-254D56:** ±5 x 10-6 **CO-254D16:** ±1 x 10-6 **CO-254D57:** ±5 x 10-7	**CO-255D56:** ±5 x 10-6 **CO-255D16:** ±1 x 10-6 **CO-255D57:** ±5 x 10-7	**CO-256D56:** ±5 x 10-6 **CO-256D16:** ±1 x 10-6 **CO-256D57:** ±5 x 10-7
(Temp. Range **E**) −40°C to +75°C:	**CO-251E15:** ±1 x 10-5	**CO-252E56:** ±5 x 10-6 **CO-252E26:** ±2 x 10-6 **CO-252E16:** ±1 x 10-6	**CO-254E56:** ±5 x 10-6 **CO-254E26:** ±2 x 10-6 **CO-254E16:** ±1 x 10-6	**CO-255E56:** ±5 x 10-6 **CO-255E26:** ±2 x 10-6 **CO-255E16:** ±1 x 10-6	**CO-256E56:** ±5 x 10-6 **CO-256E26:** ±2 x 10-6 **CO-256E16:** ±1 x 10-6
(Temp. Range **F**) −55°C to +85°C: (Higher temperature operation available)	**CO-251F25:** ±2 x 10-5	**CO-252F56:** ±5 x 10-6 **CO-252F26:** ±2 x 10-6 **CO-252F16:** ±1 x 10-6	**CO-254F56:** ±5 x 10-6 **CO-254F26:** ±2 x 10-6 **CO-254F16:** ±1 x 10-6	**CO-255F56:** ±5 x 10-6 **CO-255F26:** ±2 x 10-6 **CO-255F16:** ±1 x 10-6	**CO-256F56:** ±5 x 10-6 **CO-256F26:** ±2 x 10-6 **CO-256F16:** ±1 x 10-6
Output Level & Frequency:	TTL: 50 Hz -20 MHz CMOS: 50 Hz -15 MHz SINE: 1 MHz-20 MHz		SINE: 20 MHz-140 MHz TTL: 20 MHz-100 MHz ECL: 20 MHz-140 MHz	SINE: 140 MHz-420 MHz ECL: 140 MHz-280 MHz	SINE: 420 MHz-600 MHz
Supply:	Any supply voltage in 5-28 VDC range; current as low as 3 ma for some models			12-28 VDC	12-28 VDC
Frequency Adjustment:	Screwdriver adjustment, setable to 1 x 10-7. Electronic tuning (TC/VCXO) capability optional.				
Aging Rate:	5 x 10-7 to 1 x 10-6 per year		1 to 2 x 10-6/year	1 to 2 x 10-6/year	1 to 2 x 10-6/year
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm) smaller size available		2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 3″ x ¾″ (51 x 76 x 19 mm)	2″ x 4″ x ¾″ (51 x 102 x 19 mm)

Low profile **MIL HYBRID TCXOs** are now available from Vectron. While more expensive than our standard TCXO line, these offer package size as small as 1.5″ x 1.5″ x 0.3″ (38 x 38 x 8 mm). The CO-258/259 Series are available with CMOS output from 400 Hz to 15 MHz, or TTL output from 20 KHz to 70 MHz. Please contact factory or your local representative for details.







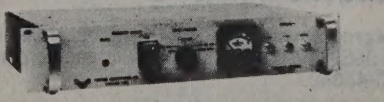


Selecting Basic Model:

1. Determine appropriate column by frequency desired.
2. Determine appropriate row by operating temperature range desired.
3. Select a basic model from those available at the desired frequency and temperature range.
4. Specify supply voltage, output level and whether pcb mount or chassis mount with rf connector.

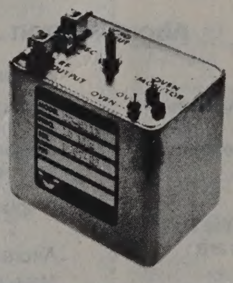
VECTRON Frequency Standards

Model:	**FS-321B**	**FS-323A**
Aging Rate:	3×10^{-10} per day at time of shipment 1×10^{-10} per day typical within 60 days "—1" OPTION 1×10^{-10} per day at time of shipment	
Frequencies:	5, 1 & 0.1 MHz	
Output Level:	1 vrms/50 ohms	
Temperature:	$\pm 5 \times 10^{-10}$ over 0-50°C	
Noise Floor:	>150 db below 5 MHz output	
Oven Control:	Double proportional	
Supply:	115/230 VAC or 22-30 VDC	115/230 VAC or 22-30 VDC
Battery Life:	24 hours rechargeable	None
Size:	5¼″ x 19″ x 14″ (13.4 x 48.3 x 35.6 cm)	3½″ x 19″ x 14″ (8.9 x 48.3 x 35.6 cm)



VECTRON Replacement for Hewlett Packard Model 10811B

Vectron type CO-811B offers mechanical and electrical-interface interchangeability with discontinued HP10811B



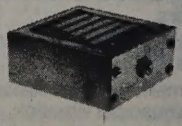
Aging:	5×10^{-10}/day 1×10^{-7}/year
0/+71°C: **−55/+71°C:**	2.5×10^{-9} p-p 4.5×10^{-9} p-p
Noise:	100 Hz: −140dBc/Hz 10 KHz: −160dBc/Hz
Crystal:	SC-cut for fast stabilization

VECTRON Hybrid Oven Low Profile Oscillator

- PCB Mounting
- Small (1″ high)
- Low power drain

CO-311 SERIES

Stability:	Same aging and temperature stability specs as CO-211 Series (see top of next page)
Output: **TTL** **CMOS** **SINE**	**Frequency Range** 250 KHz - 17 MHz 4-6 & 8-15 MHz 4-6 & 8-17 MHz
Supply:	15 VDC for oscillator 5 VDC also, if TTL out (5-28 VDC optional)
Input Power:	3 watts at turn-on 1.3 watts stabilized (25°C)
Frequency Adjust:	Mechanical; electronic optional
Size:	2¼″ x 2¼″ x 1″ (58 x 58 x 26mm)



For More Information. Circle No. 147

VECTRON

Oven Controlled Oscillators
(with Ultra-Low Noise Options *)

High Frequency (to 25 MHz)

	HIGH STABILITY (to 5 x 10^{-10}/day)			ULTRA-STABLE (to 1 x 10^{-10}/day)	
	Most economical CO-211 SERIES	Higher stability and output CO-200 SERIES	Superior temp. stability CO-244 SERIES	Best aging: single oven CO-206 SERIES	Best aging; double oven CO-246 SERIES
Frequency:	1, 2, 4, 5 or 10 MHz standard (broad range of frequencies available)			.5 MHz standard (other frequencies available)	
Temperature: (Temp. Range A) +15/+35°C:	CO-21 ☐ A38: ±3 x 10^{-8} CO-21 ☐ A59: ±5 x 10^{-9}	CO-20 ☐ A39: ±3 x 10^{-9} CO-20 ☐ A19: ±1 x 10^{-9}	CO-24 ☐ A510: ±5 x 10^{-10}	CO-20 ☐ A39-V: ±3 x 10^{-9} CO-20 ☐ A510-V: ±5 x 10^{-10}	CO-24 ☐ A210-V: ±2 x 10^{-10}
(Temp. Range B) 0/+50°C:	CO-21 ☐ B58: ±5 x 10^{-8} CO-21 ☐ B18: ±1 x 10^{-8}	CO-20 ☐ B59. ±5 x 10^{-9} CO-20 ☐ B39: ±3 x 10^{-9}	CO-24 ☐ B19: ±1 x 10^{-9}	CO-20 ☐ B59-V: ±5 x 10^{-9} CO-20 ☐ B19-V: ±1 x 10^{-9}	CO-24 ☐ B510-V: ±5 x 10^{-10}
(Temp. Range D) −20/+70°C:	CO-21 ☐ D17: ±1 x 10^{-7} CO-21 ☐ D38: ±3 x 10^{-8}	CO-20 ☐ D18: ±1 x 10^{-8} CO-20 ☐ D59: ±5 x 10^{-9}	CO-24 ☐ D39: ±3 x 10^{-9}	CO-20 ☐ D18-V: ±1 x 10^{-8} CO-20 ☐ D39-V: ±3 x 10^{-9}	CO-24 ☐ D19-V: ±1 x 10^{-9} (−20/+60°C)
(Temp. Range G) −55/+75°C:	CO-21 ☐ G27: ±2 x 10^{-7} CO-21 ☐ G58: ±5 x 10^{-8}	CO-20 ☐ G38: ±3 x 10^{-8}	CO-24 ☐ G18: ±1 x 10^{-8}	CO-20 ☐ G38-V: ±3 x 10^{-8} CO-20 ☐ G18-V: ±1 x 10^{-8}	
Aging:	4: 1 x 10^{-8}/day 5: 5 x 10^{-9}/day 6: 3 x 10^{-9}/day 7: 1 x 10^{-9}/day *8: 5 x 10^{-10}/day	1: 1 x 10^{-8}/day 2: 5 x 10^{-9}/day 3: 3 x 10^{-9}/day 4: 1 x 10^{-9}/day *5: 5 x 10^{-10}/day	4: 1 x 10^{-9}/day *5: 5 x 10^{-10}/day	6: 3 x 10^{-10}/day 5 x 10^{-8}/year *7: 1 x 10^{-10}/day 3 x 10^{-8}/year	6: 3 x 10^{-10}/day 5 x 10^{-8}/year *7: 1 x 10^{-10}/day 3 x 10^{-8}/year
	*5 x 10^{-10}/day average aging rate models are only available at 1, 2, 4, 5 or 10 MHz			*1 x 10^{-10}/day models available only at 1, 5 and 10 MHz	
Output Level:	Standard: >1 vrms into 500Ω Optional: 0 or +7 dBm/50Ω; TTL or CMOS	Standard: >1 vrms into 50Ω Optional: TTL, CMOS, or ECL	Standard: >1 vrms into 500Ω Optional: 0, 7 or +13 dBm/50Ω TTL, CMOS or ECL	Standard: >1 vrms into 50Ω Optional: TTL or CMOS	
Supply Voltage:	24 VDC standard (Operation from any voltage in 5-28 VDC range optional)			24 VDC standard (Operation from any voltage in 15-28 VDC range optional)	
Input Power:	<6 watts at turn-on (−20/+70°C); <3 watts stabilized (25°C) reduced power drain available			<6 watts at turn-on (−20/+70°C) <3 watts stabilized (25°C)	<11 watts at turn-on (0-50°C) <5 watts stabilized (25°C)
Frequency Adjustment:	Screwdriver adjustment settable to 1 x 10^{-8} nominal. Electronic tuning (VCXO) option "V"			Screwdriver adjustment and electronic tuning	
Size:	2" x 2" x 3" (51 x 51 x 76 mm)	2" x 2" x 4" (51 x 51 x 104 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	3" x 3" x 5½" (76 x 76 x 140 mm)

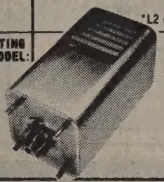
***Phase noise (typical):** with sine output in 4-12 MHz range for "High Stability" Series and in 4-6 MHz range for "Ultra-Stable" Series

Offset from Carrier	Standard	Low Noise Option (L1)	*Ultra Low Noise Option (L2)
100 Hz	−130 dB/Hz	−135 dB/Hz	−145 dB/Hz
1 KHz	−140 dB/Hz	−145 dB/Hz	−155 dB/Hz
10 KHz	−143 dB/Hz	−148 dB/Hz	−160 db/Hz
50 KHz	−145 dB/Hz	−150 dB/Hz	−163 dB/Hz

*L2 option restricted to CO-200 Series with sine output of +10 dBm or less

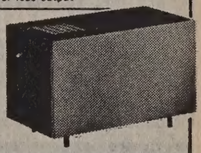
Offset from Carrier	Standard	*Ultra-Low Noise Option (L2)
10 Hz	−115 dB/Hz	−140 dB/Hz
100 Hz	−135 dB/Hz	−150 dB/Hz
1 KHz	−145 dB/Hz	−155 dB/Hz
10 KHz	−148 dB/Hz	−160 dB/Hz
50 KHz	−150 dB/Hz	−163 dB/Hz

*L2 option restricted to +10 dBm or less output



SELECTING BASIC MODEL:

1. Select "Ultra Stable" if 3 x 10^{-10}/day aging or better is required; otherwise select "High Stability"
2. Select operating temperature range required (A, B, D or G from left column under "Temperature").
3. Select frequency stability desired over temperature, this determines the oscillator. (Temperature stability improves from left to right).
4. Select desired aging rate within Series to complete basic model number.
5. Determine whether you desired a low-noise option or any characteristic which is not standard (e.g., supply voltage, output level, etc.).



VHF (25-400MHz)

	Most economical CO-228/CO-229 SERIES			Higher level and frequency CO-223/CO-224 SERIES			Superior aging and stability CO-220/CO-225 SERIES		
Frequency:	25 MHz to 200 MHz			25 MHz to 400 MHz			25 MHz to 200 MHz		
Aging:		3 x 10^{-8}/day 5 x 10^{-6}/year	1 x 10^{-8}/day 3 x 10^{-6}/year		3 x 10^{-8}/day 5 x 10^{-6}/year	1 x 10^{-8}/day 3 x 10^{-6}/year		3 x 10^{-9}/day 1 x 10^{-6}/year	1 x 10^{-9}/day 3 x 10^{-7}/year
(Temp. Range A): +15°C to +35°C:	±3 x 10^{-8}: ±5 x 10^{-9}:	CO-228A38 CO-228A59	CO-229A38 CO-229A59	±3 x 10^{-8}: ±5 x 10^{-9}:	CO-223A38 CO-223A59	CO-224A38 CO-224A59	±1 x 10^{-8}: ±1 x 10^{-9}:	CO-220A18 CO-220A19	CO-225A18 CO-225A19
(Temp. Range B): 0°C to +50°C:	±5 x 10^{-8}: ±1 x 10^{-8}:	CO-228B58 CO-228B18	CO-229B58 CO-229B18	±5 x 10^{-8}: ±1 x 10^{-8}:	CO-223B58 CO-223B18	CO-224B58 CO-224B18	±5 x 10^{-8}: ±1 x 10^{-8}: ±2 x 10^{-9}:	CO-220B58 CO-220B18 CO-220B29	CO-225B58 CO-225B18 CO-225B29
(Temp. Range D): −20°C to +70°C:	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-228D17 CO-228D38	CO-229D17 CO-229D38	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-223D17 CO-223D38	CO-224D17 CO-224D38	±3 x 10^{-8}: ±1 x 10^{-8}: ±5 x 10^{-9}:	CO-220D38 CO-220D18 CO-220D59	CO-225D38 CO-225D18 CO-225D59
(Temp. Range G): −55°C to +75°C:	±2 x 10^{-7}: ±5 x 10^{-8}:	CO-228G27 CO-228G58	CO-229G27 CO-229G58	±2 x 10^{-7}: ±5 x 10^{-8}:	CO-223G27 CO-223G58	CO-224G27 CO-224G58	±1 x 10^{-7}: ±3 x 10^{-8}:	CO-220G17 CO-220G38	CO-225G17 CO-225G38
Output Level:	Standard: >0.5 vrms into 50Ω (+7 dBm) Optional: TTL to 100 MHz			Standard: >1 vrms into 50Ω (+13 dBm) Optional: ECL, higher sinewave level			Standard: >0.5 vrms into 50Ω (+7 dBm) Optional: +13 dBm ("R"), TTL, ECL		
Supply Voltage:	24 VDC standard. Operation from any specified voltage in 12-28 VDC range optional.								
Input Power:	<6 watts at turn-on (−20/ + 70°C); <3 watts stabilized (25°C)								
Frequency Adjustment:	Screwdriver adjust, settable to <1 x10^{-8} nominal. Electronic tuning (VCXO) option "V".								
Size:	2" x 2" x 3" (51 x 51 x 77 mm)			2" x 2" x 4" (51 x 51 x 104 mm)			2" x 2" x 4" (51 x 51 x 104 mm)		

***Phase noise:** typical, with sine output in 75-125 MHz range

Offset from Carrier	Standard	
100 Hz	−120 dB/Hz	Ultra-low noise option not available
1 KHz	−135 dB/Hz	
10 KHz	−140 dB/Hz	
50 KHz	−145 dB/Hz	

Offset from Carrier	Standard	*Ultra Low Noise Option (L2)
100 Hz	−120 dB/Hz	−130 dB/Hz
1 KHz	−135 dB/Hz	−145 dB/Hz
10 KHz	−140 dB/Hz	−150 dB/Hz
50 KHz	−145 dB/Hz	−155 dB/Hz

*L2 option is restricted to 300 MHz with sine output of +10 dBm or less

Offset from Carrier	Standard	*Ultra Low Noise Option (L2)
100 Hz	−105 dB/Hz	−120 db/Hz
1 KHz	−115 dB/Hz	−130 dB/Hz
10 KHz	−120 dB/Hz	−135 dB/Hz
50 KHz	−125 dB/Hz	−140 dB/Hz

*L2 option is available to 125 MHz

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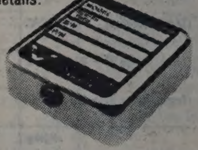
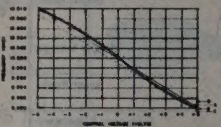
VCXOs Voltage Controlled Crystal Oscillators

	WIDE DEVIATION AND/OR LINEAR APPLICATIONS				NARROW DEVIATION PHASE LOCK APPLICATIONS			
	BASIC MODELS		OVEN CONTROLLED	EXTRA WIDE DEVIATION	SINEWAVE OUTPUT	TTL OUTPUT	CMOS OUTPUT	ECL OUTPUT
Model:	CO-271V	CO-275V	a) CO-272V b) CO-276V	c) CO-273V d) CO-274V	CO-233V SERIES	e) CO-231V f) CO-231VH	CO-236V	CO-233MEV
Range of Available Center Frequencies:	2-20 MHz (higher and lower frequencies available)	20-400 MHz	a) 2-20 MHz b) 20-400 MHz	c) 0.5-8 MHz d) 8-80 MHz	*CO-233V: 5-149 MHz *CO-233VH: 150-200 MHz **CO-233VFW: 5-400 MHz ***CO-283VW: 401-600 MHz	e) 16 KHz-25 MHz f) 25.1 MHz-70 MHz	300 Hz-15 MHz	5-200 MHz
Output Level:	1 vrms into 1K (Option "R": 1 vrms into 50Ω; TTL, CMOS or ECL logic compatible output available on some models)	0.5 vrms into 50Ω	a) 1 vrms into 1K b) 0.5 vrms/50Ω	c) 1 vrms into 1K d) 0.5 vrms/50Ω	0.5 vrms into 50Ω Option "R": 1 Vrms into 50Ω	TTL compatible	CMOS compatible	ECL compatible
Deviation:	±0.1% (wider and narrower deviation available)	±0.1%	±0.1%	±0.5%	>±.003%. This allows correcting to specified center frequency over 0-50°C for 5-10 years. Wider deviation optional; for significantly wider deviation, see models on left side of page).			
Modulation Voltage:	±5 Volts, negative transfer function (either higher or lower sensitivity available)				0 to +6V (±3V to ±10V optional)	0 to +5V	0 to +5V	0 to −5V (±3 to ±10V optional)
Linearity:	±1% (For ±5% linearity, resulting in reduced cost, add "N" to Model No.)				±20% (±10% with bipolar input) Smooth monotonic characteristic. For improved linearity see models on left side of page.	±20%	±20%	±20% (±10% with bipolar input)
Transfer Function:	Negative; frequency decreases with increasing modulation voltage.				Positive (frequency increases with increasing control voltage) (units with bipolar input have negative transfer function)			Negative
Stability 0-50°C:	CO-271VA: ± .01% CO-271VB: ±.001% (higher stability and wider temperature range optional)	CO-275VA: ± .01% CO-275VB: ±.001%	±.0001%	±.025%	±.001% (wider temperature range optional)	±.001%	±.001%	±.001%
Supply:	+24 VDC standard (operation from any specified voltage in +12 VDC to +32 VDC range optional)				+15 VDC standard	+5 VDC	+12 VDC standard	−5.2 VDC
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 3″ x ¾″ (51 x 77 x 19 mm)	2″ x 2″ x 4″ (51 x 51 x 102 mm)	c) 2″ x 3″ x ¾″ d) 3″ x 3½″ x ¾″	*1½″x1½″x⅝″ **2″x2″x¾″ ***2″x3″x¾″	e) 1½″x1½″x½″ f) 1⅝″x1⅝″x½″	1½″x1½″x½″	2″x3″x½″
Mounting:	For P.C. Board mounting (rf connector optional)	For P.C. Board mounting (rf connector optional)	Octal plug-in or solder header and rf connector	For P.C. Board mounting (rf connector optional)	*For P.C. Board mounting *⁑SMA output connector, studs for chassis mount	For P.C. Board mounting	For P.C. Board mounting	For P.C. Board mounting

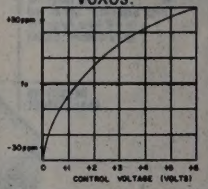
A series of **TC/VCXOs** is now available allowing significantly improved stability without an oven. Deviation is ± 100 ppm standard, with wider and narrower deviations available. Type CO-352V covers 3-60 MHz and Type CO-355V covers 60-400 MHz. Please contact factory or your local representative for details.



General characteristics of CO-270V Series Linear VCXOs.



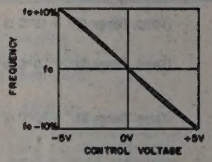
General characteristics of CO-230V Series VCXOs.

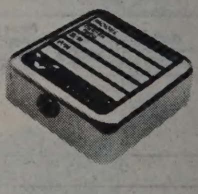


VECTRON

VCOs Voltage Controlled Oscillators (Non-crystal)

	BASIC MODEL VC-371	OVEN CONTROLLED VC-372	LOW FREQUENCY VC-381
Range of available center frequencies:	500 KHz to 500 MHz		50 Hz to 500 KHz
Output Level:	>0.5 vrms into 50Ω (+7 dBm) Option "R": +13 dBm. TTL, CMOS and ECL also optional		>1 vrms into 1000Ω TTL and CMOS optional
Deviation:	±10% (Wider and narrower deviation optional; deviation as large as an octave). For deviation less than ±1%, consider a crystal controlled VCXO rather than a VCO.		±10%
Modulation Voltage:	±5V (both higher and lower sensitivity optional)		±5V
Linearity:	**Standard:** ±10% Option "A": ± 3% (only for deviation ≤±20%) Option "B": ± 1% (only for deviation ≤±10%) (smooth monotonic characteristics with no discontinuities)		±1%
Transfer Function:	negative		positive
Accuracy: Standard:	±0.5% at 25°C for units with deviation up to ±10%. For wider deviation units, accuracy is 10% of deviation.	Tuning adjustment setable to 0.1%.	±0.5% at 25°C for units with deviation up to ±10%. For wider deviation units, accuracy is 10% of deviation.
Optional:	"T": Tuning adjustment setable to 0.1%.		"T": Tuning adjustment setable to 0.1%.
	Standard: 0/+50°C: ±1% Option 1: −20/+70°C: ±2% Option 2: −55/+85°C: ±4% *Option 3: 0/+50°C: ±0.3% *Option 4: −20/+70°C: ±0.5% *Only for deviation ≤ ±10%	**Standard:** 0/+50°C: ±0.1% Option 1: −20/+70°C: ±0.2% Option 2: −55/+85°C: ±0.5% other temperature ranges available	**Standard:** 0/+50°C: ±1.5% Option 1: −20/+70°C: ±3% Option 2: −55/+85°C: ±6%
Supply Voltage:	+15 VDC (Operation from any supply in 12 to 28 VDC range is optional.)		+15 VDC
Size:	2″ x 2″ x ¾″ (51 x 51 x 19 mm)	2″ x 2″ x 4″ (51 x 51 x 104 mm)	2″ x 2″ x ¾″ (51 x 51 x 19 mm)
Mounting:	Pins for p.c. board mounting, RF connector optional.	Chassis mount with SMA output connector. SMC or BNC optional	Pins for p.c. board mounting.





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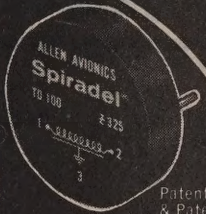

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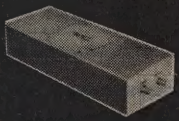

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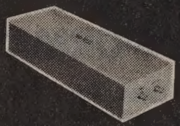

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defining a degree of excellence

series 0447 DIGITAL DELAY LINES

TECHNICAL INFORMATION

Bel Fuse Digital Delay Lines Series 0447 features five equally tapped delay lines with total delays of 25 to 500 nanoseconds. The lines are compatible with TTL and DTL circuits. Either Logic "1" or Logic "0" inputs are accepted. Cascading of units causes no undesirable reflections. The reduced dimensions, with standard Dip Pin-Out permits dense packaging on your circuit board.
Special designs upon request.

INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. 40% of Total Delay
Supply Current	60 ma typ
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

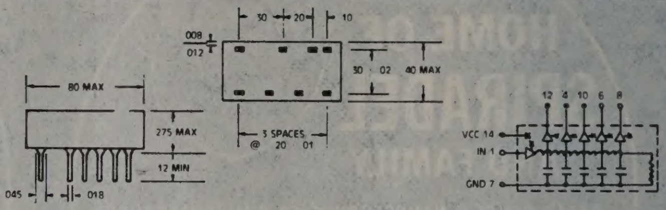
Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

- COMPATIBLE WITH TTL AND DTL CIRCUITS
- DELAY TOLERANCE ± 2Nsec or 5% WHICHEVER IS GREATER FROM INPUT TO TAP
- TAP TO TAP DELAY ± 2Nsec or 7% WHICHEVER IS GREATER
- OPERATING TEMPERATURE RANGE 0°C to 70°C
- OTHER DELAYS UPON REQUEST

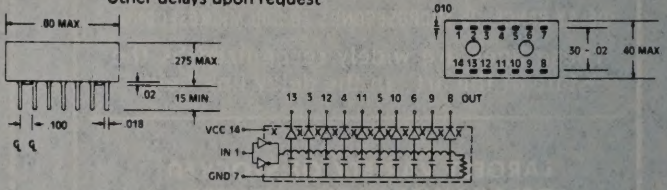
14 PIN - 5 TAP



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-02	25NS	5NS	4NS
0447-0050-02	50NS	10NS	4NS
0447-0100-02	100NS	20NS	4NS
0447-0150-02	150NS	30NS	4NS
0447-0200-02	200NS	40NS	4NS
0447-0250-02	250NS	50NS	4NS
0447-0300-02	300NS	60NS	4NS
0447-0350-02	350NS	70NS	4NS
0447-0400-02	400NS	80NS	4NS
0447-0450-02	450NS	90NS	4NS
0447-0500-02	500NS	100NS	4NS

10 TAP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2NSec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2NSec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0050-10	50NS	5NS	4NS
0447-0100-10	100NS	10NS	4NS
0447-0150-10	150NS	15NS	4NS
0447-0200-10	200NS	20NS	4NS
0447-0250-10	250NS	25NS	4NS
0447-0300-10	300NS	30NS	4NS
0447-0350-10	350NS	35NS	4NS
0447-0400-10	400NS	40NS	4NS
0447-0500-10	500NS	50NS	5NS
0447-0750-10	750NS	75NS	5NS
0447-1000-10	1000NS	100NS	5NS

[1] Delays measured at 1.5 Volt level on Leading Edge only.
[2] Rise Times measured from .75 Volts to 2.4 Volts.
[3] Measured with no loads on taps.

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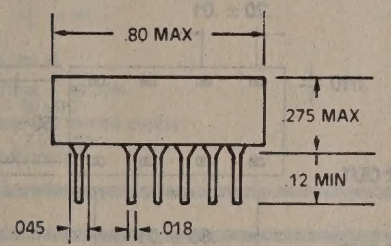
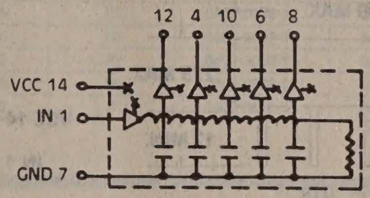
defining a degree of excellence

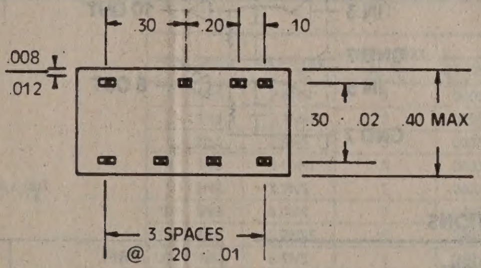
series 0447 DIGITAL DELAY LINES

CONTROLLED LEADING AND TRAILING EDGE DELAY MODULE 5 TAP

- Compatible with TTL and DTL circuits
- Delay tolerance ± 2Nsec or 5% whichever is greater from input to tap
- Tap to Tap Delay ± 2Nsec or 7% whichever is greater
- Operating temperature range 0°C to 70°C
- Other delays upon request







INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec.
Pulse Width	Min. of 20% of Total Delay
Supply Current	60 ma typ
Supply Voltage	5.0 Volts
PRR	Min 3 × Pulse Width

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 to 5.25 Volts
Logic 1 Input Current	50 Microamps Max.
Logic 0 Input Current	−2 Milliamps Max.
Logic 1 Output Voltage	2.6 Volts Min.
Logic 0 Output Voltage	.5 Volts Max.

DRIVE CAPABILITIES

Logic 0 Output	10 TTL Loads/Tap Max. (20 TTL Loads/Unit Max.)
Logic 1 Output	10 TTL Loads/Unit Max.

Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
0447-0025-A1	25NS	5NS	4NS
0447-0050-A1	50NS	10NS	4NS
0447-0100-A1	100NS	20NS	4NS
0447-0150-A1	150NS	30NS	4NS
0447-0200-A1	200NS	40NS	4NS
0447-0250-A1	250NS	50NS	4NS
0447-0300-A1	300NS	60NS	4NS
0447-0350-A1	350NS	70NS	4NS
0447-0400-A1	400NS	80NS	4NS
0447-0450-A1	450NS	90NS	4NS
0447-0500-A1	500NS	100NS	4NS

1 Delays measured at 1.5 Volt level on Leading and Trailing Edge.
2 Rise and Fall Times measured from .75 to 2.2 Volts.
3 Measured with 1 STTL load per tap.

BEL FUSE, INC.

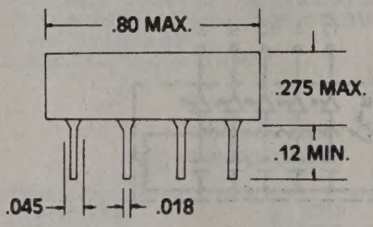
198 Van Vorst Street • Jersey City, N.J. 07302
(201) 432-0463 • TWX 710-730-5301

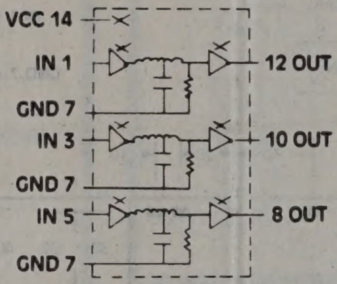
defining a degree of excellence

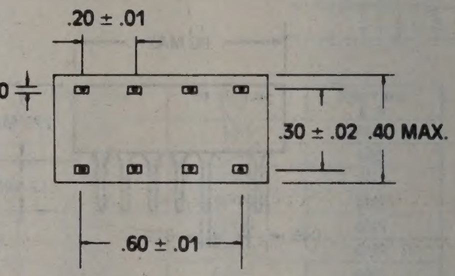
series 0447 DIGITAL DELAY LINES

TRIPLE OUTPUT MODULE

- Compatible with TTL and DTL circuits
- Operating temperature range 0°C to 70°C
- Other delays upon request







INPUT TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3 Nsec.
Pulse Width	Min. 100% of Total Delay
Supply Current	Constant "0" in 115 ma max. Constant "1" in 90 ma max.
Supply Voltage	5.0 Volts

ELECTRICAL CHARACTERISTICS

Supply Voltage Vcc	4.75 Volts to 5.25 Volts
Logic 1 Input Current	50 μa max.
Logic 0 Input Current	−2 ma max.
Logic 1 Output Voltage	2.6 Volts min.
Logic 0 Output Voltage	.5 Volts max.
Temperature Coefficient	1.5 Nsec + 100 ppm/°C max.

Part Number	Delay Time 1, 3	Rise Time 2, 3
0447-0010-A3	10 NS ± 1.5 NS	3 NS
0447-0020-A3	20 NS ± 1.5 NS	3 NS
0447-0030-A3	30 NS ± 2.0 NS	3 NS
0447-0040-A3	40 NS ± 2.0 NS	3 NS
0447-0050-A3	50 NS ± 2.5 NS	3 NS
0447-0060-A3	60 NS ± 3.0 NS	4 NS
0447-0070-A3	70 NS ± 3.5 NS	4 NS
0447-0080-A3	80 NS ± 4.0 NS	4 NS
0447-0090-A3	90 NS ± 4.0 NS	4 NS
0447-0100-A3	100 NS ± 5.0 NS	4 NS
0447-0125-A3	125 NS ± 6.0 NS	4 NS

[1] Delays measured at 1.5 Volt Leading Edge only.
[2] Rise Times measured from .75 to 2.4 Volts.
[3] Measured with 1 STTL load (15PF) on each output.

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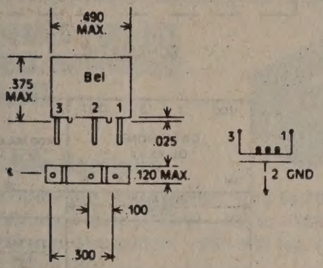
(201) 432-0463 • TWX 710-730-5301

For More Information. Circle No. 149

defining a degree of excellence

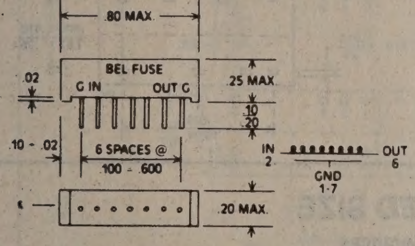
SINGLE-IN-LINE DELAY LINES

- Compatible with ECL and TTL circuits
- Temperature coefficient delay = 100 PPM/°C max.
- Operating temperature range −55°C to +125°C



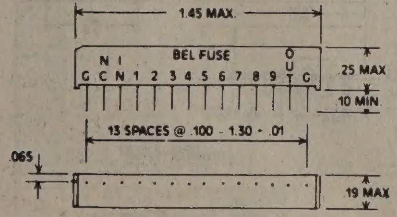
- Rise Time = 20-80%
- DWV = 50 VDC
- Pins 24 AWG tinned copper
- DIST. = 7.5% max.
- Bi-Directional

Time Delay	Rise Time	D.C.R. Max. in OHMS	Part Number	
			55 OHMS ± 10%	93 OHMS ± 10%
1 ± .2NS	1.6NS	.20	0402-0001-55	0402-0001-93
2 ± .2NS	1.6NS	.25	0402-0002-55	0402-0002-93
3 ± .2NS	1.7NS	.37	0402-0003-55	0402-0003-93
4 ± .2NS	1.7NS	.50	0402-0004-55	0402-0004-93
5 ± .25NS	1.8NS	.62	0402-0005-55	0402-0005-93
6 ± .3NS	2.0NS	.75	0402-0006-55	0402-0006-93
7 ± .3NS	2.2NS	.80	0402-0007-55	0402-0007-93
8 ± .3NS	2.4NS	.85	0402-0008-55	0402-0008-93
9 ± .3NS	2.6NS	.90	0402-0009-55	0402-0009-93
10 ± .3NS	2.8NS	.95	0402-0010-55	0402-0010-93



- Rise Time = 10 to 90%
- DWV = 50 VDC
- DIST = 10% max.
- Taps available upon request
- Other delays upon request
- Other PIN OUTS Available
- Pins .012 × .020

Time Delay	Rise Time	Atten. Max. in %	Part Number		
			55 OHMS ± 10%	100 OHMS ± 10%	200 OHMS ± 10%
1 ± .3NS	2.6NS	3	0403-0001-55	0403-0001-01	0403-0001-02
2 ± .3NS	2.75NS	3	0403-0002-55	0403-0002-01	0403-0002-02
3 ± .3NS	2.9NS	3	0403-0003-55	0403-0003-01	0403-0003-02
4 ± .3NS	3.15NS	3	0403-0004-55	0403-0004-01	0403-0004-02
5 ± .3NS	3.2NS	5	0403-0005-55	0403-0005-01	0403-0005-02
10 ± .5NS	4.0NS	5	0403-0010-55	0403-0010-01	0403-0010-02
15 ± .7NS	5.25NS	5	0403-0015-55	0403-0015-01	0403-0015-02
20 ± 1NS	6.1NS	5	0403-0020-55	0403-0020-01	0403-0020-02
25 ± 1.2NS	7.5NS	5	0403-0025-55	0403-0025-01	0403-0025-02
30 ± 1.5NS	9.0NS	6	0403-0030-55	0403-0030-01	0403-0030-02
35 ± 1.7NS	10.5NS	6	0403-0035-55	0403-0035-01	0403-0035-02
40 ± 2NS	12.5NS	6	0403-0040-55	0403-0040-01	0403-0040-02
45 ± 2.7NS	13.5NS	6	0403-0045-55	0403-0045-01	0403-0045-02
50 ± 2.5NS	15.0NS	6	0403-0050-55	0403-0050-01	0403-0050-02


1.45 MAX.
BEL FUSE
G C N I 1 2 3 4 5 6 7 8 9 O U T G
.25 MAX
.10 MIN.
13 SPACES @ .100 = 1.30 ± .01
.065
.19 MAX

- Rise Time = 10-90%
- DWV = 50 VDC
- DIST. = 10% max.
- Other delays upon request
- Pins .012 × .020

Time Delay ± 5%	Tap to Tap Delay	Rise Time	ZO ± 10% in OHMS	D.C.R. in OHMS	Part Number
10NS	1 ± .25NS	2.5NS	50	.8	0438-0010-50
20NS	2 ± .4NS	4NS	50	1	0438-0020-50
50NS	5 ± 1.5NS	9NS	50	2	0438-0050-50
100NS	10 ± 2NS	18NS	50	3	0438-0100-50
10NS	1 ± .25NS	2.5NS	100	1.6	0438-0010-01
20NS	2 ± .4NS	4NS	100	2	0438-0020-01
50NS	5 ± 1.5NS	9NS	100	4	0438-0050-01
100NS	10 ± 2NS	19NS	100	9	0438-0100-01
20NS	2 ± .4NS	4.5NS	200	5	0438-0020-02
50NS	5 ± 1.5NS	10NS	200	12	0438-0050-02
100NS	10 ± 2NS	20NS	200	17	0438-0100-02

BEL FUSE, INC.

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For More Information. Circle No. 149

DATAMAX ELECTRONICS INC.

formerly DATATRONICS LTD. (U.S.)

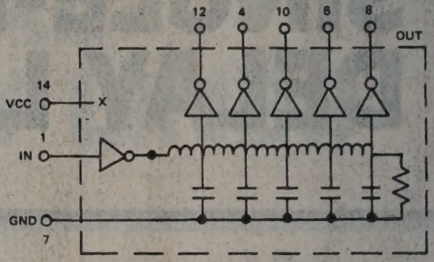
DL 6300 DIGITAL DELAY MODULES

- 14 Pin Package
- TTL and DTL Compatible
- 5 Equally Spaced Taps

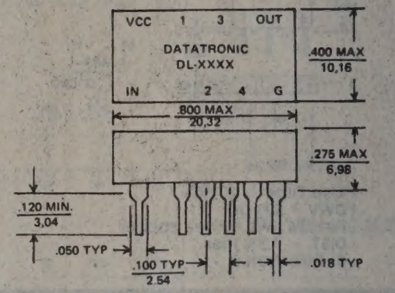
Electrical Specifications at 25°C

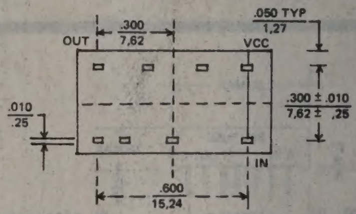
Part Number	Total Delay NS ± 5%	Tap to Tap Delay NS(1)	Rise Time NS Max(2)
DL6305	25	5	3
DL6523	30	6	3
DL6306	50	10	3
DL6525	60	12	3
DL6526	75	15	3
DL6307	100	20	3
DL6513	125	25	3
DL6308	150	30	3
DL6309	200	40	3
DL6310	250	50	4
DL6311	300	60	5
DL6582	350	70	5
DL6312	400	80	5
DL6521	450	90	5
DL6313	500	100	5

Note: (1) Measured at 1.5 v level leading edge, Tol. ±5% or ±2NS, whichever is greater.
(2) Measured from 0.75 v. to 2.4 v. (3) Measured with no loads on taps.


12
4
10
6
8
OUT
14
VCC
X
1
IN
GND
7

SCHEMATIC


VCC 1 3 OUT
DATATRONIC
DL-XXXX
IN 2 4 G
.400 MAX
10,16
.800 MAX
20,32
.275 MAX
6,98
.120 MIN.
3,04
.050 TYP
.100 TYP
2.54
.018 TYP


.050 TYP
1,27
.300
7,62
OUT
VCC
.300 ± .010
7,62 ± .25
.010
.25
IN
.600
15,24

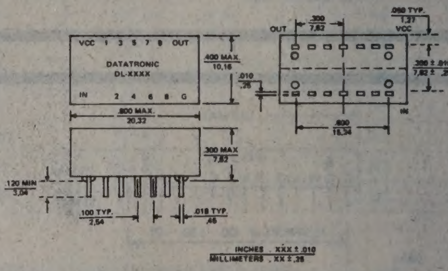
INCHES . XXX ± .010
MILLIMETERS . XX ± .25

DL 6700 DIGITAL DELAY MODULES • 10 TAPS REDUCED SIZE

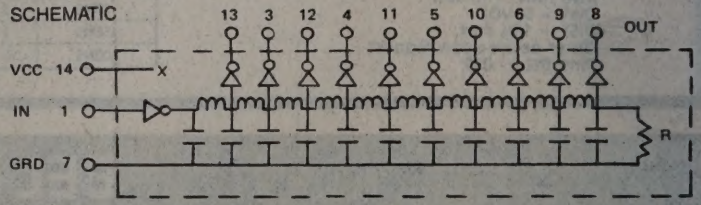
- 14 Pin Package
- TTL and DTL Compatible
- 10 Equally Spaced Taps
- Tight Tolerances

Electrical Specifications at 25°C

Part Number	Total Delay NSEC ± 5%	Tap to Tap Delay NSEC(1)	Rise Time NSEC Max(2)
DL6706	50	5	3
DL6707	100	10	3
DL6708	150	15	4
DL6709	200	20	4
DL6710	250	25	4
DL6931	300	30	5
DL6332	350	35	5
DL6933	400	40	5
DL6934	450	45	5
DL6711	500	50	5


VCC 1 3 5 7 9 OUT
DATATRONIC
DL-XXXX
IN 2 4 6 8 G
.400 MAX
10,16
.800 MAX.
20,32
.300 MAX
7,62
.120 MIN
3,04
.100 TYP.
2,54
.018 TYP.
.46
.010
.25
.050 TYP.
1,27
OUT
.300
7,62
VCC
.300 ± .010
7,62 ± .25
IN
.600
15,24
INCHES . XXX ± .010
MILLIMETERS . XX ± .25

SCHEMATIC


13
3
12
4
11
5
10
6
9
8
OUT
VCC 14
X
IN 1
GRD 7
R

Note: (1) Measured at 1.5 v level leading edge,
Tol. ±5% or ±2NS, whichever is greater.
(2) Measured from 0.75 v to 2.4 v
(3) Measured with no loads on taps

16 Pin Package is also available.

OTHER DESIGNS UPON REQUEST.
WE WELCOME YOUR INQUIRIES FOR PASSIVE DELAY LINES.

DATAMAX, P.O. BOX 2839, BLUE JAY CA. 92317 • 714-336-3561

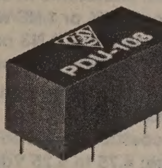
SHORT FORM CATALOG NO. 82

Call or write for a complete catalog of our products.

data delay devices, inc. ®

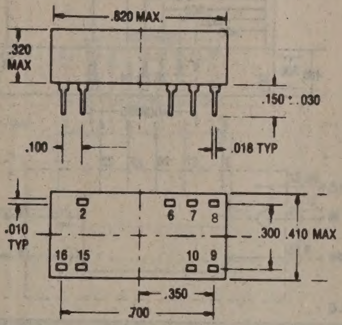
DIGITALLY PROGRAMMABLE DELAY LINES

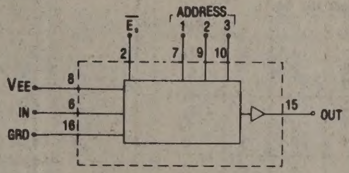
SERIES PDU-108
(ECL Interfaced)
3 BIT



Specifications

- Operating temperature: −0°C to 70°C.
- Storage temperature; −55° to +125°C.
- Power dissipation: −290 MW typ. (no load).
- 16 pin DIP.
- Delay variation: Monotonic in one direction.
- Inherent delay: 5NS typ.
- Tolerance: 5% or ½ NS, whichever is greater.


.820 MAX.
.320 MAX
.150 ± .030
.100
.018 TYP
.010 TYP
2
6 7 8
16 15
10 9
.300
.410 MAX
.350
.700


$\overline{E}_0$
ADDRESS
1 2 3
2
7 9 10
VEE
8
IN
6
GRD
16
15
OUT

TRUTH TABLE

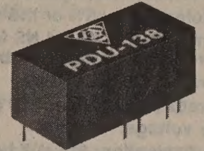
$\overline{\text{Enable}}$	Address (Bit No.) 3	2	1	Delay Out	
0	0	0	0	T_0	1 = High 0 = Low Ø = Don't care T_0 = Reference or inherent delay of circuit. T_1 to T_7 = Multiplier of incremental delay.
0	0	0	1	T_1	
0	0	1	0	T_2	
0	0	1	1	T_3	
0	1	0	0	T_4	
0	1	0	1	T_5	
0	1	1	0	T_6	
0	1	1	1	T_7	
1	Ø	Ø	Ø	0	

Part No.**	Min. Delay Increment	Total Delay* Change	Part No.**	Min. Delay Increment	Total Delay* Change
PDU-108-1	1 NS ± .4 NS	7 NS	PDU-108-10	10 NS ± 1.0 NS	70 NS
PDU-108-2	2 NS ± .4 NS	14 NS	PDU-108-20	20 NS ± 1.5 NS	140 NS
PDU-108-3	3 NS ± .5 NS	21 NS	PDU-108-40	40 NS ± 2.0 NS	280 NS
PDU-108-5	5 NS ± .6 NS	35 NS	PDU-108-50	50 NS ± 2.5 NS	350 NS

*This delay value does not include the T_0 delay.

**Other delay increments available on request.

SERIES PDU-138
(TTL Interfaced)
3 BIT

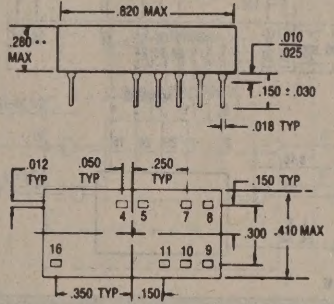


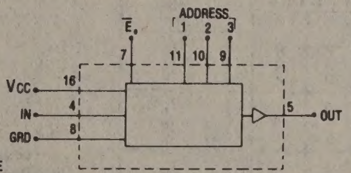
Specifications

- Inherent delay: 7 NS ±1 NS.
- Temperature coefficient: 100 PPM/°C.
- 16 pin DIP.
- Delay variation: Monotonic in one direction.
- Tolerance: 5% or ½ NS.
- Operating temperature: 0-70°C.
  (−55 to +125°C on request) *

*Add "M" after PART NO. Example PDU-138-2M

**.320 Max. for "M" Units


.820 MAX
.280** MAX
.010
.025
.150 ± .030
.018 TYP
.012 TYP
.050 TYP
.250 TYP
.150 TYP
4 5
7 8
16
11 10 9
.300
.410 MAX
.350 TYP
.150


$\overline{E}_0$
ADDRESS
1 2 3
7
11 10 9
Vcc
16
IN
4
GRD
8
5
OUT

TRUTH TABLE

$\overline{\text{Enable}}$	Address (Bit No.) 3	2	1	Delay Out	
0	0	0	0	T_0	1 = High 0 = Low Ø = Don't care T_0 = Reference or inherent delay of circuit. T_1 to T_7 = Multiplier of incremental delay.
0	0	0	1	T_1	
0	0	1	0	T_2	
0	0	1	1	T_3	
0	1	0	0	T_4	
0	1	0	1	T_5	
0	1	1	0	T_6	
0	1	1	1	T_7	
1	Ø	Ø	Ø	0	

Part ** Number	Incremental Delay Per Step	Total Delay* Change	Part ** Number	Incremental Delay Per Step	Total Delay* Change
PDU-138-1	1 NS ± .4 NS	7 NS	PDU-138-15	15 NS ± 1.3 NS	105 NS
PDU-138-2	2 NS ± .4 NS	14 NS	PDU-138-20	20 NS ± 1.5 NS	140 NS
PDU-138-3	3 NS ± .5 NS	21 NS	PDU-138-40	40 NS ± 2.0 NS	280 NS
PDU-138-5	5 NS ± .6 NS	35 NS	PDU-138-50	50 NS ± 2.5 NS	350 NS
PDU-138-10	10 NS ± 1.0 NS	70 NS			

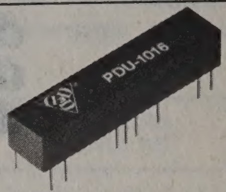
*This delay value does not include the T_0 delay.

** Other delay increments available on request.

DATA DELAY DEVICES Inc. ■ 385 Lakeview Avenue, Clifton, New Jersey 07011 ■ (201) 772-1106 ■ TWX 710-989-7008

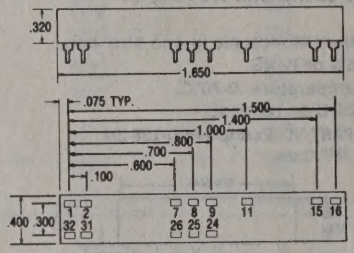
DIGITALLY PROGRAMMABLE DELAY LINES

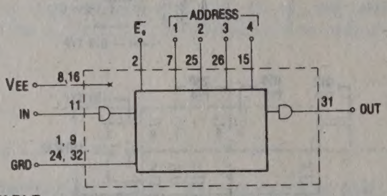
SERIES PDU-1016 (ECL Interfaced) 4-BIT



Specifications

- Input signal requirement: ECL logic.
- Output fan-out: ECL loads.
- Delay variation: Monotonic in one direction.
- Delay tolerance: ±5% or INS whichever is greater.
- Inherent delay: 11 NS ±1 NS for PDU-1016 −1 thru −5. Greater for rest of Part Numbers.
- Temperature range: 0-70°C.
- Temperature coefficient: 100 PPM/°C.
- Supply voltage: −5 Vdc.
- Power dissipation: 615 MW typ.





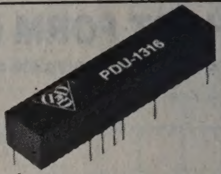
TRUTH TABLE

Enable (Eo)	Address (Bit No.)				Delay Out
	4	3	2	1	
0	0	0	0	0	T_0
0	0	0	0	1	T_1
0	0	0	1	0	T_2
0	0	0	1	1	T_3
0	0	1	0	0	T_4
0	0	1	0	1	T_5
0	0	1	1	0	T_6
0	0	1	1	1	T_7
0	1	0	0	0	T_8
0	1	0	0	1	T_9
0	1	0	1	0	T_{10}
0	1	0	1	1	T_{11}
0	1	1	0	0	T_{12}
0	1	1	0	1	T_{13}
0	1	1	1	0	T_{14}
0	1	1	1	1	T_{15}
1	∅	∅	∅	∅	0

0 = Logic 0
1 = Logic 1
∅ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{15} = Multiplier of incremental delay.

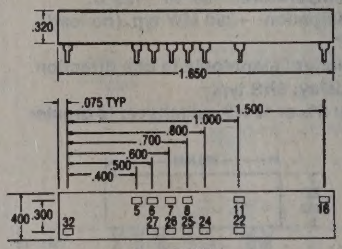
Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-1016-1	1	15	PDU-1016-20	20	300
PDU-1016-2	2	30	PDU-1016-25	25	375
PDU-1016-3	3	45	PDU-1016-30	30	450
PDU-1016-4	4	60	PDU-1016-35	35	525
PDU-1016-5	5	75	PDU-1016-40	40	600
PDU-1016-6	6	90	PDU-1016-45	45	675
PDU-1016-8	8	120	PDU-1016-50	50	750
PDU-1016-10	10	150	PDU-1016-60	60	900
PDU-1016-12	12	180	PDU-1016-80	80	1,200
PDU-1016-15	15	225	PDU-1016-100	100	1,500

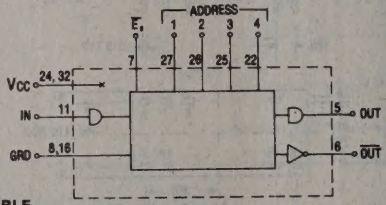
SERIES PDU-1316 (TTL Interfaced) 4 BIT



Specifications

- Input signal requirements: TTL logic.
- Output fan-out: TTL Schottky load.
- Delay variation: Monotonic in one direction.
- Delay tolerance: ±5% or 1 NS whichever is greater.
- Inherent delay: 19 NS ± 1 NS on pin 5 } for PDU-1316 -1 thru -10
  15 NS ± 1 NS on pin 6
  Greater for rest of Part Numbers
- Temperature range: 0-70°C.
- Temperature coefficient: 100 PPM/°C.
- Supply voltage: 4.75 to 5.25 Vdc.
- Power dissipation: 740 MW Max.





TRUTH TABLE

Enable (Eo)	Address (Bit No.)				Delay Out
	4	3	2	1	
0	0	0	0	0	T_0
0	0	0	0	1	T_1
0	0	0	1	0	T_2
0	0	0	1	1	T_3
0	0	1	0	0	T_4
0	0	1	0	1	T_5
0	0	1	1	0	T_6
0	0	1	1	1	T_7
0	1	0	0	0	T_8
0	1	0	0	1	T_9
0	1	0	1	0	T_{10}
0	1	0	1	1	T_{11}
0	1	1	0	0	T_{12}
0	1	1	0	1	T_{13}
0	1	1	1	0	T_{14}
0	1	1	1	1	T_{15}
1	∅	∅	∅	∅	0

0 = Logic 0
1 = Logic 1
∅ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{15} = Multiplier of incremental delay.

Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-1316-1	1	15	PDU-1316-20	20	300
PDU-1316-2	2	30	PDU-1316-25	25	375
PDU-1316-3	3	45	PDU-1316-30	30	450
PDU-1316-4	4	60	PDU-1316-35	35	525
PDU-1316-5	5	75	PDU-1316-40	40	600
PDU-1316-6	6	90	PDU-1316-45	45	675
PDU-1316-8	8	120	PDU-1316-50	50	750
PDU-1316-10	10	150	PDU-1316-60	60	900
PDU-1316-12	12	180	PDU-1316-80	80	1,200
PDU-1316-15	15	225	PDU-1316-100	100	1,500

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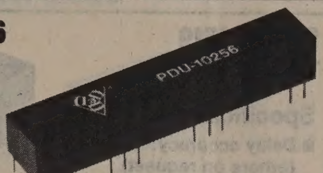
DIGITALLY PROGRAMMABLE DELAY LINES

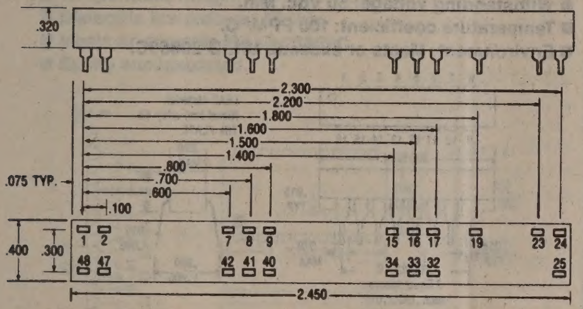
SERIES PDU-10256 (ECL Interfaced) 8-BIT

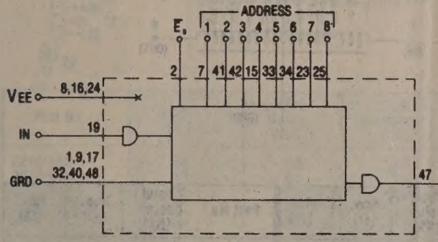


Specifications

Same as PDU-1016 except:

- **Inherent delay: 16 NS typ.**
- **Power dissipation: 925 MW typ.**


.320
2.300
2.200
1.800
1.600
1.500
1.400
.800
.700
.600
.075 TYP.
.100
.400
.300
1 2
7 8 9
15 16 17
19
23 24
48 47
42 41 40
34 33 32
25
2.450


ADDRESS
E₀
1 2 3 4 5 6 7 8
2
7 41 42 15 33 34 23 25
VEE
8,16,24
IN
19
1,9,17
32,40,48
GRD
47
OUT

TRUTH TABLE

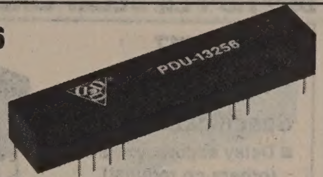
Address (Bit No.)								Enable (Eo)	Delay Out
8	7	6	5	4	3	2	1		
0	0	0	0	0	0	0	0	0	T_0
0	0	0	0	0	0	0	1	0	T_1
0	0	0	0	0	0	1	0	0	T_2
0	0	0	0	0	0	1	1	0	T_3
0	0	0	0	0	1	0	0	0	T_4
0	0	0	0	0	1	1	1	0	T_7
0	0	0	0	1	0	0	0	0	T_8
0	0	0	0	1	1	1	1	0	T_{15}
0	0	0	1	0	0	0	0	0	T_{16}
0	0	0	1	1	1	1	1	0	T_{31}
0	0	1	0	0	0	0	0	0	T_{32}
0	0	1	1	1	1	1	1	0	T_{63}
0	1	0	0	0	0	0	0	0	T_{64}
0	1	1	1	1	1	1	1	0	T_{127}
1	0	0	0	0	0	0	0	0	T_{128}
1	1	1	1	1	1	1	1	0	T_{256}
ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	1	0

0 = Logic 0 1 = Logic 1 ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{255} = Multiplier of incremental delay.

Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-10256-1	1	255	PDU-10256-6	6	1,530
PDU-10256-2	2	510	PDU-10256-7	7	1,785
PDU-10256-3	3	765	PDU-10256-8	8	2,040
PDU-10256-4	4	1,020	PDU-10256-9	9	2,295
PDU-10256-5	5	1,275	PDU-10256-10	10	2,550

NOTE: For the sake of simplicity all 256 programmable steps are not shown in this truth table.

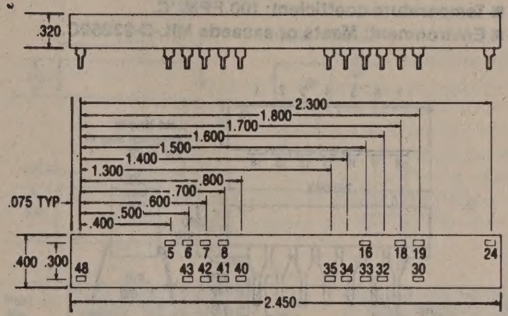
SERIES PDU-13256 (TTL Interfaced) 8-BIT

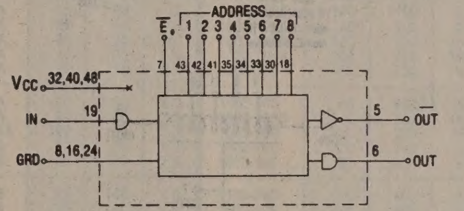


Specifications

Same as PDU-1316 except:

- **Inherent delay: 44 NS on pin 6 } typ**
  45 NS on pin 5 }
- **Power dissipation: 1.1 W Max.**


.320
2.300
1.800
1.700
1.600
1.500
1.400
1.300
.800
.700
.600
.500
.400
.075 TYP
.400
.300
5 6 7 8
16
18 19
24
48
43 42 41 40
35 34 33 32
30
2.450


ADDRESS
E₀
1 2 3 4 5 6 7 8
7 43 42 41 35 34 33 30 18
Vcc
32,40,48
IN
19
GRD
8,16,24
5
OUT
6
OUT

TRUTH TABLE

Address (Bit No.)								Enable (Eo)	Delay Out
8	7	6	5	4	3	2	1		
0	0	0	0	0	0	0	0	0	T_0
0	0	0	0	0	0	0	1	0	T_1
0	0	0	0	0	0	1	0	0	T_2
0	0	0	0	0	0	1	1	0	T_3
0	0	0	0	0	1	0	0	0	T_4
0	0	0	0	0	1	1	1	0	T_7
0	0	0	0	1	0	0	0	0	T_8
0	0	0	0	1	1	1	1	0	T_{15}
0	0	0	1	0	0	0	0	0	T_{16}
0	0	0	1	1	1	1	1	0	T_{31}
0	0	1	0	0	0	0	0	0	T_{32}
0	0	1	1	1	1	1	1	0	T_{63}
0	1	0	0	0	0	0	0	0	T_{64}
0	1	1	1	1	1	1	1	0	T_{127}
1	0	0	0	0	0	0	0	0	T_{128}
1	1	1	1	1	1	1	1	0	T_{255}
ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	ϕ	1	0

0 = Logic 0 1 = Logic 1 ϕ = Don't care
T_0 = Reference or inherent delay of circuit.
T_1 to T_{255} = Multiplier of incremental delay.

Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS	Part No.	Incremental Delay Per Step NS	Total Programmed Delay NS
PDU-13256-1	1	255	PDU-13256-6	6	1,530
PDU-13256-2	2	510	PDU-13256-7	7	1,785
PDU-13256-3	3	765	PDU-13256-8	8	2,040
PDU-13256-4	4	1,020	PDU-13256-9	9	2,295
PDU-13256-5	5	1,275	PDU-13256-10	10	2,550

NOTE: For the sake of simplicity all 256 programmable steps are not shown in this truth table.

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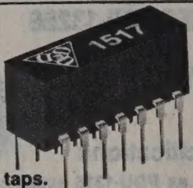
For More Information. Circle No. 151

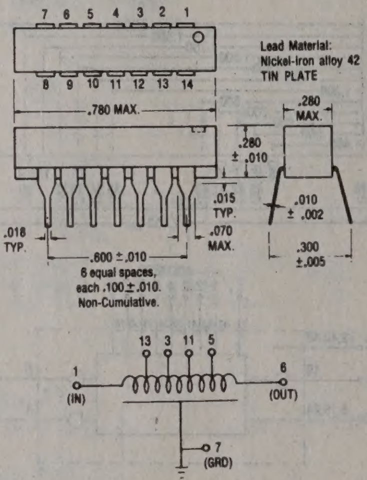
DIP-TAPPED DELAY LINES

SERIES 1517
5 Taps



Specifications

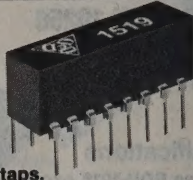
- Delay accuracy: ±5% (others on request).
- No. taps: 5 Equally spaced taps.
- Taps accuracy: ±5% of tap delay.
- Impedance tolerance: ±10% (others on request).
- Rise-Time: 30% of time delay.
- Withstanding voltage: 50 Vdc. Min.
- Temperature coefficient: 100 PPM/°C.
- Environment: Meets or exceeds MIL-D-23859C.


7 6 5 4 3 2 1
8 9 10 11 12 13 14
.780 MAX.
Lead Material:
Nickel-iron alloy 42
TIN PLATE
.280 MAX.
.280 ± .010
.015 TYP.
.010 ± .002
.018 TYP.
.070 MAX.
.600 ±.010
6 equal spaces,
each .100±.010.
Non-Cumulative.
.300 ±.005
13 3 11 5
1 (IN)
6 (OUT)
7 (GRD)

TAPS - CONNECTION

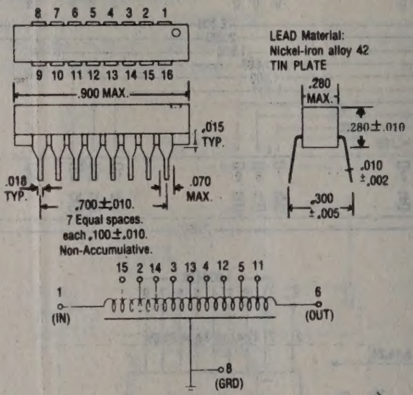
Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1517-10A	10	50	0.6	1517-150D	150	250	8.5
1517-15A	15	50	0.6	1517-15E	15	300	2.5
1517-20A	20	50	0.7	1517-30E	30	300	3.0
1517-30A	30	50	0.7	1517-50E	50	300	4.0
1517-40A	40	50	0.9	1517-60E	60	300	4.0
1517-5B	5	100	0.5	1517-75E	75	300	4.5
1517-10B	10	100	0.7	1517-90E	90	300	5.5
1517-15B	15	100	0.7	1517-120E	120	300	8.0
1517-20B	20	100	0.9	1517-130E	130	300	9.0
1517-25B	25	100	1.0	1517-180E	180	300	11.0
1517-30B	30	100	1.5	1517-220E	220	300	13.0
1517-40B	40	100	1.8	1517-20F	20	400	4.5
1517-50B	50	100	2.0	1517-40F	40	400	5.0
1517-60B	60	100	2.0	1517-60F	60	400	5.0
1517-75B	75	100	2.5	1517-80F	80	400	8.0
1517-10C	10	200	1.5	1517-100F	100	400	9.0
1517-20C	20	200	2.0	1517-120F	120	400	10.0
1517-30C	30	200	2.5	1517-160F	160	400	13.0
1517-40C	40	200	3.0	1517-180F	180	400	14.0
1517-50C	50	200	3.0	1517-240F	240	400	19.0
1517-60C	60	200	3.5	1517-300F	300	400	23.0
1517-80C	80	200	3.5	1517-25G	25	500	3.0
1517-90C	90	200	5.0	1517-50G	50	500	5.0
1517-120C	120	200	5.0	1517-75G	75	500	8.0
1517-150C	150	200	8.0	1517-100G	100	500	15.0
1517-25D	25	250	2.5	1517-125G	125	500	9.0
1517-37D	37	250	3.0	1517-150G	150	500	13.0
1517-50D	50	250	3.5	1517-200G	200	500	21.0
1517-60D	60	250	4.0	1517-225G	225	500	23.0
1517-75D	75	250	4.0	1517-300G	300	500	29.0
1517-100D	100	250	5.0				

SERIES 1519
10 Taps



Specifications

- Delay accuracy: ±5% (others on request).
- No. taps: 10 Equally spaced taps.
- Taps accuracy: ±5% of tap delay.
- Impedance tolerance: ±10% (others on request).
- Rise-Time: 20% of time delay.
- Withstanding voltage: 50 Vdc. Min.
- Temperature coefficient: 100 PPM/°C.
- Environment: Meets or exceeds MIL-D-23859C.


8 7 6 5 4 3 2 1
9 10 11 12 13 14 15 16
.900 MAX.
LEAD Material:
Nickel-iron alloy 42
TIN PLATE
.280 MAX.
.280±.010
.015 TYP.
.010 ±.002
.018 TYP.
.070 MAX.
.700±.010.
7 Equal spaces.
each .100±.010.
Non-Accumulative.
.300 ±.005
15 2 14 3 13 4 12 5 11
1 (IN)
6 (OUT)
8 (GRD)

Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1519-20A	20	50	1.0	1519-200D	200	250	10.0
1519-25A	25	50	1.0	1519-225D	225	250	11.0
1519-30A	30	50	1.2	1519-300D	300	250	17.0
1519-40A	40	50	1.5	1519-375D	375	250	20.0
1519-45A	45	50	1.5	1519-500D	500	250	24.0
1519-50A	50	50	1.5	1519-30E	30	300	5.0
1519-60A	60	50	1.5	1519-60E	60	300	6.0
1519-75A	75	50	1.8	1519-90E	90	300	7.0
1519-100A	100	50	2.0	1519-120E	120	300	8.0
1519-10B	10	100	1.0	1519-150E	150	300	9.0
1519-20B	20	100	1.5	1519-180E	180	300	11.0
1519-30B	30	100	1.5	1519-240E	240	300	16.0
1519-40B	40	100	1.8	1519-270E	270	300	18.0
1519-50B	50	100	2.0	1519-360E	360	300	21.0
1519-60B	60	100	3.0	1519-450E	450	300	25.0
1519-80B	80	100	3.5	1519-600E	600	300	40.0
1519-90B	90	100	3.5	1519-40F	40	400	8.5
1519-100B	100	100	4.0	1519-80F	80	400	9.0
1519-120B	120	100	4.0	1519-120F	120	400	9.0
1519-150B	150	100	5.0	1519-160F	160	400	16.0
1519-200B	200	100	6.0	1519-200F	200	400	18.0
1519-250B	250	100	7.0	1519-240F	240	400	20.0
1519-20C	20	200	3.0	1519-320F	320	400	26.0
1519-40C	40	200	4.0	1519-360F	360	400	28.0
1519-60C	60	200	4.5	1519-480F	480	400	38.0
1519-80C	80	200	5.5	1519-600F	600	400	45.0
1519-100C	100	200	6.0	1519-800F	800	400	40.0
1519-120C	120	200	6.5	1519-50G	50	500	6.0
1519-160C	160	200	7.0	1519-100G	100	500	10.0
1519-180C	180	200	8.5	1519-150G	150	500	16.0
1519-200C	200	200	9.0	1519-200G	200	500	30.0
1519-240C	240	200	9.5	1519-250G	250	500	18.0
1519-300C	300	200	16.0	1519-300G	300	500	26.0
1519-400C	400	200	16.0	1519-400G	400	500	42.0
1519-50D	50	250	5.5	1519-450G	450	500	45.0
1519-75D	75	250	6.0	1519-500G	500	500	55.0
1519-100D	100	250	7.0	1519-600G	600	500	58.0
1519-125D	125	250	8.0	1519-750G	750	500	50.0
1519-150D	150	250	8.5	1519-1000G	1000	500	65.0

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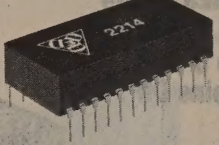
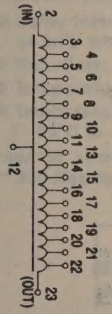
DIP-TAPPED DELAY LINES

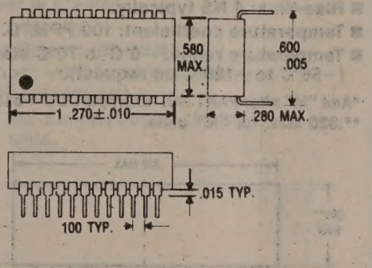
SERIES 2214
20 Taps



Specifications

- 20 Equally spaced taps.
- Td/Tr = 10/1.
- Delay tolerance: ±5% or INS whichever is greater.
- Tap tolerance: ±5% or INS whichever is greater.
- Temperature coefficient: 100 PPM/°C.
- Temperature range: −55°C to +125°C.
- Dielectric breakdown: 50 Vdc.
- Meets or exceeds MIL-D-23859C.
- Epoxy encapsulated.



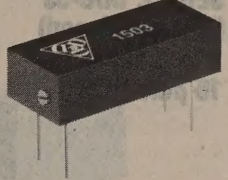


Part No.	Imp. (Ω)	Total Delay (NS)	Tap Increment (NS)	Rdc (Ω)
2214-50A	50	50	2.5	3.2
2214-60A	50	60	3.0	3.6
2214-80A	50	80	4.0	5.0
2214-100A	50	100	5.0	6.0
2214-150A	50	150	7.5	6.0
2214-200A	50	200	10.0	7.0
2214-50B	100	50	2.5	6.0
2214-60B	100	60	3.0	6.0
2214-80B	100	80	4.0	6.5
2214-100B	100	100	5.0	7.0
2214-150B	100	150	7.5	8.0
2214-200B	100	200	10.0	8.5
2214-300B	100	300	15.0	11.0
2214-400B	100	400	20.0	12.0
2214-40C	200	40	2.0	7.0
2214-80C	200	80	4.0	8.0
2214-120C	200	120	6.0	10.0
2214-200C	200	200	10.0	13.0
2214-300C	200	300	15.0	12.0
2214-400C	200	400	20.0	15.0
2214-500C	200	500	25.0	17.0
2214-600C	200	600	30.0	23.0
2214-800C	200	800	40.0	38.0
2214-50D	250	50	2.5	7.0
2214-100D	250	100	5.0	10.0
2214-150D	250	150	7.5	12.0
2214-200D	250	200	10.0	22.0
2214-250D	250	250	12.5	21.0
2214-300D	250	300	15.0	23.0
2214-400D	250	400	20.0	26.0
2214-500D	250	500	25.0	30.0
2214-600D	250	600	30.0	37.0
2214-800D	250	800	40.0	41.0
2214-1000D	250	1000	50.0	47.0
2214-200G	500	200	10.0	20.0
2214-300G	500	300	15.0	37.0
2214-400G	500	400	20.0	40.0
2214-500G	500	500	25.0	45.0
2214-600G	500	600	30.0	52.0
2214-800G	500	800	40.0	80.0
2214-1000G	500	1000	50.0	100.0
2214-1200G	500	1200	60.0	110.0
2214-1500G	500	1500	75.0	130.0
2214-2000G	500	2000	100.0	156.0

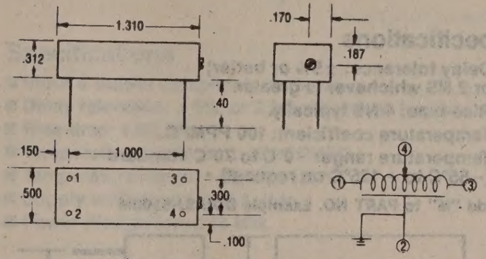
CONTINUOUSLY VARIABLE DELAY LINES

SERIES 1503

Specifications



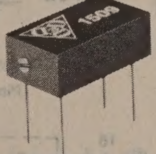
- Continuously variable delay.
- Multi-turn adjusting screw (40 turns approx.).
- Temperature coefficient — 100 PPM/°C.
- Rise-time −20% of time delay
- Flat leads (.020 x .010).
- Withstanding voltage — 50 Vdc.
- Resolution — .12NS approx.



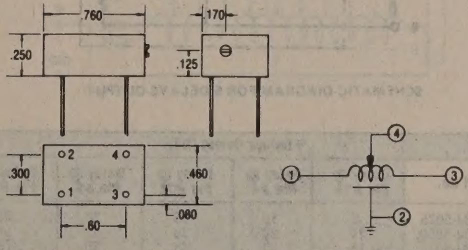
Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)
1503-15A	15	50	.7	1503-100B	100	100	6.0
1503-25A	25	50	.8	1503-120B	120	100	8.0
1503-30A	30	50	1.0	1503-160B	160	100	10.0
1503-40A	40	50	1.5	1503-200B	200	100	14.0
1503-50A	50	50	1.7	1503-30C	30	200	4.0
1503-60A	60	50	2.0	1503-60C	60	200	8.0
1503-80A	80	50	3.0	1503-100C	100	200	14.0
1503-100A	100	50	3.5	1503-20D	20	250	5.0
1503-15B	15	100	1.0	1503-20E	20	300	5.0
1503-30B	30	100	2.0	1503-30F	30	350	8.0
1503-50B	50	100	3.0	1503-25G	25	400	8.0
1503-60B	60	100	4.0	1503-40H	40	500	12.0
1503-80B	80	100	5.0				

SERIES 1509

Specifications



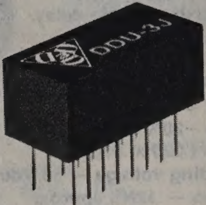
- Low cost unit.
- Fits standard DIP sockets.
- Continuously variable.
- 20 Turns approx.
- Resolution — .15 NS.
- Withstanding voltage — 100 Vdc.
- Temperature coefficient — 200 PPM/°C.
- Flat leads (.020 x .010).



Part No.	Td (NS)	Impedance (Ω)	TR (NS)	Rdc (Ω)
1509-05B	5	100	3	.4
1509-20C	20	200	8	1.0
1509-30F	30	400	10	7.0
1509-40H	40	500	15	13.0

DIGITAL DELAY LINES

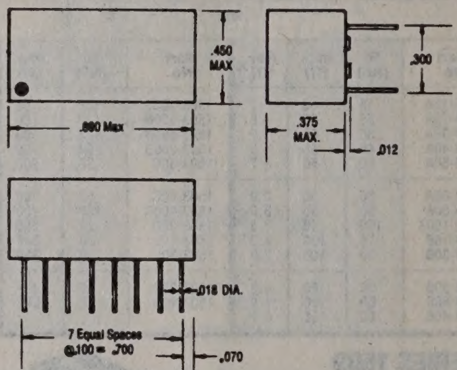
SERIES: DDU-3J (TTL Interfaced) 1 to 5 Taps, 16 pins DIP

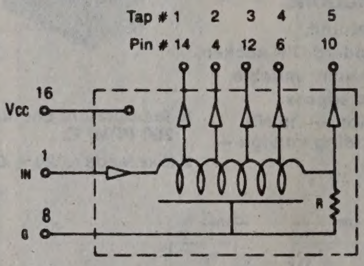


Specifications

- Delay tolerance: ±5% or better; or 2 NS whichever is greater.
- Rise-time: 4 NS typically.
- Temperature coefficient: 100 PPM/°C.
- Temperature range: −0°C to 70°C standard (−55°C to + 125°C on request).*

*Add "M" to PART NO. Example DDU-3J-5100M

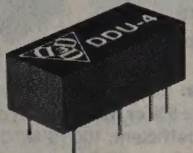

.450
MAX
.880 Max
.300
.375
MAX.
.012
.018 DIA.
7 Equal Spaces
@.100 = .700
.070


Tap # 1 2 3 4 5
Pin # 14 4 12 6 10
16
Vcc
1
IN
R
8
G

SCHEMATIC DIAGRAM FOR 5 DELAYS OUTPUT

Part No.	5 Delays Output (NS)				
	Delay @ Pin #14	Delay @ Pin #4	Delay @ Pin #12	Delay @ Pin #6	Delay @ Pin #10
DDU-3J-5025	5	10	15	20	25
DDU-3J-5050	10	20	30	40	50
DDU-3J-5075	15	30	45	60	75
DDU-3J-5100	20	40	60	80	100
DDU-3J-5125	25	50	75	100	125
DDU-3J-5150	30	60	90	120	150
DDU-3J-5200	40	80	120	160	200
DDU-3J-5250	50	100	150	200	250
DDU-3J-5300	60	120	180	240	300
DDU-3J-5400	80	160	240	320	400
DDU-3J-5500	100	200	300	400	500

SERIES DDU-4 (TTL Interfaced) 1 to 5 Taps, 14 pins DIP

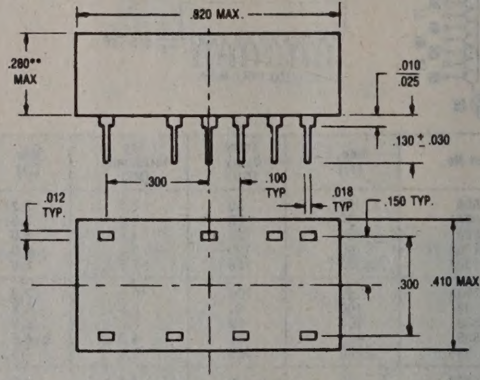


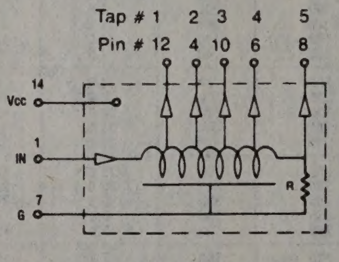
Specifications

- Delay tolerance: ±5% or better; or 2NS whichever is greater.
- Rise-time: 4 NS typically.
- Temperature coefficient: 100 PPM/°C.
- Temperature range: −0°C to 70°C standard (−55°C to +125°C on request).*

*Add "M" after PART NO. Example DDU-4-5100M

**.320 Max. for "M" units.


.820 MAX.
.280**
MAX
.010
.025
.130 ± .030
.300
.100
TYP
.018
TYP
.012
TYP.
.150 TYP.
.300
.410 MAX


Tap # 1 2 3 4 5
Pin # 12 4 10 6 8
14
Vcc
1
IN
R
7
G

SCHEMATIC DIAGRAM FOR 5 DELAYS OUTPUT

Part No.	5 Delays Output (NS)				
	Delay @ Pin #12	Delay @ Pin #4	Delay @ Pin #10	Delay @ Pin #6	Delay @ Pin #8
DDU-4-5025	5	10	15	20	25
DDU-4-5050	10	20	30	40	50
DDU-4-5075	15	30	45	60	75
DDU-4-5100	20	40	60	80	100
DDU-4-5125	25	50	75	100	125
DDU-4-5150	30	60	90	120	150
DDU-4-5200	40	80	120	160	200
DDU-4-5250	50	100	150	200	250
DDU-4-5300	60	120	180	240	300
DDU-4-5400	80	160	240	320	400
DDU-4-5500	100	200	300	400	500

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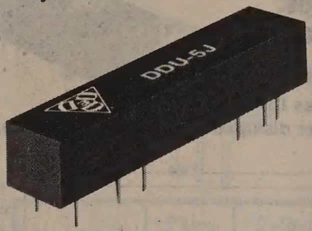
DIGITAL DELAY LINES

SERIES DDU-5J
(TTL Interfaced)
10 Taps,
32 pins DIP

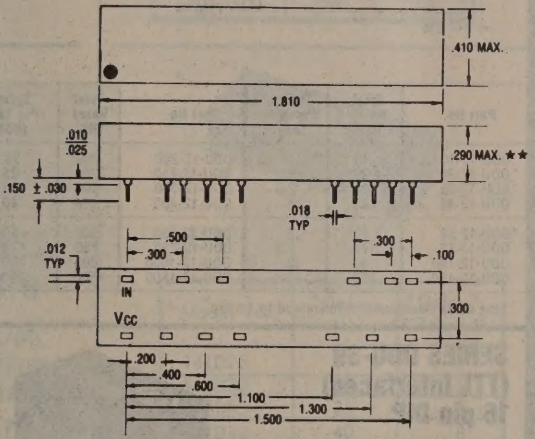


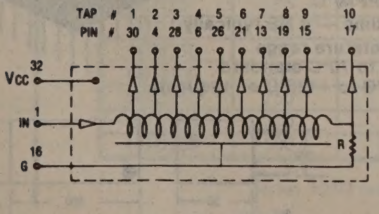
Specifications

- Delay tolerance: ±5% or better; or 2NS whichever is greater.
- Rise-time: 4 NS typically.
- Temperature coefficient: 100 PPM/°C.
- Temperature range: −0°C to 70°C standard (−55°C to +125°C on request).*

*Add "M" after PART NO. Example DDU-5J-10100M

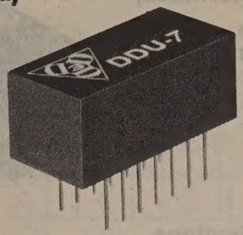
**.320 Max. for "M" units.


.410 MAX.
1.810
.010
.025
.290 MAX. ★★
.150 ± .030
.018
TYP
.012
TYP
.500
.300
.300
.100
IN
Vcc
.300
.200
.400
.600
1.100
1.300
1.500


TAP # 1 2 3 4 5 6 7 8 9 10
PIN # 30 4 28 6 26 21 13 19 15 17
32
Vcc
1
IN
16
G
R

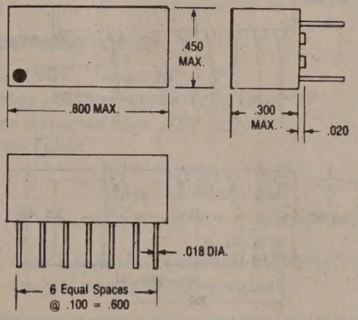
Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
DDU-5J-10050	50	5	DDU-5J-10400	400	40
DDU-5J-10100	100	10	DDU-5J-10500	500	50
DDU-5J-10150	150	15	DDU-5J-101000	1000	100
DDU-5J-10200	200	20	DDU-5J-101500	1500	150
DDU-5J-10250	250	25	DDU-5J-102000	2000	200
DDU-5J-10300	300	30			

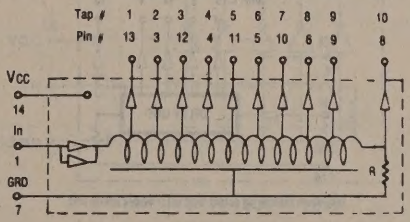
SERIES DDU-7
(TTL Interfaced)
10 Taps,
14 pins DIP



Specifications

- Input & output completely buffered.
- Delay tolerance: ±5%, or 2 NS whichever is greater.
- Rise-time: 4 NS typ.
- Temperature coefficient: 100 PPM/°C.
- Temperature range: −55°C to 125°C.
- Supply voltage: 4.5 to 5.5. Vdc.
- Power dissipation: 240 MW.


.450
MAX.
.800 MAX.
.300
MAX.
.020
.018 DIA.
6 Equal Spaces
@ .100 = .600


Tap # 1 2 3 4 5 6 7 8 9 10
Pin # 13 3 12 4 11 5 10 6 9 8
Vcc
14
In
1
GRD
7
R

Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
*DDU-7-10	10	1	DDU-7-200	200	20.0
*DDU-7-20	20	2	DDU-7-250	250	25.0
*DDU-7-25	25	2.5	DDU-7-300	300	30.0
*DDU-7-50	50	5.0	DDU-7-400	400	40.0
DDU-7-100	100	10.0	DDU-7-500	500	50.0
DDU-7-150	150	15.0			

*Time delay measurements referenced to 1st tap

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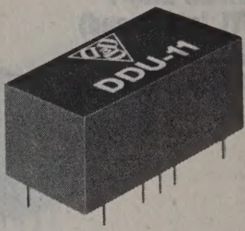
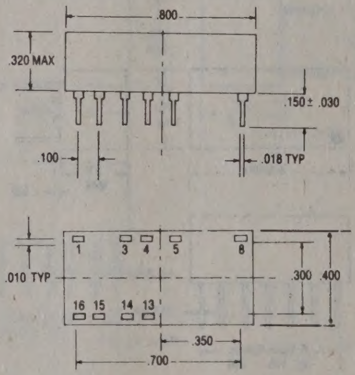
DIGITAL DELAY LINES

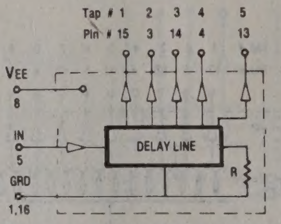
SERIES DDU-11 (ECL Interfaced) 5 Taps, 16 pins DIP



Specifications

- Input & output completely buffered.
- Delay tolerance: ±5% or 2 NS whichever is greater.
- Rise-time: 2 NS typ.
- Temperature coefficient: 100 PPM/°C.
- Temperature range: −30°C to 85°C.
- Supply voltage: −5.2 Vdc.
- Power dissipation: 200 MW typ. (no load).


.800
.320 MAX
.150 ± .030
.100
.018 TYP
.010 TYP
1
3
4
5
8
16
15
14
13
.300
.400
.350
.700

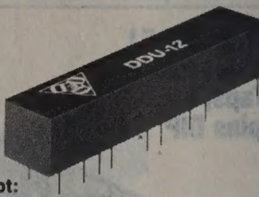

Tap # 1 2 3 4 5
Pin # 15 3 14 4 13
VEE
8
IN
5
GRD
1,16
DELAY LINE
R

Pull-down resistor on output taps not provided inside unit.

Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
*DDU-11-5	5	1	DDU-11-150	150	30
*DDU-11-10	10	2	DDU-11-200	200	40
*DDU-11-20	20	4	DDU-11-250	250	50
*DDU-11-25	25	5	DDU-11-300	300	60
DDU-11-50	50	10	DDU-11-400	400	80
DDU-11-75	75	15	DDU-11-500	500	100
DDU-11-100	100	20			

*Time delay measurements referenced to 1st tap

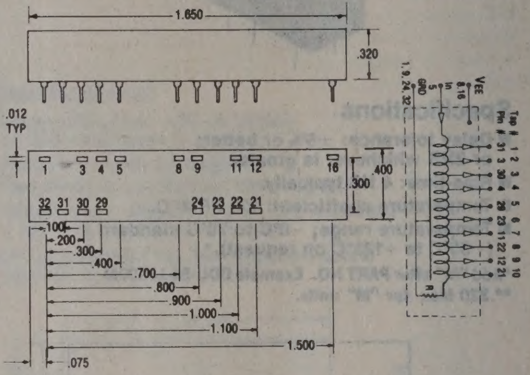
SERIES DDU-12 (ECL Interfaced) 10 Taps, 32 pins DIP



Specifications

Same as DDU-11 except:

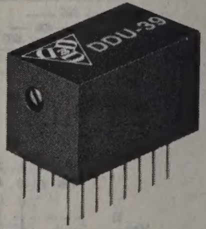
- Power dissipation: 400 MW typ (no load)


1.650
.320
.012 TYP
1
3
4
5
8
9
11
12
16
32
31
30
29
24
23
22
21
.400
.300
.100
.200
.300
.400
.700
.800
.900
1.000
1.100
1.500
.075
VEE
GRD
In
1, 9, 24, 32
Tap #
Pin #
R

Part No.	Total Delay (NS)	Delay Per Tap (NS)	Part No.	Total Delay (NS)	Delay Per Tap (NS)
*DDU-12-10	10	1	DDU-12-200	200	20
*DDU-12-20	20	2	DDU-12-250	250	25
*DDU-12-25	25	2.5	DDU-12-300	300	30
*DDU-12-40	40	4	DDU-12-400	400	40
*DDU-12-50	50	5	DDU-12-500	500	50
DDU-12-75	75	7.5	DDU-12-750	750	75
DDU-12-100	100	10	DDU-12-1000	1000	100
DDU-12-150	150	15	DDU-12-1500	1500	150

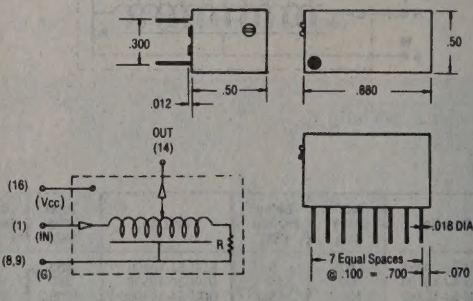
*Time delay measurements referenced to 1st tap.

SERIES DDU-39 (TTL Interfaced) 16 pin DIP.



Specifications

- Temperature coefficient −200PPM/°C.
- Rise-time — 4 NS typically.
- Temperature range −0°C to 70°C standard (−55°C to +125°C on request).


.300
.50
.012
.50
.880
OUT
(14)
(16)
(Vcc)
(1)
(IN)
(8,9)
(G)
R
.018 DIA.
7 Equal Spaces @ .100 = .700
.070

Continuously adjustable from 10NS to 30NS

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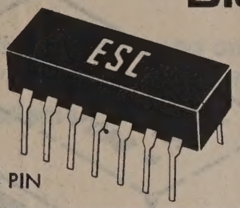
Over 30 Years of Experience!

ESC DELAY LINES

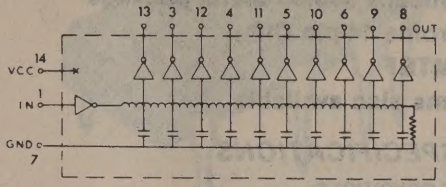
MACHINE INSERTABLE LOW PROFILE DIP DIGITAL DELAY LINES

SERIES 10TD

TTL/DTL
COMPATIBLE
10 TAPS
14 PIN
PACKAGE



Model No.	*Delay (ns)	*Delay/ Tap (ns)
10TD50	50	5
10TD100	100	10
10TD150	150	15
10TD200	200	20
10TD250	250	25
10TD300	300	30
10TD350	350	35
10TD400	400	40
10TD450	450	45
10TD500	500	50



Size: .785 X .285 X .250

SPECIFICATIONS:

- *● Delay Tolerances: ± 2ns or ± 5% whichever is greater
- ● Rise Time: 4ns max
- ● Five equally spaced taps
- ● Operating Temp. Range: 0°C to + 70°C
- ● Terminal Leads: Electro tin plated Alloy 42 .020 W X .010

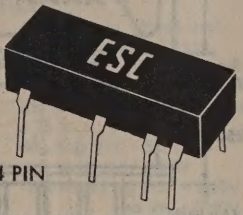
TEST CONDITIONS:

- ● Vcc = 5.0VDC, Temp. 25° ± 5°C
- ● Time delay measured at the 1.5V level
- ● Rise time measured from .75V to 2.4V
- ● Input Test Pulse:
  - Pulse voltage: 3.0V
  - Pulse rise time: 2ns
  - Pulse width: 1.2 X max Td

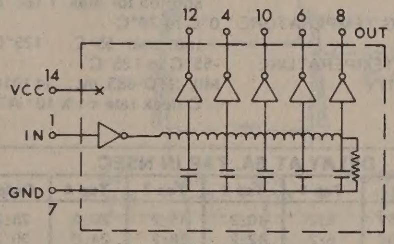
14 Pin Auto Insertable Versions of ESC'S 14G and 14P Series are also available upon request.

SERIES 14TD

TTL/DTL
COMPATIBLE
5 TAPS
14 PIN
PACKAGE



Model No.	*Delay (ns)	*Delay/ Tap (ns)
14TD25	25	5
14TD30	30	6
14TD35	35	7
14TD40	40	8
14TD45	45	9
14TD50	50	10
14TD75	75	15
14TD100	100	20
14TD150	150	30
14TD200	200	40
14TD250	250	50
14TD300	300	60
14TD500	500	100



Size: .785 X .285 X .250

Series 10TD and 14TD are interchangeable with series 10T and 14T

OTHER ESC STANDARD DELAY LINES:

Passive 7, 14, 16 and 24 Pin Types. Delays ranging from 1 nsec to 2000 nsec.

Digital Delay Lines, TTL, Low Power Schottky, ECL "10,000" in 5 tap, 10 tap, Triple and Single Output, in 8 Pin, 14 Pin and 30 Pin modules. Total delays available from 25 nsec to 1000 nsec.

Digital Programmable Delay lines utilizing TTL Schottky and ECL "10,000" circuits. 3, 4 and 6 bit types are standard.

WIRE • WRITE • OR CALL TOLL FREE (800) 631-0853 (Except N.J.)

ESC ELECTRONICS CORPORATION
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PHONE: (201) 947-0400 ● TWX 710-991-9780

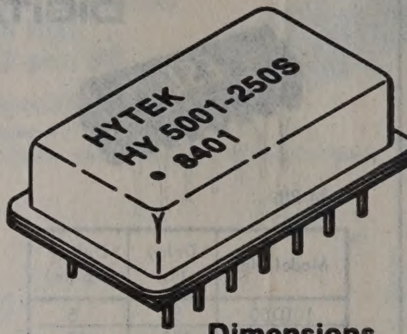
See our ads in EEM

5-TAP DIGITAL DELAY LINE (Hi-Rel Package)

HY-5001

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Hermetically sealed metal package**
- **Low profile 14-pin DIP**
- **High MTBF**
- **Customs also available**


HYTEK
HY 5001-250S
8401

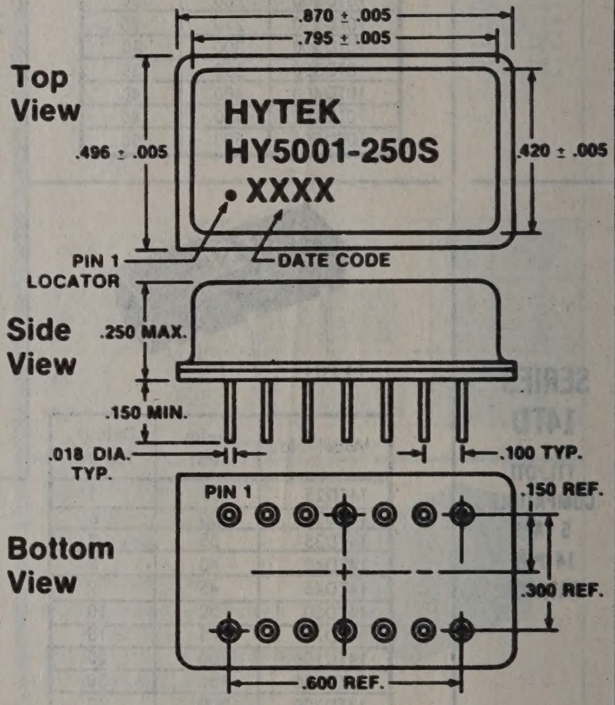
SPECIFICATIONS

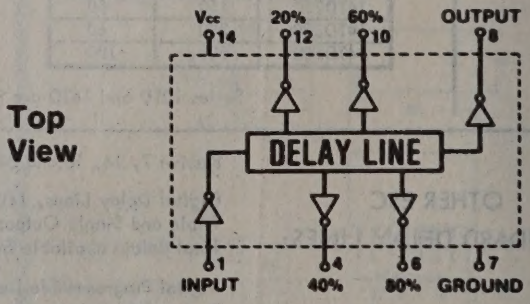
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (VCC)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max 20 TTL loads/unit max (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	65 mA max., 45 mA typical
SUPPLY VOLTAGE (VCC)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	50µA @ VCC = 5.25V and V_{IH} = 2.70V
LOGIC 0 INPUT CURRENT	-2 mA max. @ VCC = 5.25V and V_{IL} = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. VCC = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to 125°C)
STORAGE TEMPERATURE	-55°C to 125°C
HERMETICITY	MIL-STD-883, method 1014, cond. A, C (leak rate < 1 X 10[illegible] ATM. CC/S)

DELAY AT EA. TAP IN NSEC.					
Part No. †	**Tap 1**	**Tap 2**	**Tap 3**	**Tap 4**	**Output**
HY5001-025Y	5±2	10±2	15±2	20±2	25±2
HY5001-030Y	6±2	12±2	18±2	24±2	30±2
HY5001-035Y	7±2	14±2	21±2	28±2	35±2
HY5001-040Y	8±2	16±2	24±2	32±2	40±2
HY5001-045Y	9±2	18±2	27±2	36±2	45±2.3
HY5001-050Y	10±2	20±2	30±2	40±2	50±2.5
HY5001-075Y	15±2	30±2	45±2.3	60±3	75±3.8
HY5001-100Y	20±2	40±2	60±3	80±4	100±5
HY5001-150Y	30±2	60±3	90±4.5	120±6	150±7.5
HY5001-200Y	40±2	80±4	120±6	160±8	200±10
HY5001-250Y	50±2.5	100±5	150±7.5	200±10	250±12.5
HY5001-500Y	100±5	200±10	300±15	400±20	500±25

† Suffix "Y" designates:
S standard 0°C to 70°C operation
M standard -55°C to125°C operation
Z 883B screening (method 5004)

Dimensions (Inches)


Top View
.870 ± .005
.795 ± .005
.496 ± .005
HYTEK
HY5001-250S
XXXX
.420 ± .005
PIN 1 LOCATOR
DATE CODE
Side View
.250 MAX.
.150 MIN.
.018 DIA. TYP.
.100 TYP.
PIN 1
.150 REF.
Bottom View
.300 REF.
.600 REF.


Vcc
14
20%
12
60%
10
OUTPUT
8
Top View
DELAY LINE
1
INPUT
4
40%
6
80%
7
GROUND

Specifications Subject to Change Without Notice

hytek microsystems incorporated

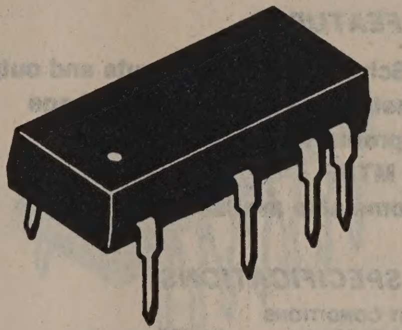
980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

HY-5003

5-TAP DIGITAL DELAY LINE
(Molded Package)

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Low profile (.220" with .015" standoff)**
- **Customs also available**
- **Auto insertable**



SPECIFICATIONS

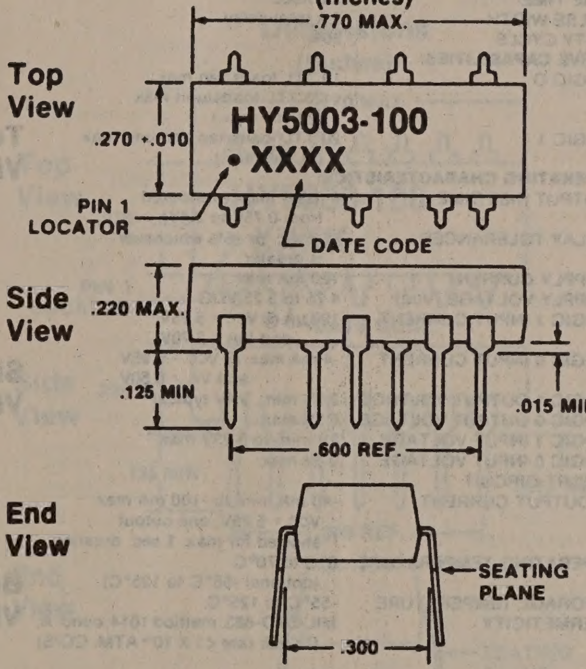
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (VCC)	5 0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max 20 TTL loads unit max (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max. (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec or ±5% whichever is greater
SUPPLY CURRENT	65 mA max., 45 mA typical
SUPPLY VOLTAGE (VCC)	4 75 to 5 25 VDC
LOGIC 1 INPUT CURRENT	50µA @ VCC = 5.25V and VIH = 2.70V
LOGIC 0 INPUT CURRENT	-2 mA max. @ VCC = 5.25V and VIL = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2 7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. VCC = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to 125°C)
STORAGE TEMPERATURE	-55°C to 125°C

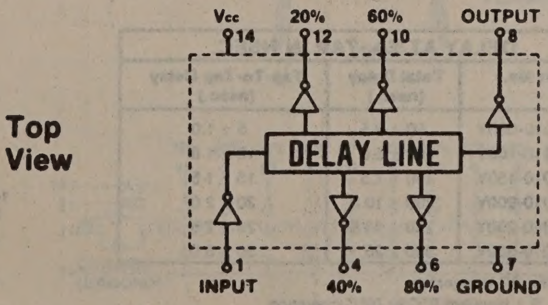
DELAY AT EA. TAP IN NSEC.

Part No. †	Tap 1	Tap 2	Tap 3	Tap 4	Output
HY5003-025Y	5±2	10±2	15±2	20±2	25±2
HY5003-030Y	6±2	12±2	18±2	24±2	30±2
HY5003-035Y	7±2	14±2	21±2	28±2	35±2
HY5003-040Y	8±2	16±2	24±2	32±2	40±2
HY5003-045Y	9±2	18±2	27±2	36±2	45±2.3
HY5003-050Y	10±2	20±2	30±2	40±2	50±2.5
HY5003-075Y	15±2	30±2	45±2.3	60±3	75±3.8
HY5003-100Y	20±2	40±2	60±3	80±4	100±5
HY5003-150Y	30±2	60±3	90±5.4	120±6	150±7.5
HY5003-200Y	40±2	80±4	120±6	160±8	200±10
HY5003-250Y	50±2.5	100±5	150±7.5	200±10	250±12.5

† Suffix "Y" designates:
S = standard 0°C to 70°C operation
M = standard -55°C to 125°C operation

Dimensions (Inches)





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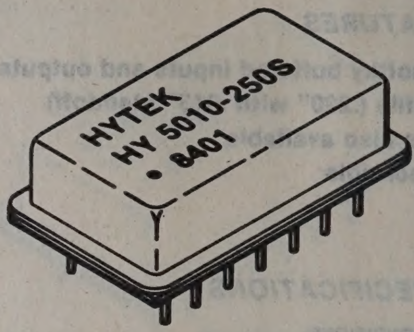
10-TAP DIGITAL DELAY LINE
(Hi-Rel Package)

HY-5010

FEATURES

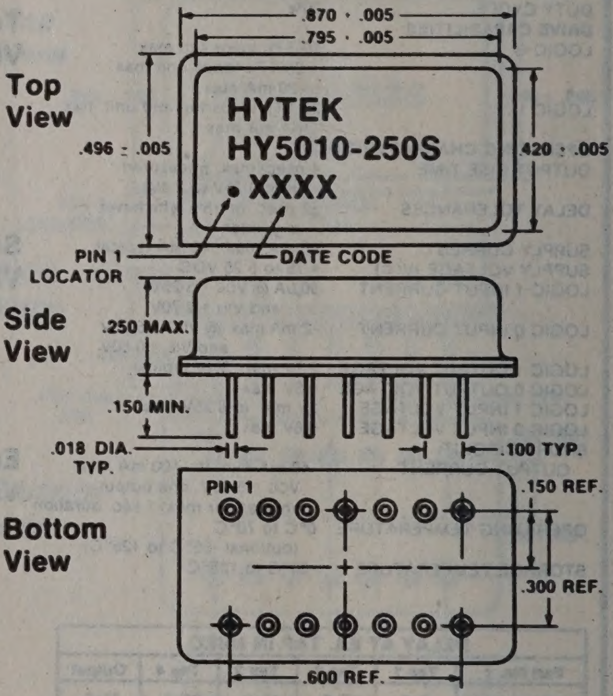
- **TTL Schottky buffered inputs and outputs**
- **Hermetically sealed metal package**
- **Low profile 14-pin DIP**
- **High MTBF**
- **Customs also available**


HYTEK
HY 5010-250S
8401

SPECIFICATIONS

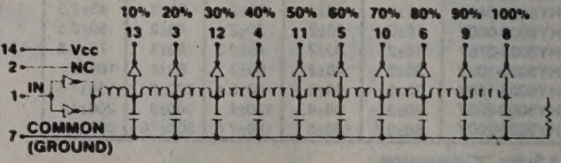
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (VCC)	5.0 VDC
PULSE VOLTAGE	Logic 1 = 3.2 volts Logic 0 = 0.0 volts
RISE TIME	3.0 nsec.
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads/tap max. 20 TTL loads/unit max (20 mA max.)
LOGIC 1	20 TTL loads/tap and unit max (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	120 mA max..
SUPPLY VOLTAGE (VCC)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	100μA @ VCC = 5.25V and V_{IH} = 2.70V
LOGIC 0 INPUT CURRENT	-4 mA max. @ VCC = 5.25V and V_{IL} = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max.
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. VCC = 5.25V, one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to 125°C)
STORAGE TEMPERATURE	-55°C to 125°C
HERMETICITY	MIL-STD-883, method 1014, cond. A, C.(leak rate < 1 X 10^{-6} ATM. CC/S)

Dimensions (Inches)


.870 ± .005
.795 ± .005
Top View
HYTEK
HY5010-250S
XXXX
.496 ± .005
.420 ± .005
PIN 1 LOCATOR
DATE CODE
Side View
.250 MAX.
.150 MIN.
.018 DIA. TYP.
.100 TYP.
Bottom View
PIN 1
.150 REF.
.300 REF.
.600 REF.

DELAY AT EA. TAP IN NSEC.		
Part No.†	**Total Delay (nsec.)**	**Tap-To-Tap Delay (nsec.)**
HY5010-050Y	50 ± 2.5	5 ± 1.0
HY5010-100Y	100 ± 5.0	10 ± 1.0
HY5010-150Y	150 ± 7.5	15 ± 1.5
HY5010-200Y	200 ± 10.0	20 ± 2.0
HY5010-250Y	250 ± 13.5	25 ± 2.5
HY5010-500Y	500 ± 25	50 ± 5.0

† Suffix "Y" designates:
S = standard 0°C to 70°C operation
M = standard -55°C to125°C operation
Z = 883B screening (method 5004)


10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
13
3
12
4
11
5
10
6
9
8
14
Vcc
2
NC
1
IN
7
COMMON
(GROUND)

Specifications Subject to Change Without Notice

hytek microsystems incorporated

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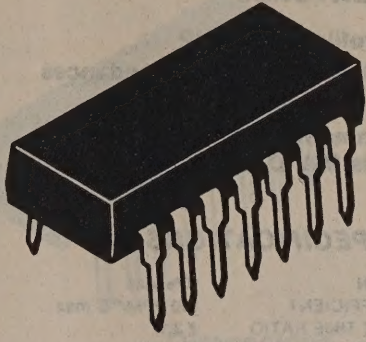
For More Information. Circle No. 153

HY-5030

10-TAP DIGITAL DELAY LINE
(Molded Package)

FEATURES

- **TTL Schottky buffered inputs and outputs**
- **Low profile (.220" with .015" standoff)**
- **Customs also available**
- **Auto Insertable**



SPECIFICATIONS

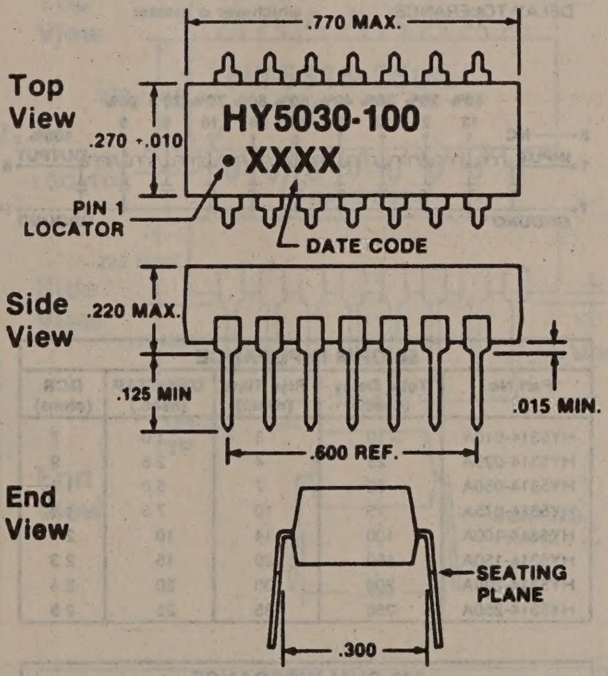
INPUT TEST CONDITIONS:	
SUPPLY VOLTAGE (VCC)	5.0 VDC
PULSE VOLTAGE	Logic 1 3.2 volts Logic 0 0.0 volts
RISE TIME	3.0 nsec
PULSE WIDTH	2 x total delay
DUTY CYCLE	20%
DRIVE CAPABILITIES:	
LOGIC O	10 TTL loads tap max 20 TTL loads unit max (20 mA max.)
LOGIC 1	20 TTL loads tap and unit max (-1 mA max.)
OPERATING CHARACTERISTICS:	
OUTPUT RISE TIME	4 nsec. max. (measured from 0.75V to 2.4V)
DELAY TOLERANCES	±2 nsec. or ±5% whichever is greater
SUPPLY CURRENT	120 mA max.
SUPPLY VOLTAGE (VCC)	4.75 to 5.25 VDC
LOGIC 1 INPUT CURRENT	100μA @ VCC = 5.25V and VIH = 2.70V
LOGIC 0 INPUT CURRENT	-4 mA max. @ VCC = 5.25V and VIL = 0.50V
LOGIC 1 OUTPUT VOLTAGE	2.7V min., 3.4V typical
LOGIC 0 OUTPUT VOLTAGE	0.5V max.
LOGIC 1 INPUT VOLTAGE	2V min. to 5.25V max.
LOGIC 0 INPUT VOLTAGE	0.8V max
SHORT CIRCUIT OUTPUT CURRENT	-40 mA min. to -100 mA max. VCC = 5.25V one output shorted for max. 1 sec. duration
OPERATING TEMPERATURE	0°C to 70°C (optional -55°C to 125°C)
STORAGE TEMPERATURE	-55°C to 125°C

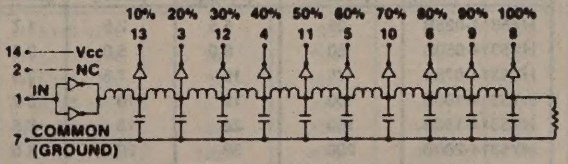
DELAY AT EA. TAP IN NSEC.

Part No.†	Total Delay (nsec.)	Tap-To-Tap Delay (nsec.)
HY5030-050Y	50 ± 2.5	5 ± 1.0
HY5030-100Y	100 ± 5.0	10 ± 1.0
HY5030-150Y	150 ± 7.5	15 ± 1.5
HY5030-200Y	200 ± 10.0	20 ± 2.0
HY5030-250Y	250 ± 13.5	25 ± 2.5

† Suffix "Y" designates
S standard 0°C to 70°C operation
M standard -55°C to125°C operation

Dimensions
(Inches)


.770 MAX.
Top View
.270 +.010
HY5030-100
• XXXX
PIN 1 LOCATOR
DATE CODE
Side View
.220 MAX.
.125 MIN
.015 MIN.
.600 REF.
End View
SEATING PLANE
.300


10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
13
3
12
4
11
5
10
6
9
8
14
Vcc
2
NC
1
IN
7
COMMON
(GROUND)

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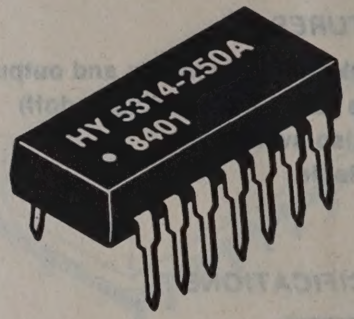
10-TAP PASSIVE DELAY LINE
(14-PIN DIP)

HY-5314

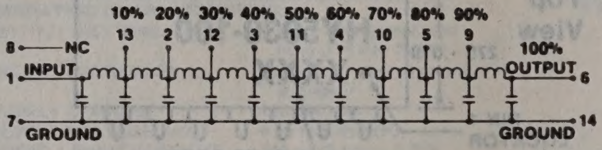
FEATURES

- **Low profile 14 pin DIP**
- **50, 100, and 200 ohm impedances**
- **TTL, ECL compatible**
- **Environmental - meets or exceeds MIL-D-23859**

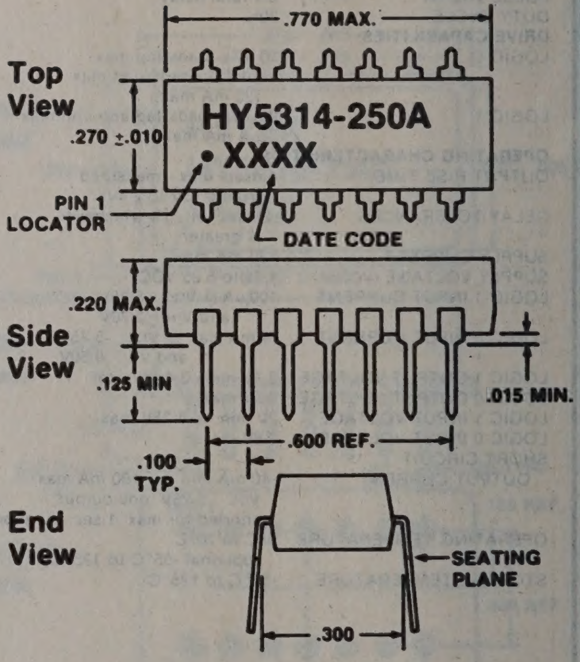

HY 5314-250A
• 8401

SPECIFICATIONS

DISTORTION	10% max.
TEMP. COEFFICIENT	100 PPM/°C max.
DELAY/RISE TIME RATIO	≥ 3:1
WITHSTANDING VOLTAGE	50 VDC min.
ATTENUATION	0.5db max.
TOTAL DELAY TOLERANCE	±5% or 2 nsec. whichever is greater
TAP-TO-TAP DELAY TOLERANCE	±10% or 0.5 nsec. whichever is greater


10%
20%
30%
40%
50%
60%
70%
80%
90%
13
2
12
3
11
4
10
5
9
8
NC
100%
1
INPUT
OUTPUT
6
7
GROUND
GROUND
14

Dimensions
(Inches)


.770 MAX.
Top View
.270 ±.010
HY5314-250A
• XXXX
PIN 1 LOCATOR
DATE CODE
.220 MAX.
Side View
.125 MIN
.015 MIN.
.600 REF.
.100 TYP.
End View
SEATING PLANE
.300

50 OHM IMPEDANCE				
Part No.	**Total Delay (nsec.)**	**Rise Time (nsec.)**	**Delay/TAP (nsec.)**	**DCR (ohms)**
HY5314-010A	10	3	1.0	.7
HY5314-025A	25	4	2.5	.9
HY5314-050A	50	7	5.0	1.3
HY5314-075A	75	10	7.5	1.8
HY5314-100A	100	14	10	2.1
HY5314-150A	150	20	15	2.3
HY5314-200A	200	30	20	2.4
HY5314-250A	250	35	25	2.5

100 OHM IMPEDANCE				
Part No.	**Total Delay (nsec.)**	**Rise Time (nsec.)**	**Delay/TAP (nsec.)**	**DCR (ohms)**
HY5314-025B	25	5.5	2.5	1.7
HY5314-050B	50	8.0	5.0	2.3
HY5314-075B	75	15	7.5	2.9
HY5314-100B	100	18	10	3.2
HY5314-150B	150	26	15	3.5
HY5314-200B	200	39	20	4.0
HY5314-250B	250	46	25	4.5

200 OHM IMPEDANCE				
Part No.	**Total Delay (nsec.)**	**Rise Time (nsec.)**	**Delay/TAP (nsec.)**	**DCR (ohms)**
HY5314-025C	25	9.0	2.5	1.8
HY5314-050C	50	15.5	5.0	2.4
HY5314-075C	75	18.0	7.5	2.5
HY5314-100C	100	20.0	10	3.0
HY5314-150C	150	30.0	15	4.0
HY5314-200C	200	40.0	20	6.0
HY5314-250C	250	50.0	25	8.5

Specifications Subject to Change Without Notice

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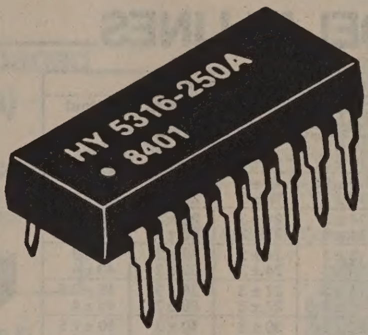
For More Information. Circle No. 153

HY-5316

10-TAP PASSIVE DELAY LINE
(16-PIN DIP)

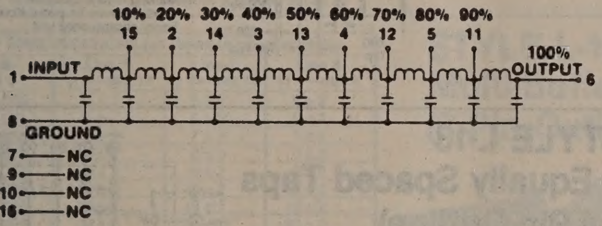
FEATURES

- **Low profile 16 pin DIP**
- **50, 100, and 200 ohm impedances**
- **TTL, ECL compatible**
- **Environmental - meets or exceeds MIL-D-23859**

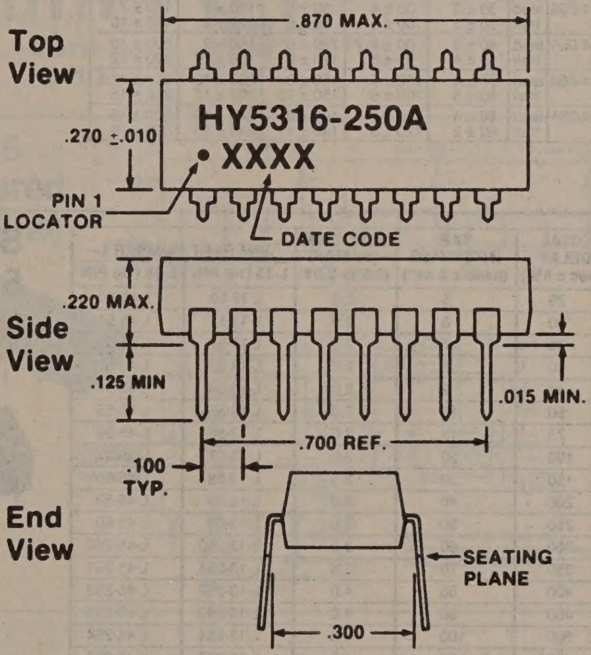

HY 5316-250A
• 8401

SPECIFICATIONS

DISTORTION	10% max.
TEMP. COEFFICIENT	100 PPM/°C max.
DELAY/RISE TIME RATIO	≥3:1
WITHSTANDING VOLTAGE	50 VDC min.
ATTENUATION	0.5db max.
TOTAL DELAY TOLERANCE	±5% or 2 nsec. whichever is greater
TAP-TO-TAP DELAY TOLERANCE	±10% or 0.5 nsec. whichever is greater


10%
20%
30%
40%
50%
60%
70%
80%
90%
15
2
14
3
13
4
12
5
11
1
INPUT
100%
OUTPUT
6
8
GROUND
7
NC
9
NC
10
NC
16
NC

Dimensions (Inches)


Top View
.870 MAX.
HY5316-250A
• XXXX
.270 ±.010
PIN 1 LOCATOR
DATE CODE
.220 MAX.
Side View
.125 MIN
.015 MIN.
.700 REF.
.100 TYP.
End View
SEATING PLANE
.300

50 OHM IMPEDANCE				
Part No.	Total Delay (nsec.)	Rise Time (nsec.)	Delay/TAP (nsec.)	DCR (ohms)
HY5316-010A	10	3	1.0	.7
HY5316-025A	25	4	2.5	.9
HY5316-050A	50	7	5.0	1.3
HY5316-075A	75	10	7.5	1.8
HY5316-100A	100	14	10	2.1
HY5316-150A	150	20	15	2.3
HY5316-200A	200	30	20	2.4
HY5316-250A	250	35	25	2.5

100 OHM IMPEDANCE				
Part No.	Total Delay (nsec.)	Rise Time (nsec.)	Delay/TAP (nsec.)	DCR (ohms)
HY5316-025B	25	5.5	2.5	1.7
HY5316-050B	50	8.0	5.0	2.3
HY5316-075B	75	15	7.5	2.9
HY5316-100B	100	18	10	3.2
HY5316-150B	150	26	15	3.5
HY5316-200B	200	39	20	4.0
HY5316-250B	250	46	25	4.5

200 OHM IMPEDANCE				
Part No.	Total Delay (nsec.)	Rise Time (nsec.)	Delay/TAP (nsec.)	DCR (ohms)
HY5316-025C	25	9.0	2.5	1.8
HY5316-050C	50	15.5	5.0	2.4
HY5316-075C	75	18.0	7.5	2.5
HY5316-100C	100	20.0	10	3.0
HY5316-150C	150	30.0	15	4.0
HY5316-200C	200	40.0	20	6.0
HY5316-250C	250	50.0	25	8.5

Specifications Subject to Change Without Notice

hytek microsystems incorporated

980 University Avenue, Los Gatos, CA 95030
Phone (408) 395-2300 TWX 910-597-5393

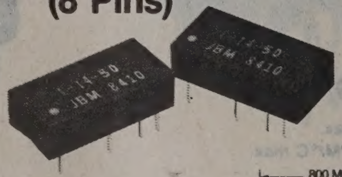
jbm Active & Passive Delay Lines

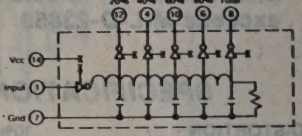
JBM produces one of the industry's broadest lines of active (digital) and passive magnetic delay lines for use in computers, communications equipment, military instrumentation, etc. In addition to hundreds of standard models, we offer extensive capabilities for the design and production of custom units for special applications.

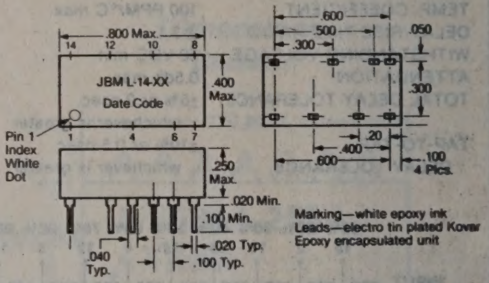
ACTIVE DELAY LINES

DELAY SPECIFICATIONS (all times in nanoseconds)						
JBM part #		Tap 1 Pin 12	Tap 2 Pin 4	Tap 3 Pin 10	Tap 4 Pin 6	Output Pin 8
L-14-050	lead	5 ± 3	10 ± 3	15 ± 3	20 ± 3	25 ± 2
	trail	5 ± 3	10 ± 3	15 ± 3	20 ± 3	25 ± 3
L-14-051	lead	6 ± 3	12 ± 3	18 ± 3	24 ± 3	30 ± 2
	trail	6 ± 3	12 ± 3	18 ± 3	24 ± 3	30 ± 3
L-14-052	lead	7 ± 3	14 ± 3	21 ± 3	28 ± 3	35 ± 2
	trail	7 ± 3	14 ± 3	21 ± 3	28 ± 3	35 ± 3
L-14-053	lead	8 ± 3	16 ± 3	24 ± 3	32 ± 3	40 ± 2
	trail	8 ± 3	16 ± 3	24 ± 3	32 ± 3	40 ± 4
L-14-054	lead	9 ± 3	18 ± 3	27 ± 3	36 ± 3	45 ± 2.5
	trail	9 ± 3	18 ± 3	27 ± 3	36 ± 3	45 ± 4
L-14-055	lead	10 ± 3	20 ± 3	30 ± 3	40 ± 3	50 ± 2.5
	trail	10 ± 3	20 ± 3	30 ± 3	40 ± 4	50 ± 4
L-14-056	lead	15 ± 3	30 ± 3	45 ± 3	60 ± 4	75 ± 4
	trail	15 ± 3	30 ± 3	45 ± 4	60 ± 5	75 ± 5
L-14-057	lead	20 ± 3	40 ± 3	60 ± 4	80 ± 4	100 ± 5
	trail	20 ± 3	40 ± 4	60 ± 5	80 ± 5	100 ± 6
L-14-058	lead	30 ± 3	60 ± 4	90 ± 5	120 ± 6	150 ± 7.5
	trail	30 ± 3	60 ± 5	90 ± 6	120 ± 9	150 ± 10
L-14-059	lead	40 ± 3	80 ± 4	120 ± 6	160 ± 8	200 ± 10
	trail	40 ± 4	80 ± 5	120 ± 8	160 ± 10	200 ± 12
L-14-060	lead	50 ± 4	100 ± 5	150 ± 8	200 ± 10	250 ± 12.5
	trail	50 ± 5	100 ± 6	150 ± 10	200 ± 12	250 ± 15
L-14-061	lead	60 ± 4	120 ± 6	180 ± 9	240 ± 12	300 ± 15
	trail	60 ± 5	120 ± 8	180 ± 11	240 ± 15	300 ± 18

STYLE L-14
5-Tap, Dual Triggerable (8 Pins)




20%
40%
60%
80%
Total
12
4
10
6
8
Vcc 14
Input 1
Gnd 7


.800 Max.
14
12
10
8
JBM L-14-XX
Date Code
.400 Max.
Pin 1 Index White Dot
1
4
6
7
.250 Max.
.020 Min.
.100 Min.
.020 Typ.
.040 Typ.
.100 Typ.
.600
.500
.300
.050
.300
.20
.400
.600
.100 4 Plcs.

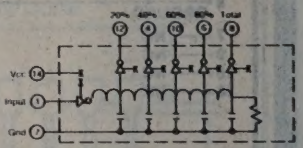
Marking—white epoxy ink
Leads—electro tin plated Kovar
Epoxy encapsulated unit

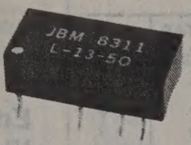
TOTAL DELAY (nsec ± 5%)	TAP INTERVALS (nsec ± 3 ns*)	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM PART NUMBER L-	
			L-13 (14) PIN	L-45 (16) PIN
25	5	2.0	L-13-50	L-45-50
30	6	2.0	L-13-51	L-45-51
35	7	2.0	L-13-52	L-45-52
40	8	2.0	L-13-53	L-45-53
45	9	2.0	L-13-54	L-45-54
50	10	2.0	L-13-55	L-45-55
75	15	2.0	L-13-56	L-45-56
100	20	2.0	L-13-57	L-45-57
150	30	2.5	L-13-58	L-45-58
200	40	3.0	L-13-59	L-45-59
250	50	3.0	L-13-60	L-45-60
300	60	3.5	L-13-250	L-45-250
350	70	3.5	L-13-251	L-45-251
400	80	4.0	L-13-252	L-45-252
450	90	4.0	L-13-253	L-45-253
500	100	4.0	L-13-254	L-45-254
600	120	4.5	L-13-255	L-45-255
700	140	4.5	L-13-256	L-45-256
750	150	4.5	L-13-257	L-45-257
800	160	5.0	L-13-258	L-45-258
900	180	5.0	L-13-259	L-45-259
1000	200	5.0	L-13-260	L-45-260

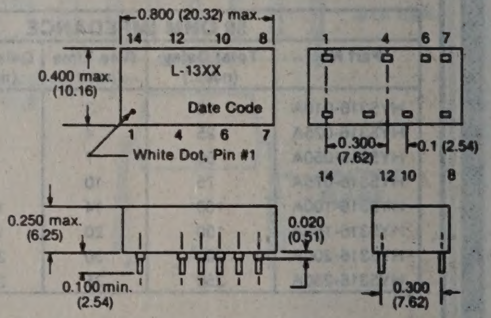
*or ± 5% whichever is greater.

Consult factory for other parameters and tolerances and low power (LS) versions.

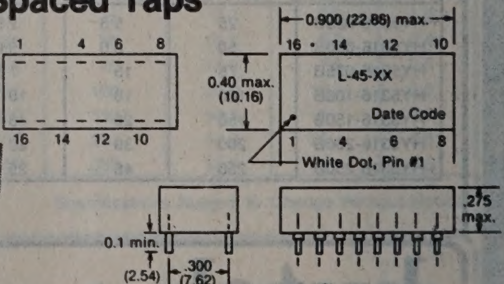
STYLE L-13
5 Equally Spaced Taps (14 Pin Outline)

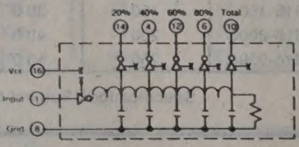

20%
40%
60%
80%
Total
12
4
10
6
8
Vcc 14
Input 1
Gnd 7

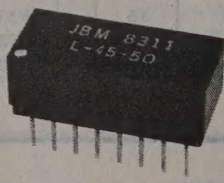



0.800 (20.32) max.
14
12
10
8
L-13XX
Date Code
0.400 max. (10.16)
1
4
6
7
White Dot, Pin #1
0.300 (7.62)
0.1 (2.54)
14
12 10
8
0.250 max. (6.25)
0.020 (0.51)
0.100 min. (2.54)
0.300 (7.62)

STYLE L-45
5 Equally Spaced Taps (16 Pins)


1
4
6
8
16
14
12
10
0.900 (22.86) max.
16
14
12
10
0.40 max. (10.16)
L-45-XX
Date Code
1
4
6
8
White Dot, Pin #1
.275 max.
0.1 min.
(2.54)
.300 (7.62)


20%
40%
60%
80%
Total
14
4
12
6
10
Vcc 16
Input 1
Gnd 8



ABOVE RATINGS & PACKAGES TYPICAL. SEND FOR COMPLETE CATALOG

JBM Electronics, Inc. • 531 Front Street • Manchester, NH 03102 • 603-623-0222
Telex No. 953134 TWX No. 710-220-8978

For More Information. Circle No. 154

Active & Passive Delay Lines

jbm

ACTIVE DELAY LINES

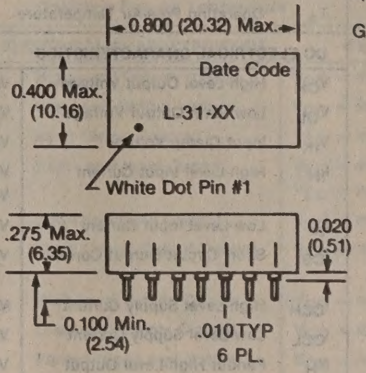
TOTAL DELAY (nsec ± 5%)	TAP INTERVALS (nsec ± 3 ns*)	RISE TIME (ns MAX) (0.8 to 2.0V)	JBM P/N L-31-XX
50	5.0	2.0	L-31-50
75	7.5	2.0	L-31-51
100	10.0	2.0	L-31-52
125	12.5	2.5	L-31-53
150	15.0	2.5	L-31-54
175	17.5	3.0	L-31-55
200	20.0	3.0	L-31-56
250	25.0	3.0	L-31-57
300	30.0	3.5	L-31-58
350	35.0	3.5	L-31-59
400	40.0	4.0	L-31-60
450	45.0	4.0	L-31-61
500	50.0	4.0	L-31-62
600	60.0	4.5	L-31-63
700	70.0	4.5	L-31-64
750	75.0	4.5	L-31-65
800	80.0	5.0	L-31-66
900	90.0	5.0	L-31-67
1000	100.0	5.0	L-31-68

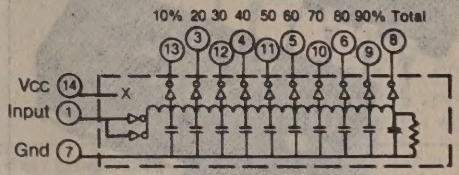
*or ± 5% whichever is greater.

Consult factory for other parameters and tolerances.

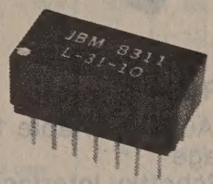
STYLE L-31

10 Equally Spaced Taps (14 Pins)


0.800 (20.32) Max.
0.400 Max.
(10.16)
Date Code
L-31-XX
White Dot Pin #1
.275 Max.
(6.35)
0.020
(0.51)
0.100 Min.
(2.54)
.010 TYP
6 PL.
0.300
(7.62)
.05 TYP


10% 20 30 40 50 60 70 80 90% Total
13
3
12
4
11
5
10
6
9
8
Vcc 14
X
Input 1
Gnd 7

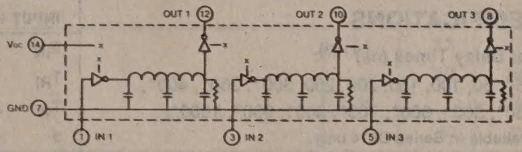
TTL and DTL Compatible

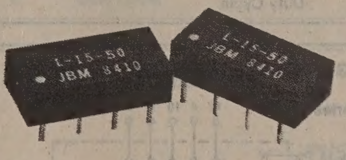

JBM 8311
L-31-10

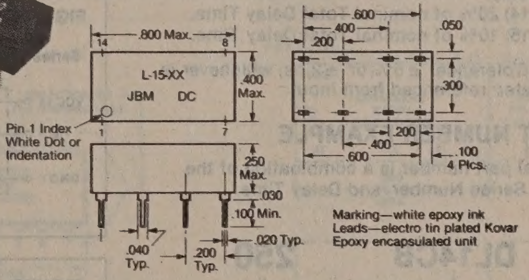
DELAY SPECIFICATIONS (all times in nanoseconds):			
JBM Part #	Line 1 in 1—out 12	Line 2 in 3—out 10	Line 3 in 5—out 8
L-15-050	5 ± 2	5 ± 2	5 ± 2
L-15-051	6 ± 2	6 ± 2	6 ± 2
L-15-052	7 ± 2	7 ± 2	7 ± 2
L-15-053	8 ± 2	8 ± 2	8 ± 2
L-15-054	9 ± 2	9 ± 2	9 ± 2
L-15-055	10 ± 2	10 ± 2	10 ± 2
L-15-056	15 ± 2	15 ± 2	15 ± 2
L-15-057	20 ± 2	20 ± 2	20 ± 2
L-15-058	30 ± 2	30 ± 2	30 ± 2
L-15-059	40 ± 3	40 ± 3	40 ± 3
L-15-060	50 ± 3	50 ± 3	50 ± 3
L-15-061	60 ± 3	60 ± 3	60 ± 3
L-15-062	70 ± 3.5	70 ± 3.5	70 ± 3.5
L-15-063	75 ± 4	75 ± 4	75 ± 4
L-15-064	80 ± 4	80 ± 4	80 ± 4
L-15-065	90 ± 4.5	90 ± 4.5	90 ± 4.5
L-15-066	100 ± 5	100 ± 5	100 ± 5
L-15-067	.125 ± 6.5	125 ± 6.5	125 ± 6.5
L-15-068	150 ± 7.5	150 ± 7.5	150 ± 7.5
L-15-069	175 ± 9	175 ± 9	175 ± 9
L-15-070	200 ± 10	200 ± 10	200 ± 10

STYLE L-15

Multi-Buffered (8 Pin Outline)


OUT 1 12
OUT 2 10
OUT 3 8
Vcc 14
GND 7
1 IN 1
3 IN 2
5 IN 3


L-15-50
JBM 8410
L-15-50
JBM 8410


.800 Max.
14
8
L-15-XX
JBM DC
.400
Max.
1
7
Pin 1 Index
White Dot or
Indentation
.250
Max.
.030
.100 Min.
.020 Typ.
.040
Typ.
.200
Typ.
.600
.400
.200
.050
.300
.200
.400
.600
.100
4 Plcs.

Marking—white epoxy ink
Leads—electro tin plated Kovar
Epoxy encapsulated unit

PASSIVE DELAY LINES

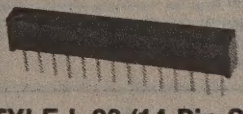
STYLE L-21 (14 Pin DIP) & STYLE L-22 (16 Pin DIP)

10 Equally Spaced Taps

JBM
L-23-10
24
13
1
12

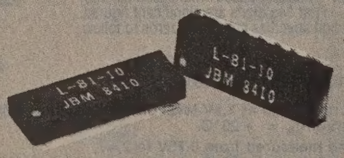
STYLE L-23

(20 Equally Spaced Taps)



STYLE L-26 (14 Pin SIP)

10 Equally Spaced Taps


L-81-10
JBM 8410
L-81-10
JBM 8410

STYLE L-81

Surface-Mounted

ABOVE RATINGS & PACKAGES TYPICAL. SEND FOR COMPLETE CATALOG

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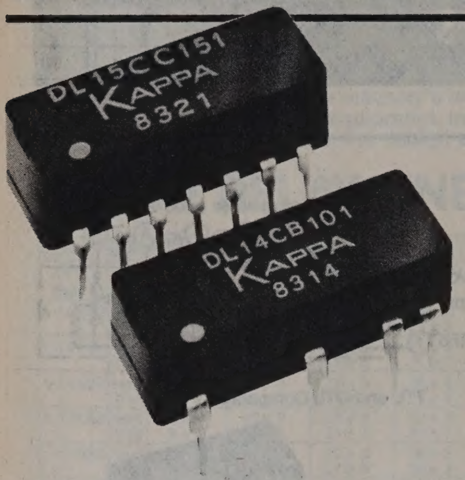
Telex No. 953134 TWX No. 710-220-8978

For More Information. Circle No. 154

SERIES DL14C/DL15C TTL SCHOTTKY (14-PIN)

5- & 10-TAP DIGITAL DELAY LINES


DL15CC151
KAPPA
8321
DL14CB101
KAPPA
8314

FEATURES

- New Auto-Insertable 14-pin Package
- TTL Schottky Interfaced
- 5 or 10 equally spaced Taps
- Risetime: 4 ns max. (see Notes 2 and 3)

SPECIFICATIONS

Total Delay Times (ns)[(1)(3)]:

25*, 50, 100, 150, 200, 250, 300*, 350*, 400*, 450*, 500*, 600*, 700*, 800*, 900*, 1000*.

*Available in Series DL14 only.

Tap Delay:
(DL14) 20% of nominal Total Delay Time.
(DL15) 10% of nominal Total Delay Time.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number and Delay Time.

DL14CB **250**

BASIC SERIES #

DELAY TIME: Expressed in nanoseconds (ns).
First two digits are significant figures.
Last digit specifies number of zeros to follow.

Notes for Specifications above.

(1) Delays measured at 1.5V level on leading edge only, V_{CC} = 5.0, T_A = +25°C.
(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0, T_A = +25°C.
(3) Measured with no loads on Taps.

PARAMETER			MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS		**TEST CONDITIONS**			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V		50	µA
		V_{CC} = max, V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

FIGURE 1 — SCHEMATIC

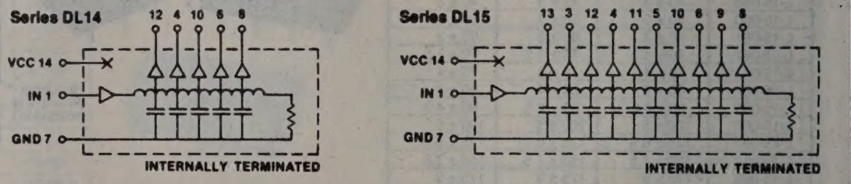
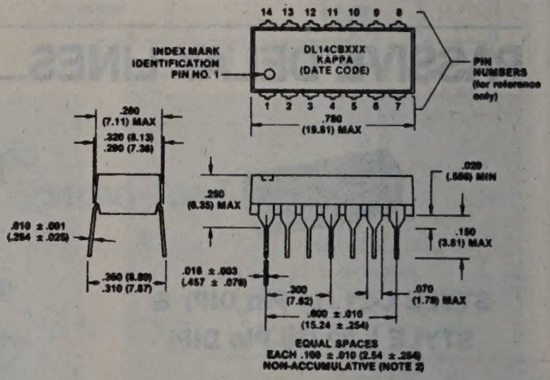

Series DL14
12 4 10 6 8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED
Series DL15
13 3 12 4 11 5 10 6 9 8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED

FIGURE 2 —
MARKING & DIMENSIONS
in inches and (mm)


14 13 12 11 10 9 8
INDEX MARK IDENTIFICATION PIN NO. 1
DL14CBXXX
KAPPA
(DATE CODE)
PIN NUMBERS (for reference only)
1 2 3 4 5 6 7
.780 (19.81) MAX
.280 (7.11) MAX
.320 (8.13)
.290 (7.36)
.010 ±.001 (.254 ±.025)
.350 (8.89)
.310 (7.87)
.250 (6.35) MAX
.020 (.508) MIN
.150 (3.81) MAX
.018 ±.003 (.457 ± .076)
.300 (7.62)
.070 (1.78) MAX
.600 ±.010 (15.24 ±.254)
EQUAL SPACES
EACH .100 ±.010 (2.54 ±.254)
NON-ACCUMULATIVE (NOTE 2)

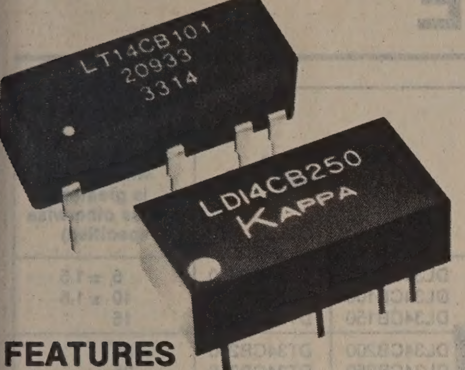
Notes for Figure 2:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.
(3) Series DL14 units may exclude terminals not shown in Figure 1 Schematic.

KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES LT14/LD14 TTL SCHOTTKY (14-PIN)

5-TAP DIGITAL DELAY MODULES


LT14CB101
20933
3314
LD14CB250
KAPPA

FEATURES

- T_{PLH} and T_{PHL} controlled
- 14-pin package
- Available in Auto-Insertable (LT14) and Standard Package (LD14)
- 5 equally spaced Delay Taps
- Operating Temperature Range: 0°C to +70°C

SPECIFICATIONS

Total Delay Times(ns)⁽¹⁾ ⁽³⁾: 25, 30, 50, 60, 75, 100, 125, 150, 175, 200, 225, 250, 300, 350, 400, and 500.

Tap Delay⁽¹⁾ ⁽³⁾: 5 equally-spaced delay taps at 20%, 40%, 60%, 80%, and 100% of nominal Total Delay.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

Output Risetime⁽²⁾ ⁽³⁾: 4nS maximum.

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS		**TEST CONDITIONS**			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V		50	µA
		V_{CC} = max, V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

Notes:

(1) Delays measured at 1.5V level on leading and trailing edges, V_{CC} = 5.0V, T_A = +25°C.

(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

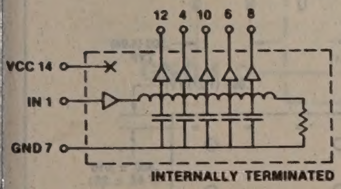
(3) Measured with no loads on taps.

PART NUMBER EXAMPLE

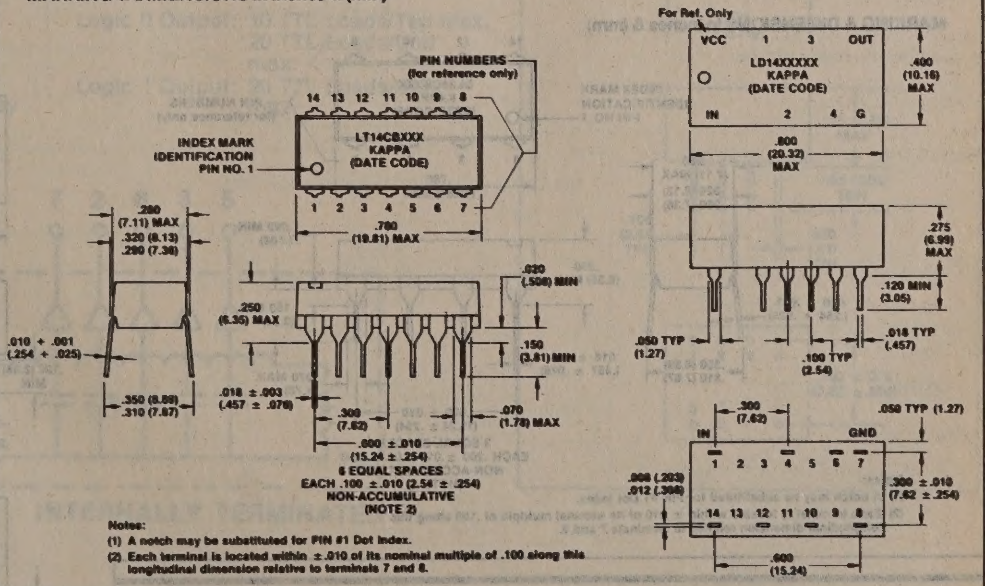
Typical Part Number is a combination of the Basic Series Number and Delay Time.

LT14CB	250
BASIC SERIES #	DELAY TIME

First two digits are significant figures. Last digit specifies number of zeros to follow (ns).


12
4
10
6
8
VCC 14
IN 1
GND 7
INTERNALLY TERMINATED

MARKING & DIMENSIONS in inches & (mm)


For Ref. Only
VCC
1
3
OUT
LD14XXXXX
KAPPA
(DATE CODE)
IN
2
4
G
.400 (10.16) MAX
.800 (20.32) MAX
PIN NUMBERS (for reference only)
14 13 12 11 10 9 8
INDEX MARK IDENTIFICATION PIN NO. 1
LT14CBXXX
KAPPA
(DATE CODE)
1 2 3 4 5 6 7
.780 (19.81) MAX
.280 (7.11) MAX
.320 (8.13)
.290 (7.36)
.010 + .001 (.254 + .025)
.350 (8.89)
.310 (7.87)
.250 (6.35) MAX
.020 (.508) MIN
.150 (3.81) MIN
.018 ± .003 (.457 ± .076)
.300 (7.62)
.070 (1.78) MAX
.600 ± .010 (15.24 ± .254)
6 EQUAL SPACES
EACH .100 ± .010 (2.54 ± .254)
NON-ACCUMULATIVE
(NOTE 2)
.275 (6.99) MAX
.120 MIN (3.05)
.050 TYP (1.27)
.018 TYP (.457)
.100 TYP (2.54)
.300 (7.62)
.050 TYP (1.27)
IN
GND
1 2 3 4 5 6 7
.008 (.203)
.012 (.306)
.300 ±.010 (7.62 ±.254)
14 13 12 11 10 9 8
.600 (15.24)

Notes:

(1) A notch may be substituted for PIN #1 Dot Index.

(2) Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

KAPPA® NETWORKS, INC.

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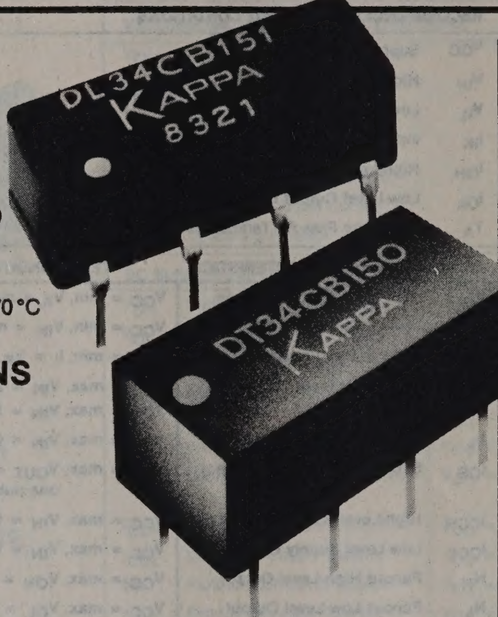
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

SERIES DL34/DT34 TTL SCHOTTKY (14-PIN)

TRIPLE-IN-LINE DIGITAL DELAY MODULE


DL34CB151
KAPPA
8321
DT34CB150
KAPPA

FEATURES

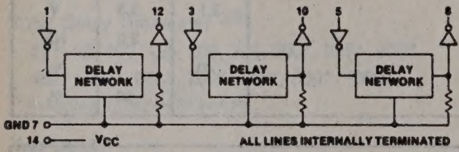
- 14-Pin DIL Package
- Available in Auto-Insertable (DL34) and Standard Package (DT34)
- Risetime 4ns Maximum
- Three Independent Equal Delays
- Operating Temperature 0°C to +70°C
- TTL Schottky Interfaced

INPUT TEST CONDITIONS

V_{CC}: 5.00V ±0.25V
Supply Current: I_{CCH} = 90mA max.
I_{CCL} = 115mA max.
Pulse Voltage: 3.2V ±0.1V
Risetime: 2.0 ns max.
Pulse Width: 100% min. of Delay
Duty Cycle: 25% or less

DRIVE CAPABILITIES

10 TTL loads per line


1
12
3
10
5
8
DELAY NETWORK
DELAY NETWORK
DELAY NETWORK
GND 7
14
V_{CC}
ALL LINES INTERNALLY TERMINATED

ELECTRICAL SPECIFICATIONS

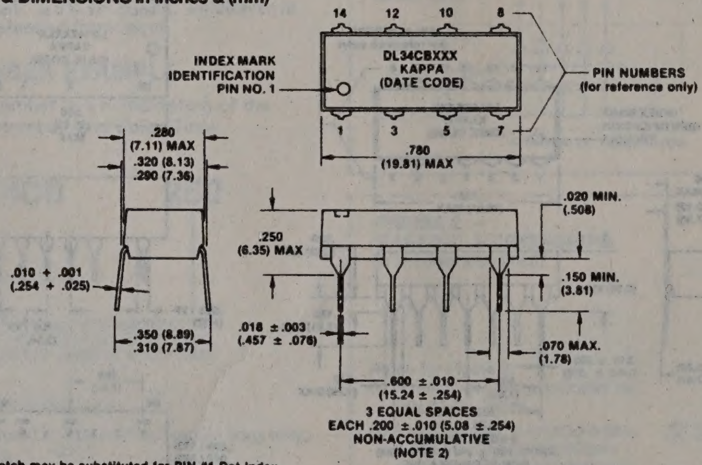
Logic 1: 50µA max., 2.0V min.
Logic 0: −2.0mA max., 0.8V max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

KAPPA PART # XXXXXXXXX		DELAY TIME (ns)(1) ±5% or ±2 ns, whichever is greater (unless otherwise specified)
DL34CB050	DT34CB050	5 ±1.5
DL34CB100	DT34CB100	10 ±1.5
DL34CB150	DT34CB150	15
DL34CB200	DT34CB200	20
DL34CB250	DT34CB250	25
DL34CB300	DT34CB300	30
DL34CB350	DT34CB350	35
DL34CB400	DT34CB400	40
DL34CB450	DT34CB450	45
DL34CB500	DT34CB500	50
DL34CB600	DT34CB600	60
DL34CB700	DT34CB700	70
DL34CB800	DT34CB800	80
DL34CB900	DT34CB900	90
DL34CB101	DT34CB101	100
DL34CB125	DT34CB125	125
DL34CB151	DT34CB151	150
DL34CB175	DT34CB175	175
DL34CB201	DT34CB201	200
DL34CB225	DT34CB225	225
DL34CB251	DT34CB251	250

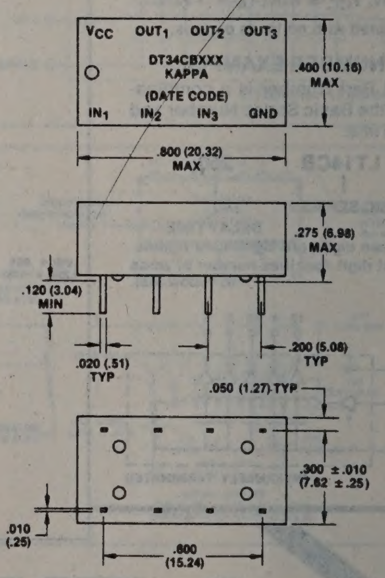
(1) Delays measured at 1.5V level on leading edge only with no loads on taps.

(2) Risetime measured from 0.75V to 2.4V.

MARKING & DIMENSIONS in inches & (mm)


14
12
10
8
DL34CBXXX
KAPPA
(DATE CODE)
INDEX MARK IDENTIFICATION PIN NO. 1
PIN NUMBERS (for reference only)
1
3
5
7
.780 (19.81) MAX
.280 (7.11) MAX
.320 (8.13)
.290 (7.36)
.010 + .001 (.254 + .025)
.350 (8.89)
.310 (7.87)
.250 (6.35) MAX
.020 MIN. (.508)
.150 MIN. (3.81)
.018 ±.003 (.457 ± .076)
.070 MAX. (1.78)
.600 ±.010 (15.24 ± .254)
3 EQUAL SPACES EACH .200 ±.010 (5.08 ±.254) NON-ACCUMULATIVE (NOTE 2)

Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located within ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.


V_{CC}
OUT_1
OUT_2
OUT_3
DT34CBXXX
KAPPA
(DATE CODE)
IN_1
IN_2
IN_3
GND
.400 (10.16) MAX
.800 (20.32) MAX
.275 (6.98) MAX
.120 (3.04) MIN
.020 (.51) TYP
.200 (5.08) TYP
.050 (1.27) TYP
.300 ±.010 (7.62 ±.25)
.010 (.25)
.600 (15.24)

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SERIES DT08 TTL SCHOTTKY (8-PIN)

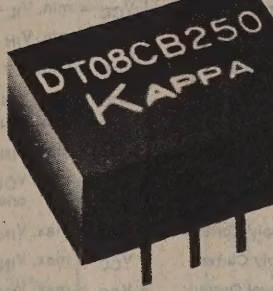
5-TAP DIGITAL DELAY MODULE

FEATURES

- TTL Schottky Interfaced
- 8-pin package
- 5 equally spaced taps
- Operating Temperature Range: 0°C to +70°C
- Risetime: 4ns max. (See Notes 2 & 3)

INPUT TEST CONDITIONS

Pulse Voltage: 3.2V
Risetime: 2ns
Supply Current: (typical) 60mA
Pulse Width: 40% min. of total delay

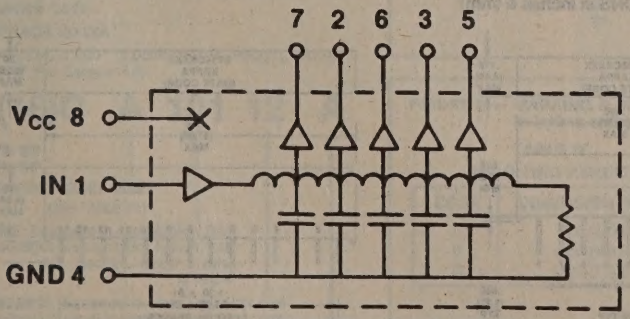

DT08CB250
KAPPA

ELECTRICAL SPECIFICATIONS

Supply Voltage (V_{CC}): 5.0V (±0.25V)
Logic 1 Input Current: 50μA max.
Logic 0 Input Current: −2mA max.
Logic 1 Voltage Output: 2.4V min.
Logic 0 Voltage Output: 0.4V max.

DRIVE CAPABILITIES

Logic 0 Output: 10 TTL Loads/Tap max.
20 TTL Loads/Unit max.
Logic 1 Output: 20 TTL Loads/Unit max.

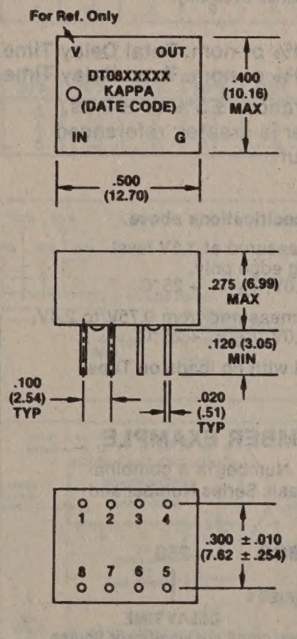

7
2
6
3
5
VCC 8
IN 1
GND 4

INTERNALLY TERMINATED

PART NUMBER	Total Delay (ns)(1)(3) ±5%	Tap Delay (ns)(1)(3) ±5% or ±2ns, WIG(4)
DT08CB250	25	5
DT08CB500	50	10
DT08CB101	100	20
DT08CB151	150	30
DT08CB201	200	40
DT08CB251	250	50
DT08CB301	300	60
DT08CB351	350	70
DT08CB401	400	80
DT08CB451	450	90
DT08CB501	500	100
DT08CB601	600	120
DT08CB701	700	140
DT08CB801	800	160
DT08CB901	900	180
DT08CB102	1000	200

Notes:
(1) Delays measured at 1.5V level on leading edge only.
(2) Risetime measured from 0.75V to 2.4V.
(3) Measured with no loads on taps.
(4) Tap tolerances referenced from input.

MARKING & DIMENSIONS
in inches and (mm)


For Ref. Only
V
OUT
DT08XXXXX
KAPPA
(DATE CODE)
IN
G
.400 (10.16) MAX
.500 (12.70)
.275 (6.99) MAX
.120 (3.05) MIN
.100 (2.54) TYP
.020 (.51) TYP
1 2 3 4
8 7 6 5
.300 ±.010 (7.62 ±.254)

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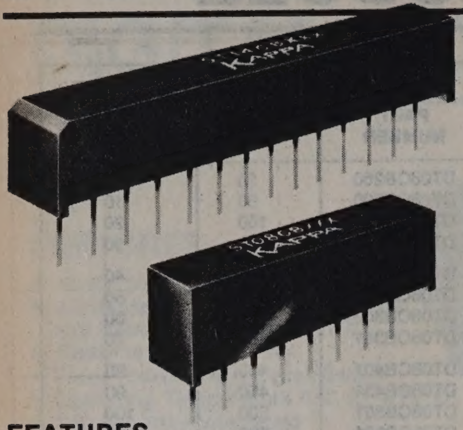
SERIES ST08C/ST14C TTL SCHOTTKY (8-PIN/14-PIN)

5- & 10-TAP DIGITAL DELAY LINES



FEATURES

- 8-Pin (ST08C) and 14-Pin (ST14C) SIP Package
- TTL Schottky interfaced
- 5 or 10 equally spaced Taps
- Risetime: 4 nS Max (See Notes 2 & 3)

SPECIFICATIONS

Total Delay Times(ns)(1) (3): 25*, 50, 100, 150, 200, 250, 300*, 350*, 400*, 450*, 500*, 600*, 700*, 800*, 900*, 1000*.

*Available in Series ST08 only.

Tap Delay:
(ST08) 20% of nom. Total Delay Time.
(ST14) 10% of nom. Total Delay Time.

Delay Tolerance: ±5% or ±2 ns, whichever is greater; referenced from input.

Notes for Specifications above.

(1) Delays measured at 1.5V level on leading edge only, V_{CC} = 5.0V, T_A = +25°C.

(2) Risetime measured from 0.75V to 2.4V, V_{CC} = 5.0V, T_A = +25°C.

(3) Measured with no loads on Taps.

PART NUMBER EXAMPLE

Typical Part Number is a combination of the Basic Series Number and Delay Time.

ST08CB **250**

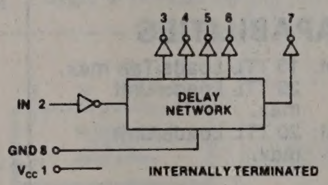
BASIC SERIES #

DELAY TIME

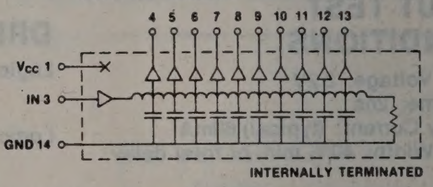
First two digits are significant figures. Last digit specifies number of zeros to follow (ns).

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
RECOMMENDED OPERATING CONDITIONS					
V_{CC}	Supply Voltage		4.75	5.25	V
V_{IH}	High-Level Input Voltage		2.0		V
V_{IL}	Low-Level Input Voltage			0.8	V
I_{IK}	Input Clamp Current			−18	mA
I_{OH}	High-Level Output Current			−1.0	mA
I_{OL}	Low-Level Output Current			20	mA
T_A	Operating Free-Air Temperature		0	+70	°C
DC ELECTRICAL CHARACTERISTICS		TEST CONDITIONS			
V_{OH}	High-Level Output Voltage	V_{CC} = min, V_{IL} = max, I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min, V_{IH} = min, I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min, I_I = I_{IK}		−1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max, V_{IN} = 2.7V V_{CC} = max, V_{IN} = 5.25V		50 1.0	μA mA
I_{IL}	Low-Level Input Current	V_{CC} = max, V_{IN} = 0.5V		−2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max, V_{OUT} = 0, one output at a time	−40	−100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max, V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max, V_{IN} = 0		75	mA
N_H	Fanout High-Level Output	V_{CC} = max, V_{OH} = 2.7V		20	TTL load
N_L	Fanout Low-Level Output	V_{CC} = max, V_{OL} = 0.5V		10	TTL load
INPUT PULSE TEST CONDITIONS					
E_{IN}	Pulse Voltage		3.1	3.3	V
T_{RI}	Pulse Rise-Time			2.0	NS
T_W	Pulse Width, of Total Delay		40		%
d	Duty Cycle			50	%

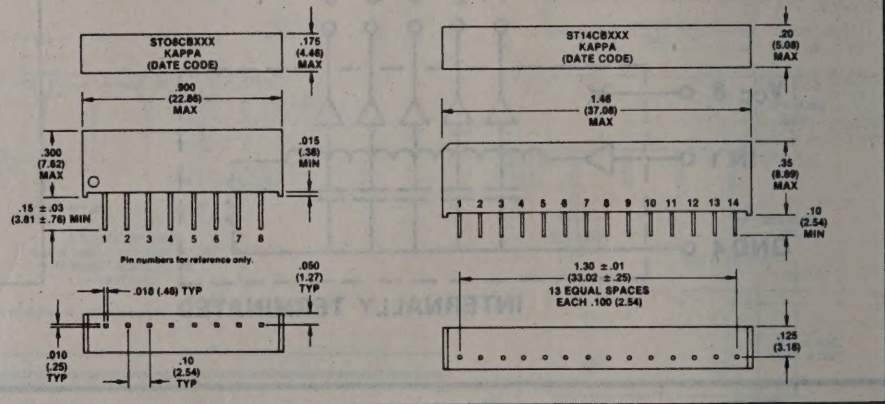
SERIES ST08 SCHEMATIC


3 4 5 6 7
IN 2
DELAY NETWORK
GND 8
Vcc 1
INTERNALLY TERMINATED

SERIES ST14 SCHEMATIC


4 5 6 7 8 9 10 11 12 13
Vcc 1
IN 3
GND 14
INTERNALLY TERMINATED

MARKING & DIMENSIONS in inches & (mm)


ST08CBXXX
KAPPA
(DATE CODE)
.175 (4.46) MAX
.900 (22.86) MAX
.300 (7.62) MAX
.015 (.38) MIN
.15 ±.03 (3.81 ±.76) MIN
1 2 3 4 5 6 7 8
Pin numbers for reference only.
.050 (1.27) TYP
.018 (.46) TYP
.010 (.25) TYP
.10 (2.54) TYP
ST14CBXXX
KAPPA
(DATE CODE)
.20 (5.08) MAX
1.46 (37.08) MAX
.35 (8.89) MAX
1 2 3 4 5 6 7 8 9 10 11 12 13 14
.10 (2.54) MIN
1.30 ±.01 (33.02 ±.25)
13 EQUAL SPACES EACH .100 (2.54)
.125 (3.18)

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For More Information. Circle No. 155

SERIES DP14C/DP16C ANALOG

14-PIN & 16-PIN DIP DELAY LINES

(available in full-MIL conformance as Series DP14M/DP16M)

DP14CA10112A
KAPPA

FEATURES

- TTL and DTL compatible
- Meets applicable requirements of MIL-D-23859
- 5/1 Delay-to-Risetime Ratio
- 10 Equally Spaced Taps
- Wide Operating Temperature Range
- Low cost

ELECTRICAL SPECIFICATIONS

Total Delay: 10 to 1000 ns
Tap Delays: 10% increments standard
(other increments available upon request)
Risetime: 20% maximum of total delay
(see Table 1)
Characteristic Impedance: 50 to 500 ohms (±10%)
Attenuation: 2dB maximum (see Table 1)
Distortion: ±10% maximum
Temperature Coefficient of Delay: 100ppm/°C max.
Operating Temperature Range: −55°C to +125°C
Storage Temperature Range: −65°C to +130°C
Insulation Resistance: 1000 megohms min.
@ 50VDC @ 25°C
Dielectric Strength: 50VDC

MECHANICAL SPECIFICATIONS

Case Configuration: See FIGURE 2
Case Material: Molded Epoxy
Terminals: Flat, DIP-type (See FIGURE 2)
Terminal Material: Kovar or equivalent, tin-plated
Pin Connections: See TABLE II and III
Potting: 100% filled with a two-component epoxy
Marking: Includes manufacturer's name, part number, and date code (See FIGURE 2)

PART NUMBER EXAMPLE

Typical part number is a combination of the Basic Series Number, Mounting Height Code, Delay Time, Impedance, and Pin Sequence Code.

EXAMPLE: DP14CA10112A

(100ns, 100 ohm, 0.200" (5.08mm) Max. Height, using the code "A" Pin Sequence).

DP14(16)C A 101 12 A

DP14C is 14-Pin DIP
DP16C is 16-Pin DIP

MOUNTING HEIGHT CODE (See TABLE IV)

DELAY TIME: Expressed in nanoseconds (ns). First two digits are significant figures. Last digit specifies number of zeros to follow.

IMPEDANCE: Expressed in ohms (Ω). First digit is significant. Last digit specifies number of zeros to follow.

PIN SEQUENCE CODE (See TABLE II and III). "STANDARD" Pin Sequence if omitted.

TABLE I

Td (ns)[1] (±5%)	Td/tap (ns)[2] [3] (±10%)	Tr (ns) MAX.	ATTENUATION (%) TYPICAL per IMPEDANCE (Ω)				
			50	100	200	300	500
10	1	3		5			
20	2	5.5	3	5	5		
30	3	6.5	3	5	5		
40	4	8	3	5	5	5	
50	5	10	3	5	5	5	7
60	6	12	3	5	5	5	7
75	7½	15	3	5	5	5	7
100	10	20	3	5	5	7	7
120	12	24	3	5	6	7	8
150	15	30	3	5	6	7	8
180	18	36	4	5	6	7	8
200	20	40	4	5	6	7	8
220	22	44	4	5	6	7	8
250	25	50	4	5	6	7	8
300	30	60		5	8	10	10
375	37½	75		7	8	10	10
500	50	100		8	10	12	12
600	60	120				15	15
750	75	150				15	20
1000	100	200					20

(1) Or ±2ns, whichever is greater. (2) Or ±1ns, whichever is greater. (3) For 10-tap lines only.

TABLE II. PIN-NUMBER SEQUENCE (FOR DP14C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
Standard	14	2	12	3	11	4	5	10	6	9	7	1. 8
A	1	2	13	3	12	4	10	5	9	6	7	14
B	2	3	4	5	6	7	9	10	11	12	13	1, 14
C	7	9	6	10	5	11	12	3	13	2	14	1, 8
D	1	13	2	12	3	11	4	10	5	9	6	7. 8. 14
E	2	3	4	5	6	7,8	9	10	11	12	13	1, 14
F	1	13	2	12	3	11	4	10	5	9	6	7
G	2	13	3	12	4	11	5	10	6	9	7	8, 14
H	2	3	4	5	6	7	9	10	11	12	13	1
I	1	13	2	12	3	11	5	10	6	9	7	8, 14
J	1	2	13	3	12	4	10	5	9	6	7	8, 14
U	2	3	4	5	6	8	9	10	11	12	13	1, 7
V	2	3	4	5	6	8	9	10	11	12	13	1
W	1	13	2	12	3	11	4	10	5	9	6	7, 14

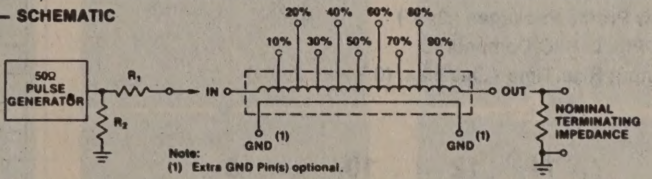
*Other pin sequences available upon request.

TABLE III. PIN-NUMBER SEQUENCE (FOR DP16C ONLY)*

CODE	IN	10%	20%	30%	40%	50%	60%	70%	80%	90%	OUT	GND
A	15	2	14	3	13	4	5	11	6	10	7	1, 9
B	1	15	2	14	3	13	4	12	5	11	6	8
C	1	15	3	14	4	13	5	12	6	11	8	9, 16

*Other pin sequences available upon request.

FIGURE 1 — SCHEMATIC

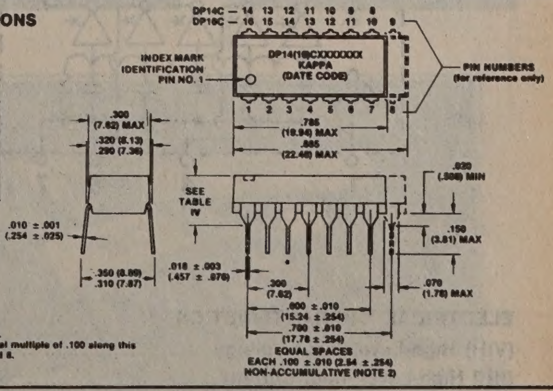

20%
40%
60%
80%
10%
30%
50%
70%
90%
50Ω PULSE GENERATOR
R₁
R₂
IN
OUT
GND (1)
GND (1)
NOMINAL TERMINATING IMPEDANCE

Note:
(1) Extra GND Pin(s) optional.

FIGURE 2 — MARKING & DIMENSIONS In Inches and (mm)

TABLE IV
MOUNTING HEIGHT

CODE	DIMENSION (MAX)
A	.200 (5.08)
B	.250 (6.35)
C	.300 (7.62)


DP14C — 14 13 12 11 10 9 8
DP16C — 16 15 14 13 12 11 10 9
INDEX MARK IDENTIFICATION PIN NO. 1
DP14(16)CXXXXXXX
KAPPA
(DATE CODE)
PIN NUMBERS (for reference only)
1 2 3 4 5 6 7 8
.300 (7.62) MAX
.320 (8.13)
.290 (7.36)
.785 (19.94) MAX
.885 (22.48) MAX
.020 (.508) MIN
SEE TABLE IV
.010 ±.001 (.254 ±.025)
.150 (3.81) MAX
.350 (8.89)
.310 (7.87)
.018 ±.003 (.457 ± .076)
.300 (7.62)
.070 (1.78) MAX
.600 ±.010 (15.24 ±.254)
.700 ±.010 (17.78 ±.254)
EQUAL SPACES
EACH .100 ±.010 (2.54 ±.254)
NON-ACCUMULATIVE (NOTE 2)

Notes:
(1) A notch may be substituted for PIN #1 Dot Index.
(2) Each terminal is located with ±.010 of its nominal multiple of .100 along this longitudinal dimension relative to terminals 7 and 8.

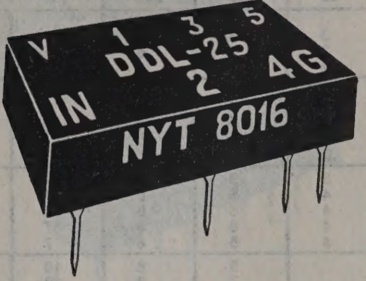
KAPPA®
NETWORKS, INC.

U.S.A. Factory Direct: 1443 Pinewood Street, Rahway, NJ 07065, Phone (201) 541-1600, Toll Free 800-223-0603, Telex 130081, KAPPA RHWY
West Coast Office: 300 Cypress Ave., Alhambra, CA 91801, Phone (213) 283-2048. West Coast Distributor: Phone (213) 283-2058.

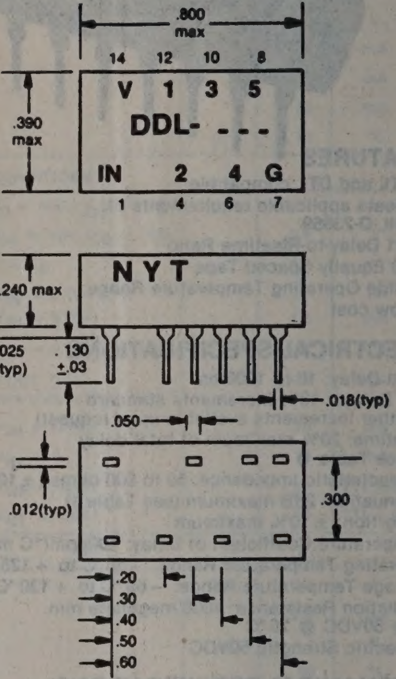
Nytronics Components Group, Inc.

ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

ACTIVE DIGITAL DELAY LINE



Nytronics Components Group, Inc. Digital Delay Lines provide a solution to terminating, driving and loading problems traditionally associated with delay line applications.



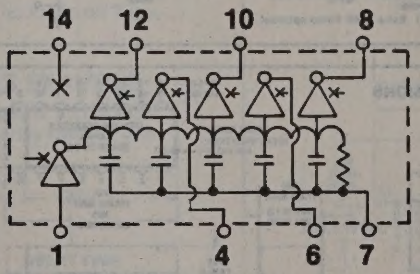
Eighteen (18) standard delay lines are offered ranging from 25ns to 500ns. Other combinations available include:

- Intermediate total delay values
- Non-symmetrical tapping points
- 2 or 3 delay lines per unit
- Closer tap and total delay tolerances
- Specified fall times and trailing edge delay times

Nytronics Components Group, Inc. Delay Line Engineering stands ready to help solve your delay line applications problems.

DIGITAL DELAY LINES FEATURE:

1) TTL Driven Inputs
2) TTL Buffered Outputs
3) Internal Terminations
4) Low Profile Packages (.240″)
5) 14-Pin, DIP-IC Compatible
6) Output Rise Time 4.0ns max. (0.75v to 2.40v)



PART NUMBER	TOTAL DELAY (NS) (1) (2)	TAP DELAY (NS) (1) (2)	INPUT PULSE WIDTH (NS MINIMUM)
DDL-25	25	5	10
DDL-30	30	6	12
DDL-35	35	7	14
DDL-40	40	8	16
DDL-45	45	9	18
DDL-50	50	10	20
DDL-75	75	15	30
DDL-100	100	20	40
DDL-125	125	25	50
DDL-150	150	30	60
DDL-175	175	35	70
DDL-200	200	40	80
DDL-250	250	50	100
DDL-300	300	60	120
DDL-350	350	70	140
DDL-400	400	80	160
DDL-450	450	90	180
DDL-500	500	100	200

(1) Measured at 1.5V level leading edge; Vcc = 5.00VDC; No loads; at +25°C.
(2) Nominal delay, ±2NS or ±5%, whichever is greater; reference to input.

ELECTRICAL CHARACTERISTICS

(VIH) High-Level Input Voltage	2.0 to 5.0V
(IIH) High-Level Input Current	50ua Max.
(VIL) Low-Level Input Voltage	0.8V Max.
(IIL) Low-Level Input Current	−2ma Max.
(VOH) High-Level Output Voltage	2.4V Min.
(VOL) Low-Level Output Voltage	0.4V Max.
High-Level Output Drives	20 TTL Loads/Unit Max.
Low-Level Output Drives	10 TTL Loads/Tap Max. 20 TTL Loads/Unit Max.

RECOMMENDED OPERATING CONDITIONS

(Vcc) Supply Voltage	5.00 ±0.25VDC
(Icc) Supply Current	60ma (typ.)
(TRin) Input Rise Time	3ns.
(TWin) Input Pulse Width	40% of Delay
(Ein) Input Pulse Voltage	3.20VDC
Operating Temperature	0°C to 70°C
Storage Temperature	−55°C to +125°C

For More Information. Circle No. 156

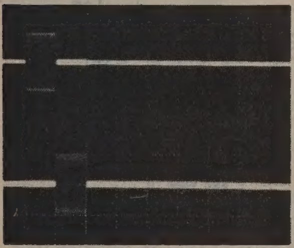
SAW Delay Lines

Surface Acoustic Wave Technology provides performance advantages and design flexibility that have proven to be invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, low shape factor and excellent rejection. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance bandpass filters, resonator products, and other state-of-the-art signal processing components including dispersive, non-dispersive and tapped delay lines. In addition to this broad product line, Sawtek provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other signal processing applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements at frequencies from 10 MHz to more than 1 GHz. Sawtek also designs and produces custom subsystems which incorporate SAW components. These include filter banks composed of cascaded filters packaged in a single assembly, amplifier-filter modules with adjustable gain, and SAW resonator-controlled oscillators. Some of the common SAW delay line products produced by Sawtek and their characteristics are summarized below.

NON-DISPERSIVE

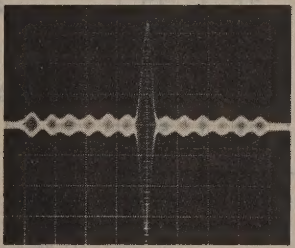
Sawtek produces non-dispersive delay lines for oscillator control, discriminator applications, and other signal processing delay requirements. SAW delay lines exhibit inherent bandpass characteristics and simultaneously provide selectivity in many cases. They are available with fractional bandwidths as large as 65% at frequencies up to 1000 MHz. The widest bandwidths require the use of lithium niobate materials with temperature coefficients of 72 to 94 PPM/°C. Quartz stability is offered for narrower band and frequency control applications with bandwidths from a few tenths percent to more than 5%. Delays from a few hundred nanoseconds to 40 microseconds are achievable. Insertion loss from 20 dB to 35 dB is typical to optimize group delay and time spurious performance. The photograph below shows a 400 MHz pulse input and subsequent output from a 2 microsecond, 250 MHz bandwidth delay line. Time spurious, including triple transit, is suppressed more than 40 dB. Low-loss versions can often be provided also.



TAPPED DELAY

SAW tapped delay lines are most frequently used to provide fixed-code generation or correlation for identification systems and spread spectrum communications. A familiar example of SAW devices of this type is demonstrated by a 13 bit Barker code at 60 MHz center frequency. The PSK code is generated by impulsing a complimentary SAW device and the subsequent matched filter output is shown below. Code lengths up to 127 bits are common. Fractional bandwidths are typically below 30% at center frequencies up to 500 MHz.

Tapped delay lines may also be used with external switches to provide variable delay or programmability. In this case, tap spacing is limited by rf feedthrough to delays larger than 100 nanoseconds. A more versatile approach to achieve programmable matched filtering is offered by SAW convolver technology. Some standard products are available and Sawtek offers rapid custom design for your specific applications.



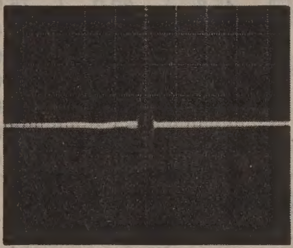
DISPERSIVE — LINEAR FM

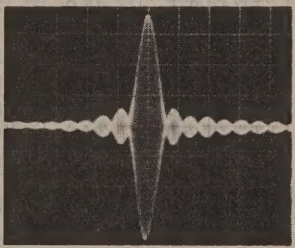
Sawtek supplies state-of-the-art linear FM delay lines for dispersive applications. Principal uses include pulse expansion and compression for radar, signal analysis for EW receivers, and transform processing for programmable filtering functions. Several different dispersive techniques are used to provide a wide parameter range: center frequencies from 10 MHz to 1 GHz, fractional bandwidths from 1% to 65%, and dispersive delays from 0.5 microsecond to 100 microseconds. Time-bandwidth products as large as 10,000 can be achieved although 50 to 2000 are more frequently used. Compressed pulse sidelobes vary from 13 dB nominally for unweighted frequency responses to 40 dB for some high performance weighted devices. A signal-to-noise ratio within 0.5 dB to 1.0 dB of theory is typical. Although all parameters cannot be optimized simultaneously, a thorough understanding of their interdependence permits maximum utilization of the advantages of SAW technology.

Conventional interdigital techniques easily achieve bandwidths up to 25% and time lengths as long as 20 usec. With quartz substrates for temperature stability, insertion loss of 40 dB to 50 dB is common for the wider fractional bandwidths. The compressed pulse shown on the left below has time sidelobes of 32 dB and is produced by a SAW expansion/compression pair at 30 MHz with 13 usec dispersive delay and 6 MHz bandwidth.

Dispersive delays up to 100 usec are implemented using Reflective Array Compressor (RAC) techniques. Compressed pulse performance is highlighted by time sidelobe suppression of 35 dB to 40 dB in most radar applications. These device types can be used to achieve very flat amplitude and accurate group delay response for EW receiver applications. This characteristic is demonstrated by the sin x/x compressed pulse at the lower right produced by a 40 microsecond RAC delay line.

RAC devices are usually supplied in an oven to minimize temperature effects on performance. In addition to ovenized assemblies, Sawtek also designs and manufactures custom subsystems employing SAW dispersive components.





Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price in production quantities. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.

When your system demands the advantages of SAW Technology. . . Demand Sawtek.

SAWTEK INC.
SAWTEK INCORPORATED

SAWTEK
INCORPORATED

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TELEX 529118 TWX 810-862-0835

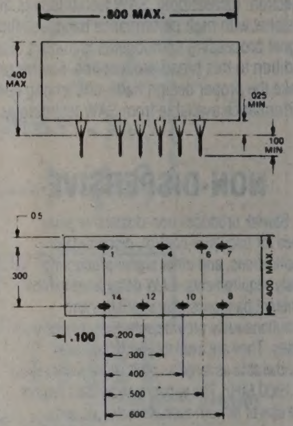
Technitrol, Inc.

HIGH PERFORMANCE TTL DELAY MODULE
STANDARD 5 TAP

DELAY CHARACTERISTICS

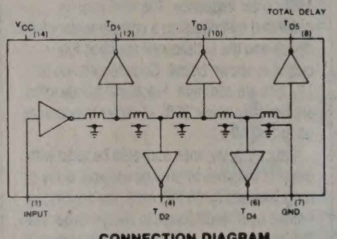
Part No.	NANOSECONDS					All Taps
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R + & T_R −
TTLDL020	10.0 ±1.5	12.5 ±1.5	15.0 ±1.5	17.5 ±1.5	20.0 ±1.5	≤2.0 ≤2.0 nsec.
TTLDL025	5.0 ±1.5	10.0 ±1.5	15.0 ±1.5	20.0 ±1.5	25.0 ±1.5	≤2.0 ≤2.0 nsec.
TTLDL050	10.0 ±1.5	20.0 ±1.5	30.0 ±1.5	40.0 ±2.0	50.0 ±2.5	≤2.0 ≤2.0 nsec.
TTLDL075	15.0 ±1.5	30.0 ±1.5	4.50 ±2.25	60.0 ±3.0	75.0 ±3.75	≤2.0 ≤2.0 nsec.
TTLDL100	20.0 ±1.5	40.0 ±2.0	60.0 ±3.0	80.0 ±4.0	100.0 ±5.0	≤2.0 ≤2.0 nsec.
TTLDL125	25.0 ±1.5	50.0 ±2.5	75.0 ±3.75	100.0 ±5.0	125.0 ±6.25	≤2.0 ≤2.0 nsec.
TTLDL150	30.0 ±1.5	60.0 ±3.0	90.0 ±4.5	120.0 ±6.0	150.0 ±9.0	≤2.0 ≤5.0 nsec.
TTLDL200	40.0 ±2.0	80.0 ±4.0	120.0 ±6.0	160.0 ±8.0	200.0 ±10.0	≤2.0 ≤5.0 nsec.
TTLDL250	50.0 ±2.5	100.0 ±5.0	150.0 ±7.5	200.0 ±10.0	250.0 ±12.5	≤2.0 ≤5.0 nsec.
TTLDL500	100.0 ±5.0	200.0 ±10.0	200.0 ±15.0	400.0 ±20.0	500.0 ±25.0	≤2.0 ≤9.0 nsec.

Delay Characteristics @ V_{cc} = 5.0V, 25°C no load


.800 MAX.
400 MAX
025 MIN
100 MIN
05
300
1
4
6
7
14
12
10
8
400 MAX.
.100
200
300
400
500
600

Recommended Operating Conditions

	Min.	Typ.	Max.	Unit
Supply Voltage V_{cc}	4.5	5.0	5.5	Volts
Operating Free Air Temp. Range	0	25	75	°C


TOTAL DELAY
VCC (14)
TD1 (12)
TD3 (10)
TD5 (8)
(1) INPUT
(4) TD2
(6) TD4
(7) GND

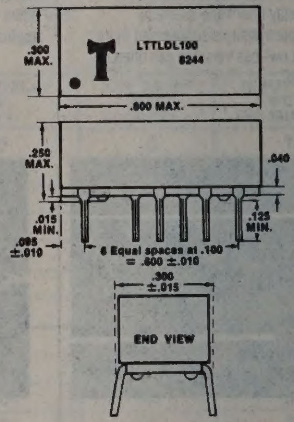
CONNECTION DIAGRAM
5 TAP VERSION

STANDARD TTL DELAY MODULE

LOW PROFILE TTL DELAY MODULE CHARACTERISTICS

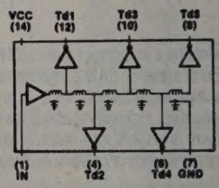
Part No.	NANOSECONDS					All Taps (Max.)	
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R−
LTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
LTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
LTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
LTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
LTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
LTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
LTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0
LTTLDL250	50.0	100.0	150.0	200.0	250.0	2.0	5.0
LTTLDL500	100.0	200.0	200.0	400.0	500.0	2.0	9.0

Delay Characteristics @ V_{cc} = 5.0V, 25°C no load
Delay Tolerance ±2 NS or 5% whichever is greater


.300 MAX.
LTTLDL100
8244
.800 MAX.
.250 MAX.
.040
.015 MIN.
.125 MIN.
.095 ±.010
6 Equal spaces at .100 = .600 ±.010
.300 ±.015
END VIEW

Recommended Operating Conditions

	Min.	Typ.	Max.	Unit
Supply Voltage V_{cc}	4.5	5.0	5.5	Volts
Operating Free Air Temp. Range	0	25	70	°C


VCC (14)
Td1 (12)
Td3 (10)
Td5 (8)
(1) IN
(4) Td2
(6) Td4
(7) GND

TTL DELAY MODULES

TTL Delay Modules are designed to be used directly with super high speed TTL, standard TTL, and DTL logic circuits. They provide many timing applications without any or with minimum interface.

TTL Delay Modules can be cascaded to get any combination of delay without degrading output rise time (T_R+ or T_R−). The delay to rise time ratio (T_D/T_R) of individual modules is very high (approximately 50:1) and improves with cascading modules.

Output rise times of each module are independent of input rise times up to 50 nsec. TTL Delay Modules are encapsulated by transfer molding. They are pin compatible with 74/54 Series TTL/SSI 14 Lead DIP Circuits.

Technitrol, Inc.

DEPT. GB 1952 E. Allegheny Avenue (800) 523-3816
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

Specialists in transformers and completely transfer molded, welded DIP delay lines under ³⁄₁₆" high

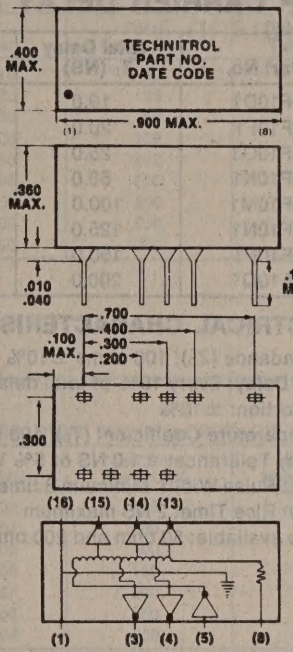
Technitrol, Inc.

ECL DELAY MODULE

DELAY CHARACTERISTICS

	NANOSECONDS					All Taps (Max.)	
Part No.	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R-*
ECLDL025	5 ±1	10 ±1	15 ±1	20 ±1	25 ±1	4	4
ECLDL050	10 ±1	20 ±1	30 ±1.5	40 ±2	50 ±2.5	4	4
ECLDL075	15 ±1	30 ±1.5	45 ±2	60 ±3	75 ±3.75	5	5
ECLDL100	20 ±1	40 ±2	60 ±3	80 ±4	100 ±5	6	6
ECLDL125	25 ±1	50 ±2.5	75 ±3.75	100 ±5	125 ±6.0	7	7
ECLDL150	30 ±1.5	60 ±3.0	90 ±4.5	120 ±6	150 ±7.5	7	7
ECLDL200	40 ±2	80 ±4	120 ±6	160 ±8	200 ±10	8	8
ECLDL250	50 ±2.5	100 ±5	150 ±7.5	200 ±10	250 ±12.5	10	10
ECLDL300	60 ±3	120 ±6	180 ±9	240 ±12	300 ±15	15	15
ECLDL350	70 ±3.5	140 ±7	210 ±10.5	280 ±14	350 ±17.5	15	15
ECLDL400	80 ±4	160 ±8	240 ±12	320 ±16	400 ±20	15	15
ECLDL450	90 ±4.5	180 ±9	270 ±13.5	350 ±18	450 ±22.5	20	20
ECLDL500	100 ±5	200 ±10	300 ±15	400 ±20	500 ±25	20	20

* T_R = Measured from 20% to 80%



TECHNITROL
PART NO.
DATE CODE
.400 MAX.
.900 MAX.
(1)
(8)
.360 MAX.
.010
.040
.100 MIN.
.700
.400
.300
.200
.100 MAX.
.300
(16)
(15)
(14)
(13)
(1)
(3)
(4)
(5)
(8)

ELECTRICAL CHARACTERISTICS

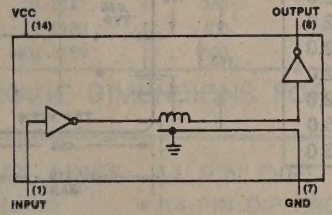
Over operating temperature range and Vee = −5.2 ±0.01V with 500 liner FPM air flow and all output terminals with 50 to −2.0 VDC.

Symbol	Parameter	Min.	Max.	Unit	Test Conditions
I_{EE}	Supply Current		75	MA	
I_{IH}	Input Current HIGH		425	MA	V_{IH} = −.810V
I_{LH}	Input Current LOW	.5		MA	V_{IL} = −1.850V
V_{OH}	Logic "1" Output Voltage	−1.060	−0.700	VDC	V_{IH} = −0.810
V_{OL}	Logic "O" Output Voltage	−1.890	−1.615	VDC	V_{IL} = −1.850

All specifications are subject to change without notice.

Recommended Operating Conditions	Min.	Typ.	Max.
Vee	−5.72	−5.2	−4.68
Operating Temp Range With Airflow 500 LFPM	−30°C	25°C	80°C
Fan Out			85 ECL Loads

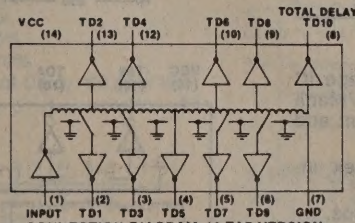
SINGLE OUTPUT



VCC
(14)
OUTPUT
(8)
(1)
INPUT
(7)
GND

Buffered delay lines available from 5 NS to 500 NS only pins used brought out specification similar to standard 5 tap units.
Part Number TTLISXXX XXX = Delay, 025 etc.

TEN TAP

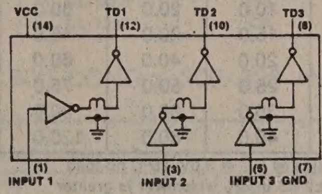


VCC
(14)
TD2
(13)
TD4
(12)
TD6
(10)
TD8
(9)
TOTAL DELAY
TD10
(8)
(1)
INPUT
(2)
TD1
(3)
TD3
(4)
TD5
(5)
TD7
(6)
TD9
(7)
GND

CONNECTION DIAGRAM 10 TAP VERSION

TTL buffered delay lines available with 3 individual inputs and outputs in delays from 5 NS to 250 NS (each delay).
Part Number TTLDDXXX, XXX = Delay each section.

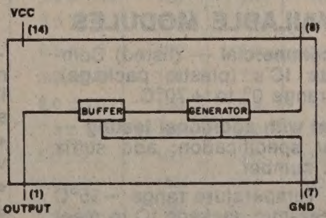
TRIPLE OUTPUT



VCC
(14)
TD1
(12)
TD2
(10)
TD3
(8)
(1)
INPUT 1
(3)
INPUT 2
(5)
INPUT 3
(7)
GND

Delay Modules are now available in 10 tap versions from 50 to 500 NS total delay. Specifications are comparable to the standard 5 tap units. The physical outline is the same as the 5 tap with the exception of 5 additional pins as noted in the connection diagram.
Part Number TTL3SXXX, = Delay.

SQUARE WAVE OSCILLATOR



VCC
(14)
(8)
BUFFER
GENERATOR
(1)
OUTPUT
(7)
GND

TTL Square Wave Oscillators are available in the range of 2 MHz to 100 MHz. Frequency tolerance ±2%. Physical outline same as 5 tap standard TTL delay line.
Part Number TTLOSXXX, XXX = Frequency.

Technitrol, Inc.

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Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

Specialists in transformers and completely transfer molded, welded DIP delay lines under 3/16″ high

Technitrol, Inc.

CHIP CARRIER DELAY LINE

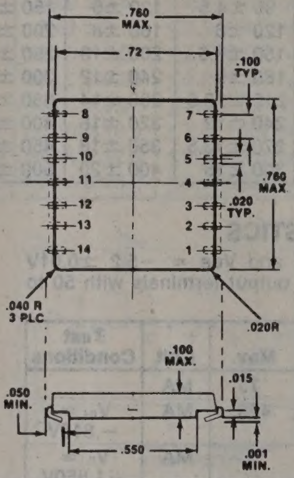
Part No.	Total Delay T_D (NS)	Rise Time T_R (NS)	RDC (ohms)
CF10D1	10.0	2.2	1.0
CF10F1	20.0	4.0	2.0
CF10G1	25.0	5.0	3.0
CF10K1	50.0	10.0	5.0
CF10M1	100.0	20.0	8.0
CF10N1	125.0	25.0	9.0
CF10P1	150.0	30.0	10.0
CF10Q1	200.0	40.0	12.0

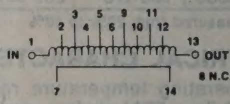
ELECTRICAL CHARACTERISTICS

- Impedance (Z_O): 100 ohms ±10%
- Tap Delay: Every 10% of total delay
- Distortion: ±10%
- Temperature Coefficient (T_D): 100 PPM/°C
- Delay Tolerance: ±1.0 NS or 5% W.I.G.
- Input Pulse Width: Minimum 3 times output rise time
- Input Rise Time: 2 NS maximum
- Also available: 50 ohm and 200 ohm impedance

FEATURES

- Compact module .10″ high
- Ten tap line provides delays from 10 NS to 200 NS
- Designed to use with TTL logic
- Can be mounted in standard chip carrier socket
- Designed for surface mounting using reflow soldering
- Military temperature range −55°C to +125°C


.760 MAX.
.72
.100 TYP.
8
9
10
11
12
13
14
7
6
5
4
3
2
1
.760 MAX
.020 TYP.
.040 R 3 PLC
.020R
.100 MAX.
.015
.050 MIN.
.550
.001 MIN.


3
5
9
11
2
4
6
10
12
1
IN
13
OUT
8 N.C.
7
14

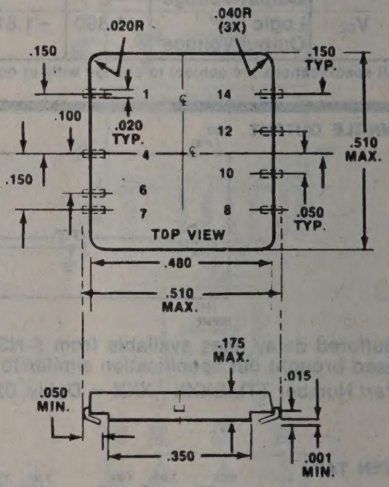
Also available in
¾ sq. x .100 for 0° to +70°C
¾ sq. x .175 for −55°C to +125°C

CHIP CARRIER TTL DELAY MODULE

CHIP CARRIER TTL DELAY MODULE CHARACTERISTICS

Part No.	NANOSECONDS					All Taps (Max.)	
	T_D1	T_D2	T_D3	T_D4	T_D5	T_R+	T_R-
BTTLDL020	10.0	12.5	15.0	17.5	20.0	2.0	2.0
BTTLDL025	5.0	10.0	15.0	20.0	25.0	2.0	2.0
BTTLDL050	10.0	20.0	30.0	40.0	50.0	2.0	2.0
BTTLDL075	15.0	30.0	45.0	60.0	75.0	2.0	2.0
BTTLDL100	20.0	40.0	60.0	80.0	100.0	2.0	2.0
BTTLDL125	25.0	50.0	75.0	100.0	125.0	2.0	2.0
BTTLDL150	30.0	60.0	90.0	120.0	150.0	2.0	5.0
BTTLDL200	40.0	80.0	120.0	160.0	200.0	2.0	5.0

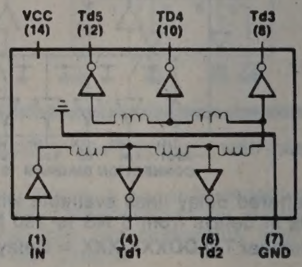
Delay Characteristics @ V_{cc} = 5.0V, 25°C no load
Delay Tolerance ±2 NS or 5% whichever is greater


.020R
.040R (3X)
.150
.150 TYP.
1
14
.100
.020 TYP.
12
4
.510 MAX.
.150
10
6
7
8
.050 TYP.
TOP VIEW
.480
.510 MAX.
.175 MAX.
.015
.050 MIN.
.350
.001 MIN.

Recommended Operating Conditions	Min.	Typ.	Max.	Unit
Supply Voltage V_{CC}	4.5	5.0	5.5	Volts
Operating Free Air Temperature Range	0	25	70	°C

OTHER AVAILABLE MODULES

- **Standard commercial** — (listed) Commercial grade IC's (plastic package), temperature range 0° to +70°C.
- **Commercial with additional testing** — Per customer specification; add suffix "MY" to part number.
- **Military** — Temperature range −55°C to +125°C, ceramic package IC to meet MIL-STD-883 but not screened to that specification. Add suffix "M" to part number.
- **Military Hi-Rel** — Temperature range −55°C to +125°C, ceramic package IC meeting MIL-STD-883 and 38510/Mach IV program screened and burned in; add suffix "MX" to part number.
- **Low power Schottky** — LS hex inverters used.
- **Single output versions** — No taps.
- **Multiple (up to 3) individual lines per module** — Can be same or different delays.
- **Unequal taps** — Within a single line.
- **Programmable delay modules**


VCC (14)
Td5 (12)
TD4 (10)
Td3 (8)
(1) IN
(4) Td1
(6) Td2
(7) GND

Technitrol, Inc.

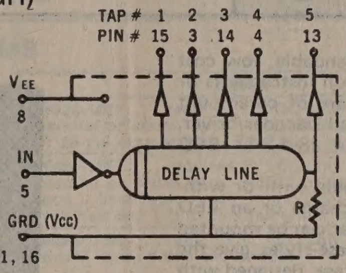
DEPT. GB 1952 E. Allegheny Avenue (800) 523-3816
Philadelphia, Pa. 19134 • (215) 426-9105 • TELEX 834245

For More Information. Circle No. 158

valor 31 YEAR ANNIVERSARY (1953-1984) DELAY LINES
ELECTRONICS, INC.

ECL DIGITAL DELAY LINES 16 PIN DIP PACKAGE (.400 WIDE x .800 LONG x .300 HIGH)

- ECL 10K compatible, input and output buffered
- Delay tolerance ±5% or ±2 Ns whichever is greater
- Typical delays shown — other delays available
- 20% taps; 70 ECL fan-out capacity
- Fast rise time on all outputs — 4 Ns typ.
- Operating temperature range −30°C to +85°C
- Supply voltage − 5.2 VDC


TAP # 1 2 3 4 5
PIN # 15 3 14 4 13
V_{EE}
8
IN
5
DELAY LINE
R
GRD (Vcc)
1, 16

Pull down resistor on output taps not provided inside unit.

Part Number	Total Delay (Ns)	Delay Per Tap (Ns)
DE-0010	10	2
DE-0025	25	5
DE-0050	50	10
DE-0100	100	20
DE-0150	150	30
DE-0200	200	40
DE-0250	250	50
DE-0500	500	100
DE-1000	1000	200

TTL DIGITAL DELAY LINES 10 TAP AND 5 TAP

SPECIFICATIONS

Supply Voltage: 4.75 to 5.25V

Supply Current: 120 mA max. (10 Tap), 65 mA max. (5 Tap)

Input Pulse: +3.2V

Input Rise Time: 3 Ns

Pulse width: Min. 25% of total delay (10 Tap); 80% (5 Tap)

Schottky TTL buffered

Output Rise Time: 4 Ns Typ.

Operating Temp. Range: 0°C/70°C standard (−55°C/125°C available)

Logic 0 loading: 10 TTL loads/ Tap max.

Logic 1 loading: 20 TTL loads/ Tap max.

PIN CONNECTIONS
16 PIN DIP

1	Input
14	20% Delay
4	40% Delay
12	60% Delay
6	80% Delay
10	Output
8	Ground
16	Vcc

5 Tap TTL/DTL Digital Delay Lines 16 Pin DIP

Valor P/N	Total Delay Nsec ±5%	Delay/Tap Nsec (1)(2)
DL-1803	25	5
DL-1804	50	10
DL-1805	100	20
DL-1806	150	30
DL-1807	200	40
DL-1808	250	50
DL-1809	500	100

PIN CONNECTIONS
14 PIN DIP
(10 TAP)

1	Input
13	10% Delay
3	20% Delay
12	30% Delay
4	40% Delay
11	50% Delay
5	60% Delay
10	70% Delay
6	80% Delay
9	90% Delay
8	Output
7	Ground
14	Vcc

10 Tap Digital Delay Lines in 14 Pin Package

Valor P/N	Total Delay Nsec ±5%	Delay/Tap Nsec (1)(2)
DL-2181	50	5
DL-2182	100	10
DL-2183	150	15
DL-2184	200	20
DL-2185	250	25
DL-2186	300	30
DL-2187	350	35
DL-2188	400	40
DL-2189	500	50

PIN CONNECTIONS
14 PIN DIP
(5 TAP)

1	Input
12	20% Delay
4	40% Delay
10	60% Delay
6	80% Delay
8	Output
7	Ground
14	Vcc

5 Tap TTL Digital Delay Lines 14 Pin DIP

Valor P/N	Total Delay Nsec ±5%	Delay/Tap Nsec (1)(2)
DL-1883	25	5
DL-1884	50	10
DL-1885	100	20
DL-1886	150	30
DL-1887	200	40
DL-1888	250	50
DL-1889	500	100

PACKAGE DIMENSIONS FOR TTL LINES .400 WIDE x .800 LONG x .300-.325 HIGH

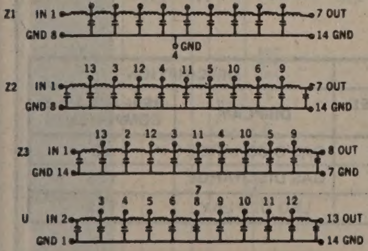
PASSIVE DELAY LINES 14 PIN DIP

- PRECISION DELAYS
- 10 TAPS
- 14 PIN DIP PACKAGE
- TTL, ECL COMPATIBLE

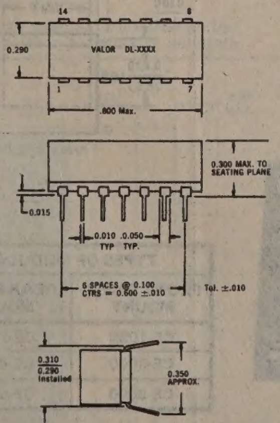
SPECIFICATIONS

Temperature: −55°C to +125°C
Voltage: Test
Working
— 100 volts dc max.
— 50 volts dc max.
Delay Time: Td ±5%
Impedance Zo: ±10%
Temp. Coefficient of Delay: 50 ppm typ.

TERMINATIONS


Z1 IN 1
13 2 12 3 11 5 10 6 9
7 OUT
GND 8
14 GND
GND
4
Z2 IN 1
13 3 12 4 11 5 10 6 9
7 OUT
GND 8
14 GND
Z3 IN 1
13 2 12 3 11 4 10 5 9
8 OUT
GND 14
7 GND
U IN 2
3 4 5 6 7 8 9 10 11 12
13 OUT
GND 1
14 GND

PACKAGE OUTLINE


14
8
0.290
VALOR DL-XXXX
1
7
.800 Max.
0.300 MAX. TO SEATING PLANE
0.015
0.010 TYP
0.050 TYP.
6 SPACES @ 0.100 CTRS = 0.600 ±.010
Tol. ±.010
0.310
0.290
Installed
0.350 APPROX.

Lumped Constant Delay Lines 14 Pin DIP

Part No.	Total Delay Nsec	Tap to Tap Nsec	Imped-ance Zo ohms	Rise Time Nsec Max.	Dist. % Max.	Attn. % Max.	Termi-nation
DL-1717	10	1.0 ± .25	50	3.0	10	1	Z1
DL-1721	20	2.0 ± .5	50	4.5	10	2	Z2
DL-1619	50	5.0 ±1.0	50	8.5	10	4	U
DL-1706	10	1.0 ± .25	100	3.5	10	1	Z2
DL-1715	20	2.0 ± .5	100	4.5	10	2	Z2
DL-1707	25	2.5 ± .5	100	5.0	10	2	Z2
DL-1708	50	5.0 ±1.0	100	7.5	10	2	Z2
DL-1598	50	5.0 ±1.0	100	8.5	10	2	U
DL-1720	75	7.5 ±1.5	100	12.5	10	4	U
DL-1586	80	8.0 ±2	100	13.0	10	4	Z3
DL-1595	100	10.0 ±2	100	14.0	10	10	Z3
DL-1597	100	10.0 ±2	100	17.0	10	5	U
DL-1716	100	10.0 ±2	100	15.0	10	5	Z2
DL-1709	125	12.5 ±2	100	21.0	10	5	U
DL-1704	150	15.0 ±2	100	25.0	10	5	U
DL-1848	150	15.0 ±2	100	25.0	10	5	Z2
DL-1893	200	20.0 ±3	100	34.0	10	10	U
DL-1601	250	25.0 ±3	100	42.0	10	12	U

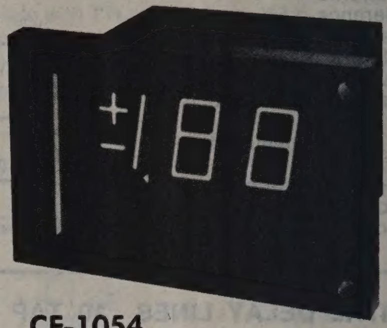
6750 NANCY RIDGE DRIVE / SAN DIEGO, CA 92921 / PHONE (619) 458-1471 / TWX: 910-595-2480

CANYON® electronics

READOUT ASSEMBLIES

The MINI-PAK® modules are compact, expandable, low cost read-out assemblies, specifically designed for use on instruments or systems where packaging and panel limitations are of paramount importance. The module contains the display and decoder/driver, which is TTL/LSI compatible, accepting 4 bit (8-4-2-1) BCD information.

The MINI-PAK® read-out modules are available with or without replaceable components, in either a gas discharge or an LED display, in 1½-, 2-, 2½- and 3 digit configuration that can be mounted individually or as a multi-digit display. A two case-styles give the design engineer a choice of a front panel mount case, designed with an integral bezel fitted with glare-free filter. The module can be very economically and efficiently mounted from the front of the panel, thereby covering the panel cut-out. The rear panel mount case, is designed so that the module can be mounted from the rear of the panel, allowing the design engineer a wider front panel space for nomenclature use.



CE-1054
CE-3034

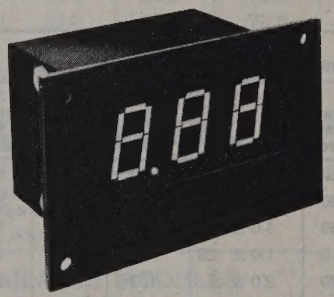
MECHANICAL SPECIFICATIONS

NO DIGITS	BODY WIDTH DIM. A NOM.		BEZEL WIDTH DIM. B NOM.		HOLE SPACING *DIM. C NOM.		PANEL CUTOUT † DIM. D		PANEL CUTOUT †† DIM. E		FILTER SIZE 1.25/31,80 X	
2	1.26	32,00	1.94	49,28	1.62	41,15	1.38	35,1	1.14	28,96	1.42	36,07
3	1.80	45,72	2.48	62,99	2.16	54,86	1.92	48,8	1.68	42,68	1.96	49,78
4	2.36	59,94	3.04	77,22	2.72	69,09	2.48	63,0	2.24	56,90	2.52	64,01
5	2.90	73,66	3.58	90,93	3.26	82,80	3.02	76,70	2.78	70,62	3.06	77,72
▲ 6	3.44	87,40	4.12	104,65	3.80	96,52	3.56	90,42	3.32	84,33	3.60	91,44
7	4.00	101,60	4.68	118,87	4.36	110,74	4.12	104,7	3.88	98,56	4.16	105,66
▲ 8	4.54	115,30	5.22	132,59	4.90	124,46	4.66	118,4	4.42	112,27	4.70	119,38

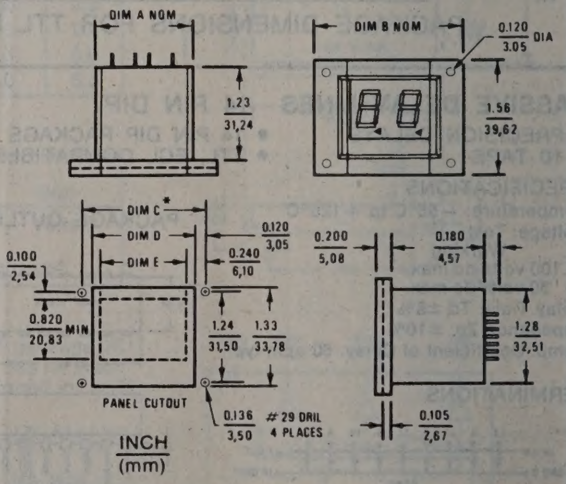
▲ Assumes maximum 3 digits modules per assembly.

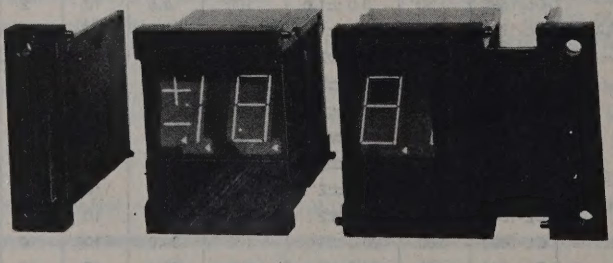
† D Dimension applies to CE-1000/3000/5000 series.

†† E Dimension applies to CE-2000/4000/6000 series.



CE-6037





CE-1044

TYPES OF MODULES		DESCRIPTION	
FRONT PANEL MOUNT	REAR PANEL MOUNT	DISPLAY	REPLACEABLE COMPONENTS
CE-1000	CE-2000	GAS DISCHARGE	NO
CE-3000	CE-4000	GAS DISCHARGE	YES
CE-5000	CE-6000	LED DISPLAY	YES

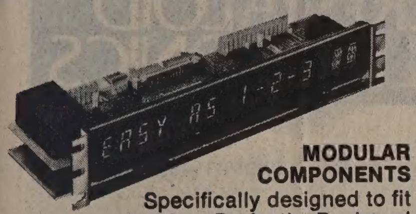
CANYON ELECTRONICS 2001 W. North Lane, Phoenix, Arizona 85021 (602) 944-4421

CHERRY Displays

TECHNICAL INFORMATION

- 100,000 hour display life. • Wide viewing angle.
- Baud rates from 300 to 9600 selectable on back panel.
- RS232C, RS422, 20 ma loop, or TTL parallel interface operation.
- End of Line Modes — left entry with automatic carriage return; writeover carriage return, horizontal scroll.
- Self-test mode: ASCII character set scrolled across panel.
- Environmental Operating Range: 0-70°C, 5-95% relative humidity (non-condensing).
- Designed to meet NEMA Pub. ICS 2-230 standard for EMI noise immunity (showering arc transients).
- Metal enclosure wth sealed bezel compatible with NEMA 12 standards.
- 115/220 VAC • Full address capability

ALPHANUMERIC DISPLAY SYSTEMS



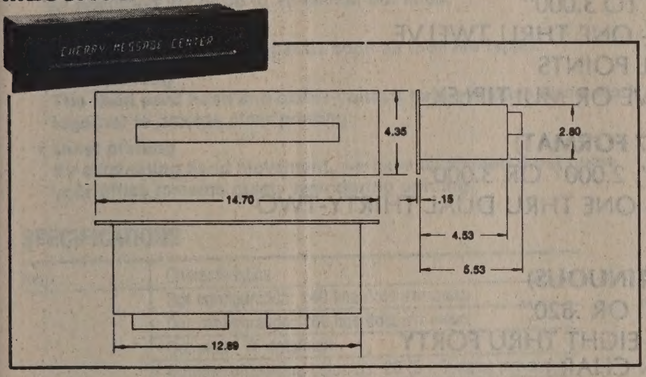
MODULAR COMPONENTS
Specifically designed to fit together. Perfectly. Designed so you can use each module alone . . . or put them all together.

24 CHARACTER ALPHANUMERIC DISPLAY MODULE
A totally self-contained system. Complete microprocessor controlled circuitry includes drivers, character generator, refresh memory and provides all standard functions.

Result	Characteristics
W424-1051 . . . requires 12 VDC only and accepts parallel or serial input — serial in either RS232 or 20 ma current loop. Selectable baud rates.	Receives only, in parallel or serial.
W424-1053 . . . requires 12 VDC only and accepts parallel or serial input (RS232 or 20 ma current loop.) Selectable baud rates. Fully interactive with half and full duplex operation capability.	Receives in parallel or serial. Sends in serial only.
W424-1058 . . . requires 12 VDC only and accepts binary input, 6 bits and strobe.	Will output a total of 64 messages, each being as long as 32 bytes. User can program his own message EPROM (2716). Requires no ASCII code or serial input.

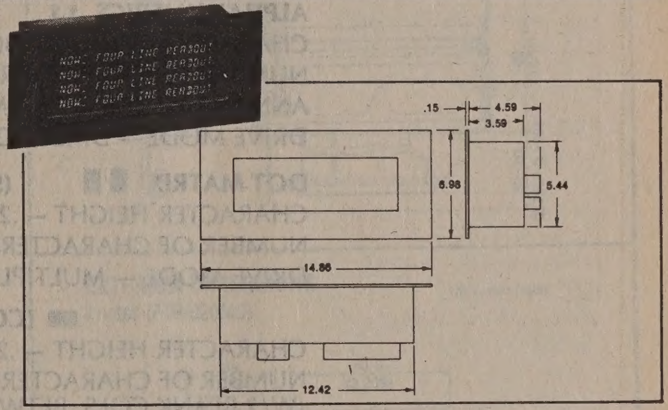
ALPHANUMERIC

MESSAGE CENTER


CHERRY MESSAGE CENTER
4.35
2.80
14.70
.15
4.53
5.53
12.89

- 24 Characters • Alphanumeric
- Receives serial or parallel ASCII output.
- Microprocessor Controlled

W424-105B — It displays up to 24 character messages in large half-inch bright orange neon 14 segment characters.


NOW: FOUR LINE READOUT
NOW: FOUR LINE READOUT
NOW: FOUR LINE READOUT
NOW: FOUR LINE READOUT
.15
4.59
3.59
6.98
5.44
14.86
12.42

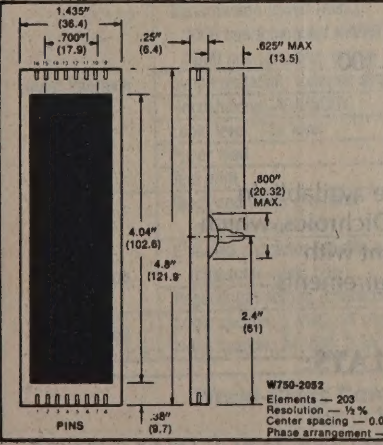
W424-105D — It can display up to 256 messages that have been stored in a nonvolatile, battery backed CMOS RAM.

W424-4040 — On a 4-line by 24 character display, the W424-4040 can show any of the 256 messages stored in the battery backed CMOS RAM memory. Each message may be up to 32 characters in length.

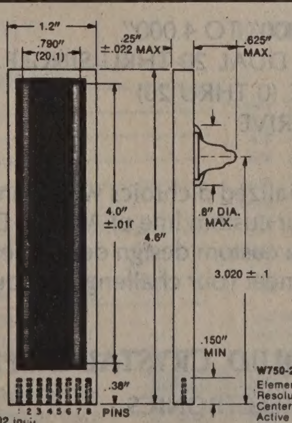
GAS DISCHARGE BAR GRAPH DISPLAY

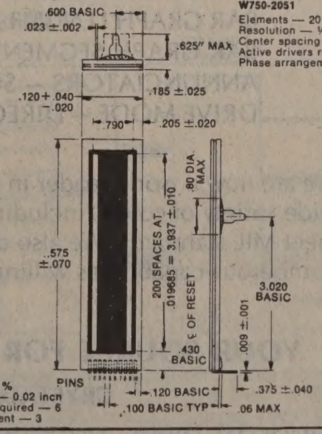
The single wide bar graph is 10 inches long and is viewable at 50 feet. The elements are bussed together in a 5-phase arrangement for high brightness and provide for a flicker-free continuous appearing display.

Two separate graphs give continuous glow on precisely controlled bar lengths. The bars operate independently of each other because of separate connections. Each bar graph can be viewed from both directions at once, or from either direction. Two separate pieces of information can be viewed in each bar as long as the total elements do not exceed 201. Cathodes in each bar are bussed together in a 3-phase arrangement.


1.435″
(36.4)
.700″
(17.9)
.25″
(6.4)
.625″ MAX
(13.5)
.800″
(20.32)
MAX.
4.04″
(102.6)
4.8″
(121.9
2.4″
(61)
.38″
(9.7)
PINS

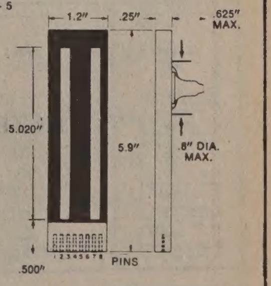
W750-2052
Elements — 203
Resolution — ½ %
Center spacing — 0.02 inch
Phase arrangement — 3


1.2″
.790″
(20.1)
.25″
±.022 MAX
.625″
MAX.
4.0″
±.010
4.6″
.8″ DIA.
MAX.
3.020 ± .1
.150″
MIN
.38″
1 2 3 4 5 6 7 8 PINS


.600 BASIC
.023 ±.002
.625″ MAX
.120 + .040 − .020
.185 ±.025
.790
.205 ±.020
.80 DIA. MAX
200 SPACES AT .019685 = 3.937 ±.010
.575 ±.070
℄ OF RESET
.009 ±.001
3.020 BASIC
.430 BASIC
PINS
.120 BASIC
.100 BASIC TYP
.375 ±.040
.06 MAX

W750-2051
Elements — 201
Resolution — ½ %
Center spacing — 0.02 inch
Active drivers required — 8
Phase arrangement — 5

W750-2050
Elements — 201
Resolution — ½ %
Center spacing — 0.02 inch
Active drivers required — 6
Phase arrangement — 3


1.2″
.25″
.625″
MAX.
5.020″
5.9″
.8″ DIA.
MAX.
PINS
.500″

W725-2050
Elements — 100
Resolution — 1%
Center spacing — 0.05 inch
Active drivers required — 6
Phase arrangement — 3

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

CRYSTALOID ELECTRONICS CO.
LIQUID CRYSTAL DISPLAYS

- **A STANDARD LINE** consisting of over 70 LCDs available for use in a variety of digital, alphanumeric, dot matrix, graphic and bar graph formats.
- **CUSTOM CAPABILITIES** include a professional staff willing to assist you in your design, a special prototype department for quick turnaround and an in-house laboratory for liquid crystal research and development.
- **CRYSTALOID's LCDs** are offered with multiplex or direct drive capabilities, commercial or hi-grade properties, in a variety of modes and configurations and now *Crystaloid* offers dichroics in a variety of color and mode combinations. LCD test equipment is also available.

CRYSTALOID™
ELECTRONICS

CHOOSE FROM ONE OF THE WIDEST LCD STANDARD LINES AROUND:

DIGITS ±8.8
DIGIT HEIGHT — .300″ to 3.000″
NUMBER OF DIGITS — ONE THRU TEN
ANNUNCIATORS — DECIMAL POINTS, COLONS,
PLUS/MINUS, "LO BAT", "AM/PM"
DIRECT MODE — DIRECT DRIVE OR MULTIPLEX

ALPHANUMERICS ▩ ▩
CHARACTER HEIGHT — .300″ TO 3.000″
NUMBER OF CHARACTERS — ONE THRU TWELVE
ANNUNCIATORS — DECIMAL POINTS
DRIVE MODE — DIRECT DRIVE OR MULTIPLEX

DOT MATRIX ▦ ▦ **(5 x 7 FORMAT)**
CHARACTER HEIGHT — .250″, 2.000″ OR 3.000″
NUMBER OF CHARACTERS — ONE THRU DUAL THIRTY-TWO
DRIVE MODE — MULTIPLEX

▒ **(CONTINUOUS)**
CHARACTER HEIGHT — .250″ OR .820″
NUMBER OF CHARACTERS — EIGHT THRU FORTY
(W/2 BLANK COLS. BETWEEN CHAR.)
ANNUNCIATORS — NONE
DRIVE MODE — MULTIPLEX

■ **(SQUARE)**
IMAGE AREA — 1.400″ SQUARE
MATRIX SIZE — 16 x 16 OR 32 x 32
ANNUNCIATORS — NONE
DRIVE MODE — MULTIPLEX

BAR GRAPHS ▬
BAR GRAPH LENGTH — 2.000″ TO 4.000″
BAR GRAPH SEGMENTS — DUAL 20 THRU SINGLE 100
ANNUNCIATORS — SCALE (0 THRU 20)
DRIVE MODE — DIRECT DRIVE

NOTE: We are now a world leader in specialized dichroics which are available in wide variety of colors, including our custom line of Avionic Dichroics, which meet MIL standards. We also offer a custom design department with numberous capabilities willing to meet your challenging requirements.

YOUR SOURCE FOR LIQUID CRYSTAL DISPLAYS:

CRYSTALOID ELECTRONICS
P.O. BOX 628 / 5282 HUDSON DRIVE, HUDSON, OHIO 44236 / PHONE: (216) 655-2429 / TELEX: 241244

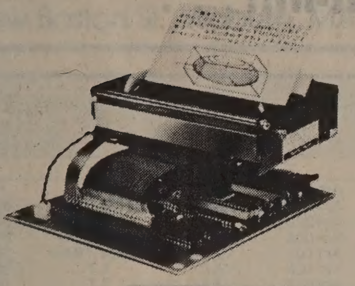
VOL 2/352

For More Information. Circle No. 162

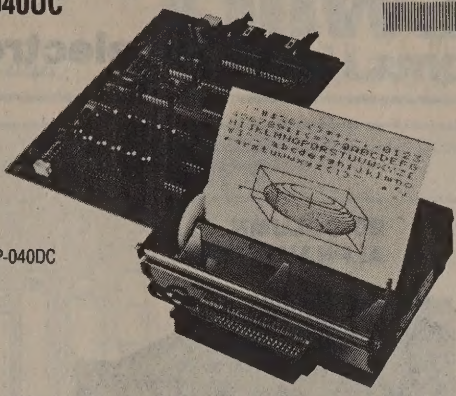
Fujitsu Mini–Thermal Printer

Printer Unit FTP-020UC & FTP-040UC

FUJITSU



Controller FTP-020DC Printer FTP-020MC



Controller FTP-040DC

Printer FTP-040MC

The Fujitsu FTP-020UC; FTP-040UC, mini-thermal printer, with its line-dot recording method, provides multi-purpose applications.

Features

- **Maintenance-free**
  Because of the line-dot recording method, the print head does not move, making maintenance obsolete.
- **High-speed printing**
  The FTP-020UC will print up to 80 characters/s.
- **Long life**
  The unique structure protects the print head from wear, providing an operating life of up to 20 million dot lines.
- **Visible last line**
  Printed lines are visible just as soon as they are typed.
- **Clear printing**
  The fixed print head and stable-contact heat-sensitive forms work together to provide clear printing.
- **Quiet printing**
  By eliminating head movement, we have eliminated most noise. your office remains quiet, even during printing.

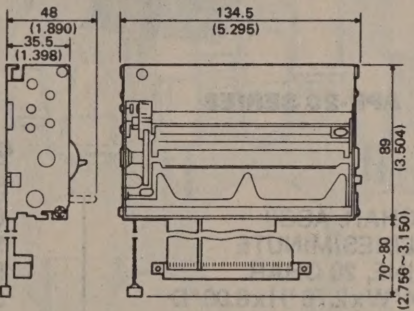
SPECIFICATIONS

Item	Characteristics
Printer	Dot configuration: 140 line dots (FTP-020MC)
	Dot configuration: 280 line dots (FTP-040MC)
	Dot pitch: 70 dots/inch
	Number of printing columns: 20 (5 x 7 dots) (FTP-020MC)
	Number of printing columns: 40 (5 x 7 dots) (FTP-040MC)
	Character size: 1.8 x 3.0mm
	Printing speed: 80 characters/s (standard)
	Weight: Approx. 300 g (FTP-020MC)
	Weight: Approx. 500 g (FTP-040MC)
	Printing paper width: 60mm (max.)
	Recommended papers: TP50KS-F (Jujo Paper) F-200H (Mitsubishi Paper) PS65B (Honshu Paper)
Input interface	8-bit parallel (Centronics standards)
	Transmission speed (min.): 1000 cps (character mode) or 2000 cps (graphics mode)
	Synchronization: External strobe pulse
	Handshaking: ACK/BUSY
	Logic level: TTL level
	Paper feed
	Test print
Control codes	Black and white reversible (graphics mode only)
	Enlarged character (double column) (character mode only)
	Page length setting (character mode only)
Power source	Logic section: 5 VDC, 1A (max.)
	Head section: 24 VDC, 2.5A (max.)

EXTERIOR DIMENSIONS

Printer (FTP-040MC)

Unit: mm(inch)

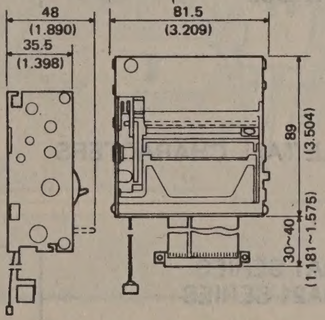


48
(1.890)
35.5
(1.398)
134.5
(5.295)
89
(3.504)
70~80
(2.756~3.150)

EXTERIOR DIMENSIONS

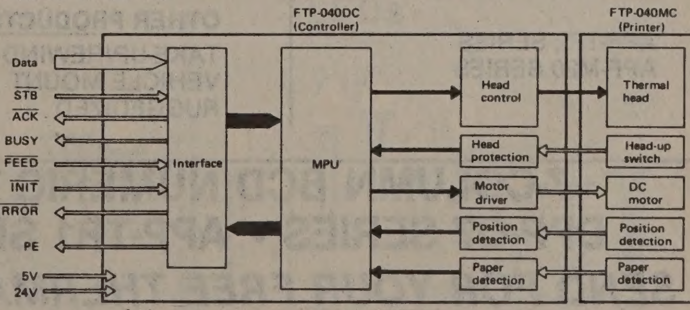
Printer (FTP-020MC)

Unit: mm(inch)



48
(1.890)
35.5
(1.398)
81.5
(3.209)
89
(3.504)
30~40
(1.181~1.575)

BLOCK DIAGRAM



FTP-040DC
(Controller)
FTP-040MC
(Printer)
Data
$\overline{\text{STB}}$
$\overline{\text{ACK}}$
BUSY
$\overline{\text{FEED}}$
$\overline{\text{INIT}}$
$\overline{\text{ERROR}}$
PE
5V
24V
Interface
MPU
Head control
Head protection
Motor driver
Position detection
Paper detection
Thermal head
Head-up switch
DC motor
Position detection
Paper detection

World-Class Components
Part of Tomorrow's
Technology

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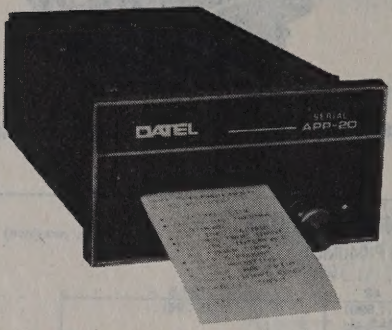
Component Division Fujitsu America, Inc.
918 Sherwood Drive, Lake Bluff, IL 60044
(312) 295-2610 Telex: 206196 TWX: 910-651-2259

MINI THERMAL PANEL PRINTERS

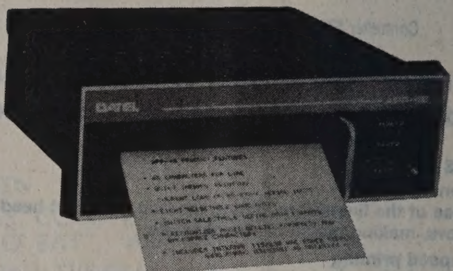
. . . All electronics are built-in!! . . .

20-COLUMN ALPHANUMERIC



APP-20 SERIES

48-COLUMN ALPHANUMERIC



APP-48 SERIES

COMMON FEATURES

APP-20 SERIES		APP-48 SERIES
96-CHAR. ASCII	CHARACTERS	96-CHAR. ASCII
63 LINES/MINUTE	SPEED	72 LINES/MINUTE
1 LINE, 20 CHAR.	BUFFER	1 LINE, 48 CHAR.
4.44″W x 2.76″H x 8.00″D	SIZE	8.20″W x 2.84″H x 8.14″D
4.3 LB (AC), 2.5 LB (DC)	WEIGHT	6 LB.
115,230 VAC OR 12 VDC	POWER	115,230 VAC or 12 VDC
2.31″ WIDE	PAPER	5″ WIDE
5 x 7, 0.11″ HIGH	FONT	5 x 7, 0.11″ HIGH
SELECTABLE	INVERTED PRINTOUT	SELECTABLE

SPECIAL FEATURES

APP-20 SERIES	APP-48 SERIES
SELECTABLE TALL CHARACTERS	SELECTABLE 2ND 96-CHAR. SET

INTERFACE MODELS

APP-20 SERIES		APP-48 SERIES
APP-20A1 SERIES	BYTE—PARALLEL	APP-48A1 SERIES (CENTRONICS)
APP-20A21 SERIES	SERIAL, RS-232-C AND ISOL. 20 mA	APP-48A2 SERIES
APP-20A3 SERIES	IEEE-488 GPIB	APP-48A3 SERIES

OTHER PRODUCTS:

APP-20 SERIES		APP-48 SERIES
APP-TR2 SERIES	TAKE-UP/REWIND REEL	APP-TR5 SERIES
APP-M20 SERIES	VEHICLE MOUNT	APP-M48 SERIES
	RUGGEDIZED	

7-COLUMN BCD NUMERIC THERMOPRINTERS
DPP-Q7 SERIES • APP-TR1 SERIES TAKE-UP REEL

SEND FOR YOUR FREE THERMAL PRINTER BROCHURE

DATEL

11 CABOT BOULEVARD, MANSFIELD, MA 02048/TEL. (617)339-9341/TWX 710-346-1953/TLX 951340
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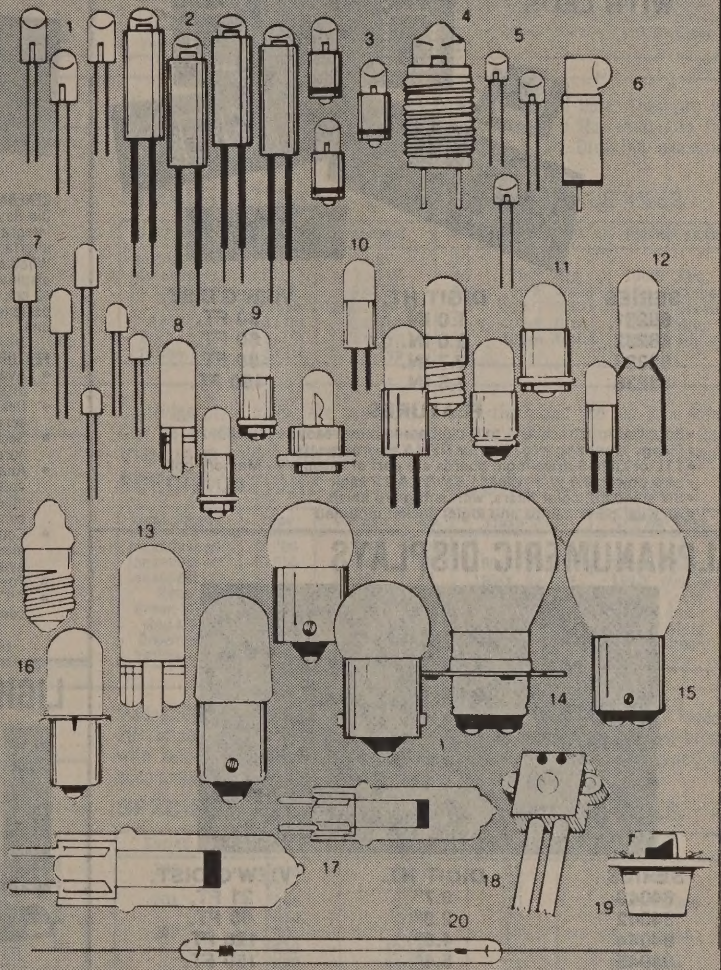
For More Information. Circle No. 164

Gilway Technical Lamp

165 New Boston St., Woburn, MA 01801 USA 617/935-4442

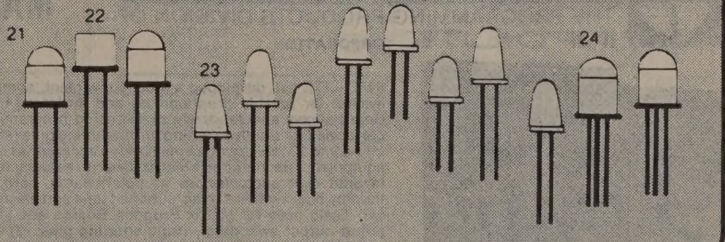
LAMPS

LENS END LAMPS				
180-1	T-1¾	2.5V	350 mA	1
L 1005	T-2	2.5V	340 mA	2
L 1023	T-2	2.5V	340 mA	2
L 4044	GROOVED	2.5V	350 mA	3
L 4040	CARTRIDGE	2.5V	300 mA	6
L 1006	T-2	3.5V	450 mA	2
L 1021	T-2	3.5V	600 mA	2
L 1007	T-2	5.0V	160 mA	2
L 1025	T-2	5.0V	220 mA	2
1150-1	T-1	5.0V	115 mA	5
L 8006	T-4	5.0 V	775 mA	4
HALOGEN LAMPS				
182	5W	3.5V	25 HR	7
L 7387	10W	6.0V	100 HR	17
L 7388	20W	6.0V	100 HR	17
L 7394	20W	6.0V	2000 HR	17
L 7401	20W	12.0V	250 HR	17
L 7389	50W	12.0V	2000 HR	17
L 7390	100W	12.0V	2000 HR	17
SUBMINIATURE LAMPS				
6833	T-¾	5.0V	60 mA	7
6153	T-¾	5.0V	60 mA	7
7153	T-¾	5.0V	115 mA	7
7201	T-1	1.5V	15 mA	7
683	T-1	5.0V	60 mA	7
715	T-1	5.0V	115 mA	7
7715	T-1	5.0V	115 mA	10
8111	T-1	14.0V	65 mA	7
6838	T-1	28.0V	24 mA	7
7839	T-1	28.0V	24 mA	10
324	T-1¼	3.0V	190 mA	12
583	T-1¼	5.0V	60 mA	12
515	T-1¼	5.0V	115 mA	12
8610	T-1¼	6.3V	200 mA	12
8640	T-1¼	14.0V	80 mA	12
2182	T-1¾	14.0V	80 mA	12
2162	T-1¾	14.0V	100 mA	12
387	T-1¾	28.0V	40 mA	11
73	WEDGE	14.0V	80 mA	8
74	WEDGE	14.0V	100 mA	8
MINIATURE LAMPS				
259	WEDGE	6.3V	250 mA	13
161	WEDGE	14.0V	90 mA	13
194	WEDGE	14.0V	270 mA	13
6	S-8	6.4V	3.0 A	15
6IF	S-8	6.4V	3.0 A	15
8	S-8	8.0V	2.2 A	15
1460X	S-8	6.5V	2.7 A	14
1631X	S-8	6.5V	2.7 A	14
1649	S-8	6.5V	2.7 A	14
1204	S-8	28.0V	710 mA	15
1228	S-8	34.0V	450 mA	15
FLASHLIGHT KRYPTON HI - BEAMS				
K-3	3.0 W	3.6V	3.2 M.S.C.P.	16
K-13	3.6W	4.8V	4.4 M.S.C.P.	16
K-12	5.0W	5.9V	6.0 M.S.C.P.	16
LINE FILAMENT LAMPS				
L 9013	1.2 FILAMENT	6.0V	370 mA	20
L 9014	2.4 FILAMENT	12.0V	370 mA	20
HALOGEN LAMP HOLDERS				18
WEDGE BASE LAMP HOLDERS				19



LEDs

LEDs (very bright)				
E 100	T-1	RED	200 mcd	23
E 102	T-1	ORANGE	200 mcd	23
E 104	T-1	YELLOW	200 mcd	23
E 106	T-1	GREEN	200 mcd	23
IR LEDs				
E 10	TO-18 LENS	940 nm	15 mW	21
E 11	TO-18 FLAT	940 nm	4 mW	22
E 14	T-1¾	940 nm	15 mW	23
PHOTOTRANSISTORS				
D 32	TO-18 LENS	8.0 mA	500 Lux	24
D 37	T-1	1.0 mA	500 Lux	23
PHOTODARLINGTONS				
D 57	T-1	5.0 mA	200 Lux	23



For more specifications please request our catalogue. (617) 935-4442 TELEX 287617 (GWAY UR)

DIO-REY

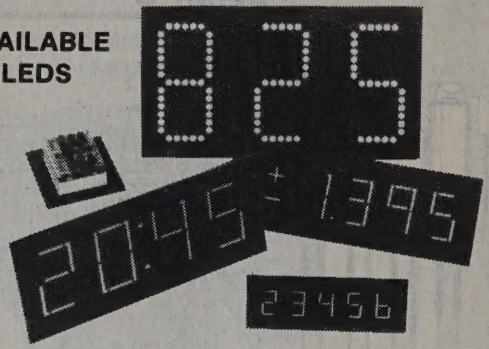
"LINKS BETWEEN MAN AND MACHINE"

THE INFORMATION DISPLAY DIVISION OF
INFO-LITE CORPORATION

422 Cliff Street • Fairview, NJ 07022
(201) 941-4455

LARGE DIGITAL DISPLAYS

NOW AVAILABLE
WITH LEDS

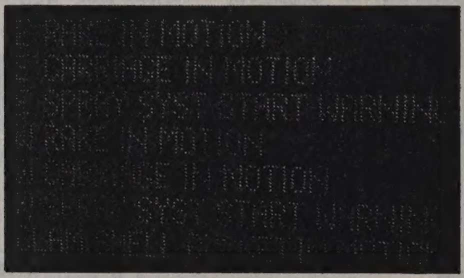


SERIES	DIGIT HT.	VIEW'G DIST.
68231	1.0 IN.	30 FT.
68232	2.0 IN.	60 FT.
68233	2.7 IN.	80 FT.
68236	5.5 IN.	150 FT.

FEATURES

- Supplied in attractive, 1 to 8 digit assemblies ready to install
- Flange mounting w/gasket for NEMA environments
- TTL or CMOS drive logic boards are part of assembly—Memory opt'l.
- Low power: 0.8 W/1" digit; 1.6 W/2" & 2.7 digit
- Six standard, color filters, with anti-glare finish
- All wear parts (lamps and logic) socket mounted

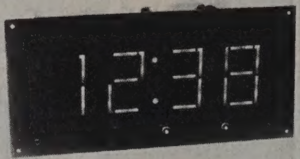
ALPHANUMERIC DISPLAYS

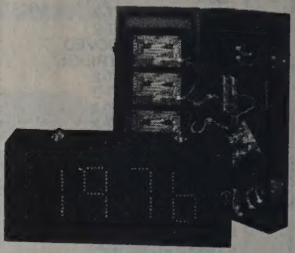


SERIES	DIGIT HT.	VIEW'G DIST.
84040	0.7"	21 FT.
84042	2.0"	60 FT.
84044	4.0"	120 FT.
84045	5.4"	150 FT.

Micro-processor buss compatible & can interface with Dio-Rey's 820 Series ASCII Serial Receivers (up to 16 characters can be driven by one 820 receiver). Multi-character units supplied (16 & 18 character Std.). Can be supplied in NEMA or Designer enclosures. Optional display controller allows various modes of display including direct copy, horizontal scroll, vertical scroll, etc. Multiple units may be driven off a single data loop with each unit being addressable. —For further information or applications engineering assistance, please contact us or your area representative.

NUMERIC & ALPHANUMERIC INSTRUMENTS & DISPLAY SYSTEMS





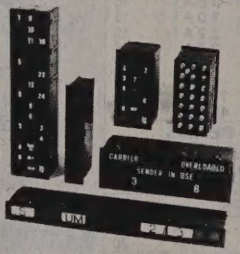
Laddle Wt meter (5½")

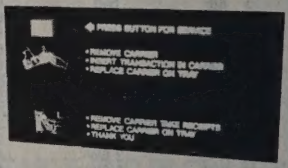
GENERAL
Dio-Rey standard instruments integrate a wide range of display interfaces and power supplies. Whether it be a 6 digit, 5½" high display w/serial interface in a NEMA 12 box or a 2" 4 digit clock in a designer enclosure, Dio-Rey has the unit.

FEATURES
- Available in rugged Industrial or attractive Designer packages
- Designed for long, trouble-free service
- Serial interface is EIA RS232 or current loop compatible
- Analog to digital interfaces are voltage, current, temperature, load-cell and tachometer compatible
- Counters, clocks and timers in most popular configurations are available
- Powered from 110/220V, 50/60 Hz
- All wear and calibration components easily accessible

APPLICATIONS
- Clocks
- Bidirectional counters
- Serial Data Displays
- Decade counters
- Event counters/timers
- Pulse counters
- AC/DC ammeters
- AMP-HR meters
- Decibel indicating meters
- Fluid flow meters
- Volt meters
- Ohm meters
- Temperature meters
- Watt meters
- Timers
- Special indicators
- Weight/scale readouts

LIGHTED INDICATORS & ANNUNCIATORS





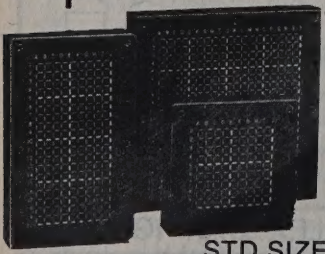
NOW AVAILABLE
WITH LEDS

Any group of messages/symbols can be displayed in any combination of colors • Construction is modular • Front panel graphics are back lighted using Std. MFB T 1 3/4 lamps • Units are supplied in an attractive package with bezel and "Black-Out" front panel, ready to snap into rectangular panel cutout • Common ground reduces installation time • Serviced from the front • Lamp drivers and special logic available. INFO-LITE has the engineering support and experience required to deliver CUSTOM ANNUNCIATORS, STATUS DISPLAYS, MAP BOARDS, PROCESS FLOW INDICATORS & DEAD FRONT PANELS.

CROSSPOINT

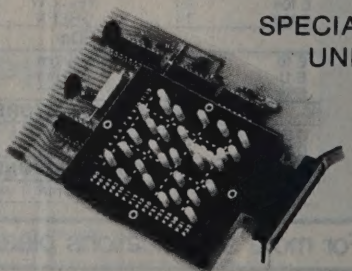
THE PROGRAMMING PRODUCTS DIVISION OF
INFO-LITE CORPORATION

MATRIX PROGRAMMING BOARDS



INFO-LITE has developed a most convenient, compact and economical system for reliable programming and switching • The Matrix Program Board allows a wide variety of switching/programming functions to be performed by simply inserting programming pins (shorting or diode type) into a 2 to 10 deck contact matrix • No accessories such as "read" "write" equipment are required • Matrix Board features have lead them to be favored over such devices as patchboards, card readers, toggle and thumbwheel switches, mag/punched tape and electronic memories • The two basic uses for Matrix Program Boards are: (1) Cordless patching (input-output switching), using shorting pins; (2) Programmable diode matrices (logic memories), using diode pins • Units with up to 100 × 100 crosspoints can be supplied to meet your requirements, whether for prototype or production quantities.

SPECIAL
UNIT



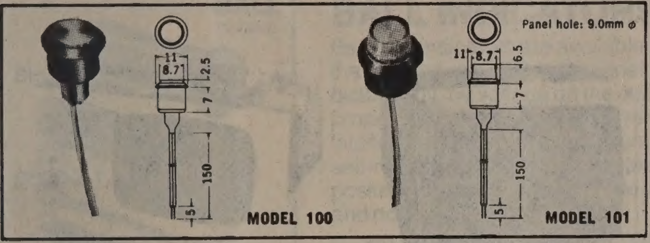
STD SIZES: 10 × 10, 10 × 15, 10 × 20, 10 × 25, 10 × 50,
20 × 20, 25 × 25, 50 × 50

For More Information. Circle No. 166

INTER-MARKET INCORPORATED

1946 LEHIGH AVENUE, GLENVIEW, ILLINOIS 60025 • (312) 729-5330 • TWX 910-651-1997

MODELS 100/101 — MODULAR INDICATORS

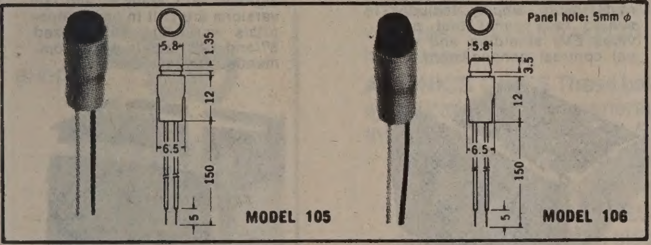

Panel hole: 9.0mm ϕ
11
8.7
2.5
7
150
5
MODEL 100
11
8.7
6.5
7
150
5
MODEL 101

Modular concept provides low cost and great versatility. Rubber bushing snaps into 9mm panel cut out. Lens then snaps into bushing from front while light source fits in from behind. Ordering example: F606-101-R

SPECIFICATIONS — LIGHT SOURCE — LENSES

Light Source	Type	Voltage	mA	Flush Lens	Top Hat Lens
Incandescent	F606	5-6.3V	50		
Incandescent	F614	12-14V	80	100-R Red	101-R Red
Incandescent	F628	24-48V	40	100-A Amber	101-A Amber
Neon	N5115	100-120V AC	1.5	100-G Green	101-G Gren
Green Glow	G5115	100-120V AC	1.5	100-B Blue	101-B Blue
Red LED	L-617RL	2.0 Typ	10	100-W White	101-W White
Green LED	L-617GL	1.9 Typ	10	100-C Clear	101-C Clear
Yellow LED	L-617YL	1.9 Typ	10		

MODELS 105/106 — MODULAR INDICATORS

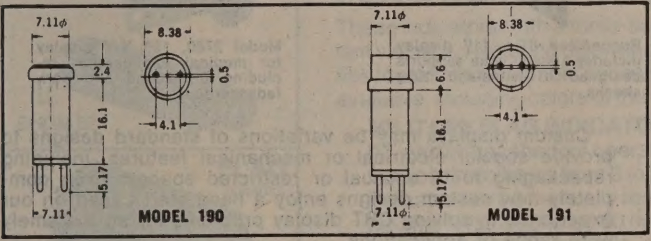

Panel hole: 5mm ϕ
5.8
1.35
12
6.5
150
5
MODEL 105
5.8
3.5
12
6.5
150
5
MODEL 106

Miniature modular concept requires only 5mm panel hole. They are installed by pressing the lens through the panel from the front into the rubber bushing containing the lamp on the back. Ordering example: F305-105-R

SPECIFICATIONS — LIGHT SOURCE — LENSES

Light Source	Type	Voltage	mA	Flush Lens	Top Hat Lens
Incandescent	F305	4-6V	60		
Incandescent	F314	12-14V	40	105-R Red	106-R Red
Incandescent	F328	24-28V	24	105-A Amber	106-A Amber
Neon	N3115	100-120V AC	1.0	105-G Green	106-G Green
Red LED	L-317RL	2.0 Typ	10	105-B Blue	106-B Blue
Green LED	L-317GL	1.9 Typ	10	105-W White	106-W White
Yellow LED	L-317YL	1.9 Typ	10		

MODELS 190/191 — CARTRIDGE LAMPS

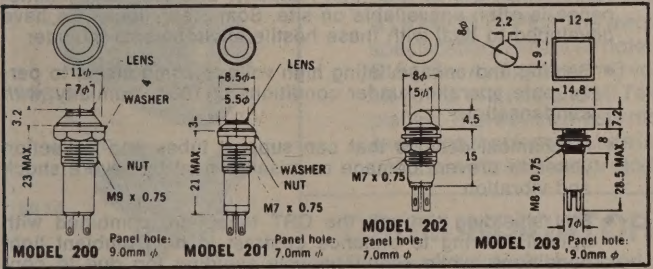

7.11ϕ
8.38
2.4
0.5
16.1
4.1
5.17
7.11
MODEL 190
7.11ϕ
8.38
6.6
0.5
16.1
4.1
5.17
7.11ϕ
MODEL 191

Cartridge style lamps are available in both flush and top hat type lens. Can be used in place of similar types from other manufacturers. Cartridge Lamp holders are also available as CLH-B (black) or CLH-S (silver).

SPECIFICATIONS — LIGHT SOURCE — LENSES

Light Source	Type	Voltage	mA	Flush Lens	Top Hat Lens
Incandescent	CLF06	5-7V	200		
Incandescent	CLF14	12-14V	80	190-R Red	191-R Red
Incandescent	CLF28	24-28V	40	190-Y Yellow	191-Y Yellow
Neon	CLN115	110-120	1.5	190-G Green	191-G Green
Green Glow	CLG	110-120	1.5	190-B Blue	191-B Blue
Red LED	CLLR	2.0	10	190-W White	191-W White
Green LED	CLLG	1.9	10	190-C Clear	191-C Clear
Yellow LED	CLLY	1.9	10		

MODELS 200 to 203 — INCANDESCENT INDICATORS

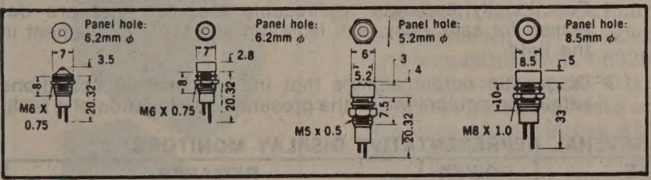

LENS
11ϕ
7ϕ
WASHER
3.2
23 MAX.
NUT
M9 x 0.75
MODEL 200
Panel hole: 9.0mm ϕ
LENS
8.5ϕ
5.5ϕ
3
21 MAX.
WASHER
NUT
M7 x 0.75
MODEL 201
Panel hole: 7.0mm ϕ
8ϕ
5ϕ
4.5
15
M7 x 0.75
MODEL 202
Panel hole: 7.0mm ϕ
8ϕ
2.2
9
12
14.8
7.2
8
28.5 MAX.
M8 x 0.75
7ϕ
MODEL 203
Panel hole: 9.0mm ϕ

Model 200 is rugged chrome plated brass with long life T1¾ lamp. Model 201 is smaller version of 200 above. Model 202 is chrome plated brass with removable lens for lamp replacement. Model 203 is designed to accommodate custom legends and is front relampable.

SPECIFICATIONS — LIGHT SOURCE — LENSES

Series	Type	Voltage	mA	Lens
200	FA06	5-7	50	R — Red
	FA14	12-14	30	
201	FB06	5-7	50	Y — Yellow
	FB14	12-14	30	
202	FK05	4-6	60	G — Green
	FK14	12-14	40	
	FK28	24-28	24	B — Blue
203	FJ06	5-7	200	
	FJ14	12-14	80	W — White
	FJ28	24-28	40	

MODELS 406 to 409 — SOLID STATE INDICATORS

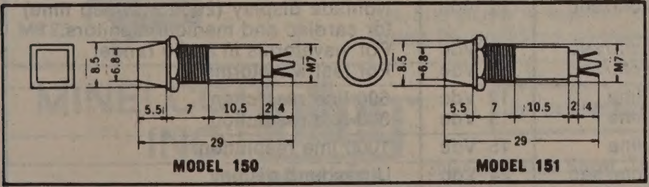

Panel hole: 6.2mm ϕ
7
3.5
8
20.32
M6 X 0.75
Panel hole: 6.2mm ϕ
7
2.8
8
20.32
M6 X 0.75
Panel hole: 5.2mm ϕ
6
5.2
3
4
7.5
20.32
M5 x 0.5
Panel hole: 8.5mm ϕ
8.5
5
10
33
M8 X 1.0

All of chrome plated brass except 409 is black anodized only, with low current LED lamp. Ordering example: LED-406R

SPECIFICATIONS — LIGHT SOURCE — LENSES

Type	Color (All)	Volts (All)	MA (All)	MCD
LED-406 LED-407 LED-440 LED-409	R — Red G — Green Y — Yellow	2.0	1.0	1.2

MODELS 150/151 — UNIVERSAL INDICATORS


8.5
6.8
M7
5.5
7
10.5
2
4
29
MODEL 150
8.5
6.8
M7
5.5
7
10.5
2
4
29
MODEL 151

Attractive, low cost plastic assembly, mounts in 7mm hole with nut and washer supplied. Square or round in a variety of light sources and colors. Ordering example: F151-12R

HOW TO ORDER: XX - 15X - XXX

LIGHT SOURCE
F — Incandescent
L — LED
NR — Neon, w/resistor

SHAPE
0 — Square
1 — Round

VOLTS
06 — 6 Volts
12 — 12 Volts
24 — 24 Volts
10 — 110 Volts
20 — 220 Volts

COLOR
A — Amber
G — Green
R — Red
C — Clear
B — Blue
Y — Yellow

INFODEX INCORPORATED
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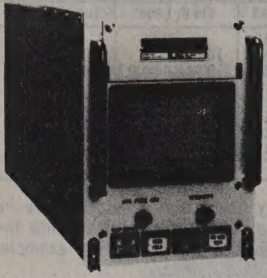
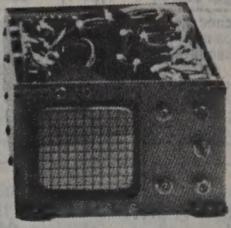
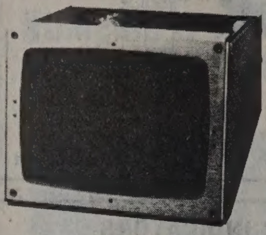
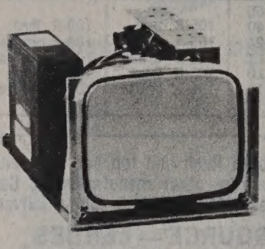
OEM CRT DISPLAYS

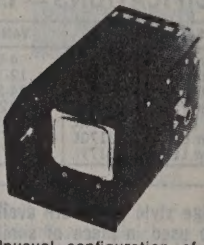

5" waveform display for Airborne MIL-Spec application. Complete unit supplied ready for operation as shown.


Model 7800. Extremely compact 3" waveform monitor.

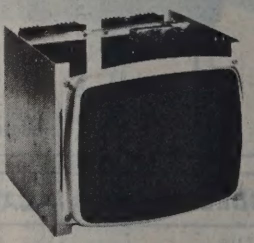

Ruggedized 12" MIL-Spec raster scan display includes sealed face panel that provides EMI shielding and visual contrast enhancement.

Nonfade 8" cardioscope display. Infodex supplied the industry's earliest nonfade designs in 1972. Many 8" and 17" versions are still in use in hospitals worldwide. Ruggedized 6" and 12" models are recommended for new design.


Model 7715. 6" flat face raster scan display.


Unusual configuration of this 3" oscilloscope display provides extremely dense and compact packaging that most effectively uses a limited mounting space.

Ruggedized 8" x 11" display includes special yoke supports designed to withstand 100g shocks.


Model 2780. 12" X-Y display for medical applications, including ultrasound and nonfade cardiac.

Infodex CRT Displays include a wide range of standard sizes, capabilities, and features that encompass most needs of builders of military, industrial, and medical equipment. Custom models are also supplied in single or production quantities to satisfy individual requirements or provide special features. Recent applications for Infodex displays include:

MILITARY (MIL SPEC)

Flight simulators, Automatic carrier landing systems, Radar bomb directors, Weapons system trainers, Airborne and ground based electronic warfare systems.

MEDICAL

Ultrasonic diagnostic systems, X-Ray film recording (e.g., CAT scanners), EKG monitors, Nonfade cardiac monitors, Pulse monitors, X-Ray image intensifiers.

INDUSTRIAL

Graphic slide and film recorders, Engine analyzers, Television monitors, Oceanographic displays, Computer output graphics, Waveform monitors.

Most Infodex OEM displays are supplied as compact one piece assemblies, without enclosures, for direct installation behind control panels. Screens up to seven inch diagonal are typically flat face, and include both magnetic and electrostatic deflection amplifiers, video amplifiers, and high voltage power supplies. The only connections needed to use circuits are low level video and sync inputs, or X and Y deflection signals for random access displays. Units may be supplied to operate from 12, 15, 24, or 28 Vdc sources within user equipment, or from 110/220 Vac.

Custom displays may be variations of standard designs to provide special electrical or mechanical features, including repackaging to fit unusual or restricted spaces. Even completely new custom designs enjoy a head start based on our experience in solving CRT display problems for an extremely wide range of applications.

In military and medical applications, there can be no tradeoff on reliability, yet continuous operation is common at elevated temperatures and high humidity, and technical maintenance is often unavailable on site. Some techniques we have developed to deal with these hostile environments include:

- Sealing and encapsulating high voltage components to permit safe operation under conditions of 100% humidity, *with* condensation.
- Mechanical designs that can support tubes and deflection yokes to prevent damage or misalignment by severe shock and vibration.
- EMI shielding through the CRT faceplate, combined with optical filtering to enhance contrast in high ambient light conditions, while simultaneously avoiding fog due to condensation at 100% humidity, and permitting easy field replacement.
- Functionally separate replaceable modules that are designed for safe, easy fault isolation and fast replacement in the field.
- Diagnostic output signals that indicate normal conditions within the equipment, or the presence and location of a fault.

THE FOLLOWING TABLE LISTS THE MAJOR FEATURES OF SEVERAL REPRESENTATIVE DISPLAY MONITORS.

TYPE	MODEL	DEFLECTION	RATE	POWER	REMARKS
3" X-Y	7800	Electrostatic	1 MHz	12 Vdc	Mount easily to user's panel.
	7801	Electrostatic	1 MHz	12 Vdc	Adjustable, built-in sweep.
6" X-Y	2740A	Magnetic	25,000 cm/sec	12 Vdc	Nonfade display (2000 x sweep time) for cardiac and medical monitors.
	2750A	Magnetic	25,000 cm/sec	12 Vdc	For waveforms in audio range.
	2750B	Magnetic	125,000 cm/sec	15 Vdc	For fast waveforms.
6" RASTER	7715	Magnetic	525 line	12 Vdc	600 line resolution.
	7715A	Magnetic	525 line	15 Vdc	800 line resolution.
7" RASTER	7725	Magnetic	525 line	15 Vdc	1000 line resolution.
12" X-Y	2780	Magnetic	200,000 cm/sec	24 Vdc	Ultrasound display.

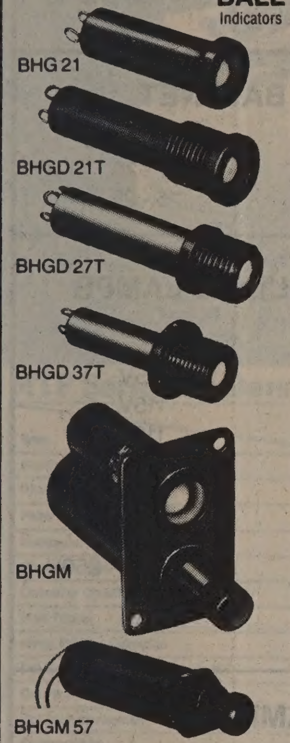
MINELCO INC. | Talley™ Industries

MILITARY and AVIONIC BITE* INDICATORS

with MEMORY • NON-VOLATILE

*Built In Test Equipment

BALL Indicators



BALL INDICATORS

Ball type indicators are available both in military and commercial versions. They are unique in that they have a latching magnet just behind the ball. This latch operates rapidly to a position dictated by the voltage on the coil, and in addition magnetically causes the ball to rotate to the proper color. Even with power removed, the ball will retain its position since it is magnetically latched. No change will occur until a reset pulse is applied. Minelco offers manual-reset and self-restoring models for special applications, as well as optional colors for the "set" and "reset" positions. Other options include lead wires, suppression and/or steering diodes, "O" ring seals, and non-glare glass.

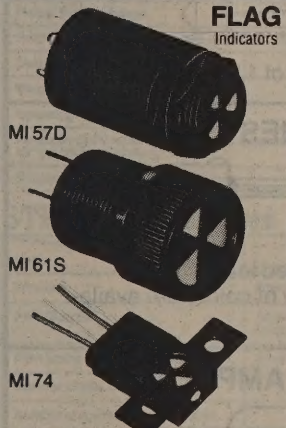
MILITARY BALL INDICATORS Qualified to MIL-I-83287/03, these units are available in several different sleeve and threaded mounting configurations. These are the series BHG (single coil) and BHGD (double coil). This type meets all of the temperature, vibration, shock, and other critical environmental specifications of the mil spec. They are available in voltages from 1.5 through 28, and operate with pulse power of 650 milliwatts applied for 20 ms or more.

AVIONICS TYPES These ball indicators meet all the critical requirements of the military specification, and are generally used where fully qualified units are not needed. They are available in voltages from 1.5 through 28 volts DC. The following types are available:

BIS SERIES These are self-restoring devices. A continuous voltage is necessary to keep the ball in the "set" position.

MANUAL RESET TYPES Types BHGM, BHGM 57, BHGDM 57 are all manually resettable, but may also be electrically reset if desired.

FLAG Indicators



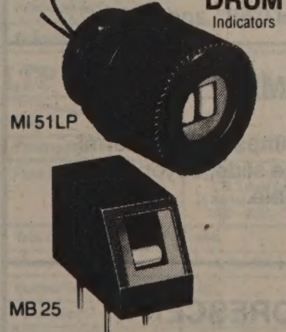
FLAG INDICATORS

These indicators, with a three-segment display, provide a good contrast indication with excellent visibility. A rotating disc, magnetically-actuated, provides the color change, and also carries the latching magnets necessary to make the display non-volatile. Several options are available, including colors of the "set" and "reset" positions, lead configurations, etc.

MILITARY FLAG INDICATORS MI 57D — The military version is qualified to MIL-I-83287/02, and is furnished for operation at 28 VDC. The MI 57D is also available in a non-military version, in voltages from 3 to 28 VDC. Both types are dual coil units. MI 61S — This latching indicator can be manually reset, or electrically reset with a reverse pulse. Turning the knurled knob clockwise 60 degrees resets the unit. The knob has a spring return. The unit is qualified to MIL-I-83287/01, and available in voltages from 3 to 28 VDC. MI 61R — A modified version of the MI 61S, above. The MI 61R is manufactured to withstand the severe requirements of random vibration, and is especially suitable for stringent aircraft applications. The unit meets the requirements of MIL-I-83287.

AVIONICS TYPES The avionic units meet all the environmental requirements of the MIL specification, except as noted, and are suitable for all types of aircraft applications. MI 51SMS — Available from 3 volts to 28 VDC, and may be either manually or electrically reset. MI 70 (no bracket) and MI 74 (with bracket) — These units have the display visible from two planes. This device meets most of the requirements of the military specification, with the exception that temperature is limited to + 105°C. Voltages are from 5 through 28 VDC, and optional switches and/or diodes are available, mounted internally.

DRUM Indicators



DRUM INDICATORS

This type indicator is characterized by either one or two rotating drums or barrels to provide the indication. As with the ball and flag types, the drum indicator is a magnetically-latched device.

MILITARY DRUM INDICATORS MI 51LP — This indicator utilizes two miniature drums, working in unison. It is a manual reset device, with a sensitivity of 50 milliwatts, making it the most sensitive of all the indicators. D.C. voltages from 1.5 to 28 volts are available, and the unit is qualified to MIL-I-83287/4. MB 25 — This Mini Bite™ indicator is ideal for applications singly or in multiple on PC board assemblies, where edge viewing is needed. The slanted face allows viewing from a wide angle. Units may be mounted in close proximity. Pulse power required is 90 mw at 5 VDC. This unit meets all the requirements of MIL-I-83287, and has been submitted for QPL listing.

AVIONIC TYPES MI 61 SERIES is available in three configurations, as follows: MI 61M — Self restoring, power on/off indicator; MI 61L — Single-coil magnetic-latching indicator; and MI 61LD — Dual-coil magnetic-latching indicator. Displays may be obtained in various colors, and also with legends (optional). This unit is available in 3 through 28 volts DC and meets the basic requirements of MIL-I-83287. (These models not shown.)

MINELCO INC. | Talley™ Industries

For COMMERCIAL TYPES see Minelco ad in Directory Section under Indicators, Fault.

135G South Main Street, Thomaston, CT 06787-0459 Phone (203) 283-8261 TWX 710-475-1091

For More Information. Circle No. 169

MURA®

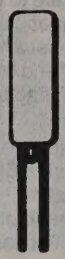
CORPORATION

177 CANTIAGUE ROCK ROAD, WESTBURY, N.Y. 11590
(516) 935-3640/Telex: 967 879

INCANDESCENT, NEON AND FLORESCENT LAMPS

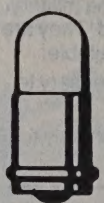
This page summarizes the many subminiature and miniature incandescent lamps, neons and florescent tubes available from Mura. For fast reference we have shown the size and voltage ranges that are available for each of the different standard lamp bases. Please call or write us for our complete catalog.

WIRE TERMINAL



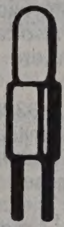
Size	Voltage
T-¾	1½ - 5V
T-1	1¼ - 28V
T-1¼	1.3 - 28V
T-1¾	1.35 - 48
T-2	4 - 120V
TL-¾	
TL-1	

MIDGET FLANGED



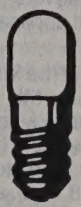
Size	Voltage
T-¾	1½ - 5V
T-1	1¼ - 28
T-1¼	1.3 - 28
T-1¾	1.35 - 48
TL-¾	5V
TL-1	1.5 & 5V

BI-PIN



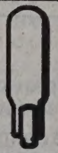
Size	Voltage
T-¾	1½ - 5V
T-1	1¼ - 28V
T-1¼	1.3 - 28V
T-1¾	1.35 - 28V
TL-¾	5V
TL-1	1.5 & 5V

SCREW BASE



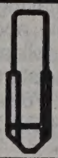
Size	Voltage
T-1¼	1.3 - 28V
T-1¾	1.35 - 28V
T-3¼	2 - 28V
GTL-3	1.2 - 2.33V
G-2	7-14 - 28V
G-3½	1.25 - 14.4V

WEDGE BASE



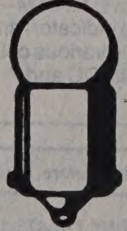
Size	Voltage
T-1¾	6.3 - 28V
T-3¼	6.3 - 28V

SLIDE BASE



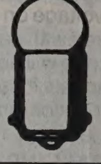
Size	Voltage
T-2	4 - 120V

S/C BAYONET



Size	Voltage
T-3¼	2 - 55V
G-3½	6.3 - 18
G-4½	6.5 - 14
G-6	7 - 28
S-8	5 - 28

D/C BAYONET

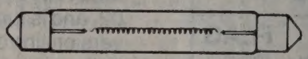


Size	Voltage
G-6	7 - 28
S-8	5 - 28

STD. VOLTAGE LAMPS

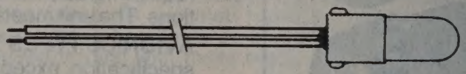
	Size	Voltage
CANDELABRA	S-6	115 - 250V
	T-4½	115V
	C-7	115V
	T-6	115V
	T-7	115V
	T-8	115V
D.C. BAYONET	S-6	115V - 250V
	C-7	115V
	T-7	115V

FUSE LAMP



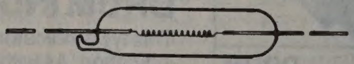
6 and 12 volt in lengths of 1.3″ and 1.7″

"L" SERIES



2 thru 28 volts
Standard with 6″ UL insulated leads.
Plastic lens caps in a variety of colors are available as well.

PIGTAIL LAMP



6 and 12 volt in lengths of 0.68″ and 1.05″

NEON LAMPS:

A wide selection of neon lamps with wire terminal, midget flange, telephone slide, bayonet and candelabra bases are available.

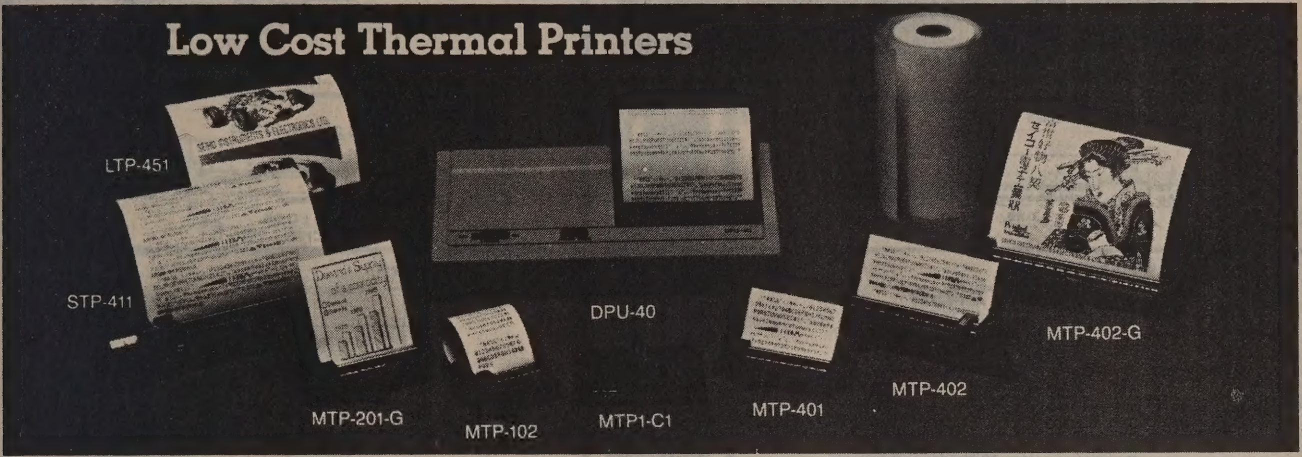
MINIATURE FLORESCENT:

Available in sizes T5 to T8, from 4 to 25 watts in daylight, coolwhite, black light and black light blue. U shaped and "tight-U" are also available.

For More Information. Circle No. 170

SEIKO INSTRUMENTS

Low Cost Thermal Printers



MTP Series Printers

Character Printers / Graphic Printers

Model / Item	MTP102		MTP201		MTP401		MTP402	MTP201		MTP401			MTP402
	13BM	16BM	20BN	24BN	32BN	40BN	40BN	G128	G166	G192	G256	G280	G280
Printing System	Heat-sensitive serial dot system							Heat-sensitive serial dot system					
Printing Direction	Left to right							Left to right					
Paper Width (mm)	38^{+0}_{-1}		58^{+0}_{-1}		80^{+0}_{-1}		112^{+0}_{-1}	58^{+0}_{-1}		80^{+0}_{-1}			112^{+0}_{-1}
Number of Columns	13	16	20	24	32	40	40	—					
Character Size (mm)	2.4 x 1.4	2.4 x 1.1	2.4 x 1.5	2.4 x 1.3	2.4 x 1.4	2.4 x 1.1	2.4 x 1.6	2.4 x 1.6	2.4 x 1.3	2.4 x 1.6	2.4 x 1.2	2.4 x 1.1	2.4 x 1.6
Character Construction	7 x 5 dot matrix							7 x 5 dot matrix					
Print Timing	Tacho-generator synchronized system							Tacho-generator synchronized system					
Home Position Detection	Mechanical switching system							Mechanical switching system					
Dot Composition (Columns x rows)	—							126 x 8	166 x 8	192 x 8	256 x 8	280 x 8	280 x 8
Dot Pitch (vertical) (mm)	—							0.35	0.35	0.35	0.35	0.35	0.35
Dot Pitch (horizontal) (mm)	—							0.35	0.277	0.35	0.26	0.24	0.35
Printing Width (mm)	—							44.8	46.0	67.2	66.6	67.2	98.0
Printer Supply Voltage (v)	DC 5.0 ± 1							DC 5.0 ± 1					
Printing Speed (room temperature, 5.0V) (lines/sec)	Approx. 1.5		Approx. 0.8		Approx. 0.6		Approx 0.35	Approx. 0.9	Approx. 0.8	Approx. 0.7	Approx. 0.6	Approx. 0.6	Approx 0.4
Dimensions (W x D x H) (mm)	48 x 31 x 13.8		70 x 34 x 14.4		91.5 x 35.5 x 20		122.5 x 35.5 x 20	70 x 34 x 14.4		91.5 x 35.5 x 20			122.5 x 35.5 x 20
Weight (g)	Approx. 35		Approx. 40		Approx. 50		Approx. 70	Approx. 40		Approx. 50			Approx. 70
Operating Temperature Range (°C)	0 ~ 50°C												
Reliability (5.0V rated energy, normal temperature, "8" full columns printing)	MCTF 500,000 Lines												
Recommended Heat-sensitive Paper	Jujo Paper TP50KS-A or equivalent												

STP Series Printers

Model / Item	STP411-256	STP411-320
Principle	Thermal serial dot method	
Print Direction	Character: double direction logical seek Graphics: single direction logical seek	
Print timing	Synchronization of step motor	
Number of total dots per line	7 x 5 dots	9 x 7 dots
Number of figures (one dot space)	42	40
Print dot size (H x w) (mm)	0.3 x 0.2	0.23 x 0.2
Print width (mm)	89.6	
Character size (H x W) (mm)	2.4 x 1.6	2.47 x 1.88

Model / Item	STP411-256	STP411-320	Comments
Print speed Uni-Directional (LPS) Bi-Directional (LPS)	approx. 0.5 approx. 1.0	approx. 0.4 approx. 0.8	Total dot print (Motor: 250 pps)
Paper feeding force (at 5.0V)	more than 50 g		(Motor: 300 pps)
Paper holding force	more than 100 g		Paper feeding motor not magnetized
Life MTBF Min. 500,000 lines			at 5.0V rated energy
Outline Dimension (W x D x H) (mm)	153 x 44.5 x 20		
Weight (g)	135		
Printer supply voltage	D.C. 5.0 ± 0.5V		
Environmental Operation temp. range Characteristics Storage temp. range	0°C 50°C – 20°C 60°C		

LTP Series Printers

Model / Item	LTP-451	Comments:
Printing System:	Thermal Line Printing	
Input Interface:	1) Parallel Input Centronics Compatible TTL Level 8-Bit Code 2) Serial Input RS232C Suitable 300 ~ 9600 Selectable Baudrate	
Total Dots/Line:	256	
Character Font:	7 x 5 Dot Matrix	
Number of Columns:	40	
Pixcel Size:	0.35 mm (H) x 0.35 mm (W)	
Printing Width:	89.6 mm	
Character Size:	2.45 mm (H) x 1.75 mm (W)	
Printing Speed:	1) Text Mode—240 Characters/Second Max 2) 15 m sec/1 dot line max	Choice of 1) or 2) Depends on external switch

Model / Item	LTP-451	Comments:
Dimensions:	156 mm (W) x 56 mm (D) x 30 mm (H)	
Weight	500 g	
Output Interface:	1) Paper Feed 2) Test Mode 3) White and Black Reverse 4) Magnified Print 5) Exchange Up and Down	Controlled by external switch
DC Power Supply	24VDC 3.5A Max 5VDC 1.0A Max	

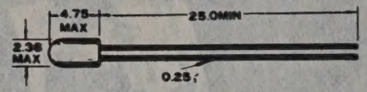
SEIKO INSTRUMENTS U.S.A., INC., 2990 W. Lomita Blvd., Torrance, CA 90505 • (213) 530-8777

OSHINO

unit in m/m

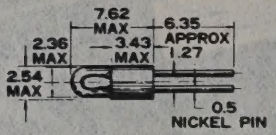
SUBMINIATURE LAMP BULBS

1. T-3/4 Wire Terminals US Mil. Std MS90452


4.75 MAX
25.0MIN
2.36 MAX
0.25

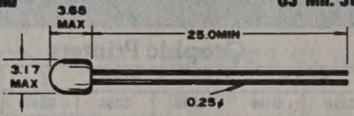
1.5-5V

2. T-3/4 Bi-Pin


7.62 MAX
6.35 APPROX
2.36 MAX
3.43 MAX
1.27
2.54 MAX
0.5 NICKEL PIN

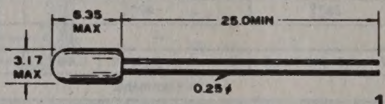
1.5-5V

3. T-1 Short Bulb US Mil. Std. MS90451


3.68 MAX
25.0MIN
3.17 MAX
0.25

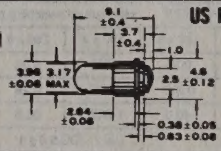
1.5-5V

4. T-1 Wire Terminals US Mil. Std. MS24367


6.35 MAX
25.0MIN
3.17 MAX
0.25

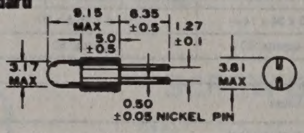
1.5-28V

5. T-1 Sub-Midget Flanged Base (SM4s/4) US Mil. Std. MS24515 MS3338


9.1 ±0.4
3.7 ±0.4
1.0
3.96 ±0.06
3.17 MAX
4.6
2.5 ±0.12
2.64 ±0.06
0.38±0.05
0.63±0.08

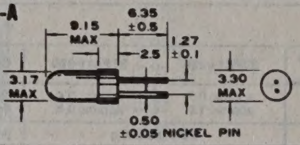
1.5-28V

6. T-1 Bi-Pin Standard


9.15 MAX
6.35 ±0.5
1.27 ±0.1
5.0 ±0.5
3.17 MAX
3.81 MAX
0.50 ±0.05 NICKEL PIN

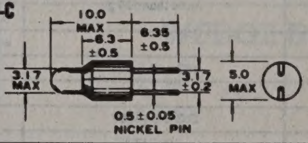
1.5-28V

7. T-1 Bi-Pin Type-A


6.35 ±0.5
9.15 MAX
1.27 ±0.1
2.5
3.17 MAX
3.30 MAX
0.50 ±0.05 NICKEL PIN

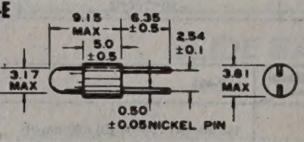
1.5-28V

8. T-1 Bi-Pin Type-C


10.0 MAX
6.3 ±0.5
6.35 ±0.5
3.17 MAX
3.17 ±0.2
5.0 MAX
0.5±0.05 NICKEL PIN

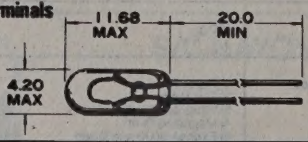
1.5-28V

9. T-1 Bi-Pin Type-E


9.15 MAX
6.35 ±0.5
5.0 ±0.5
2.54 ±0.1
3.17 MAX
3.81 MAX
0.50 ±0.05 NICKEL PIN

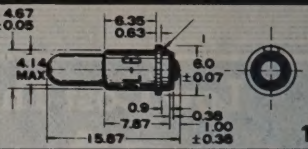
1.5-28V

10. T-1 1/4 Wire Terminals


11.68 MAX
20.0 MIN
4.20 MAX

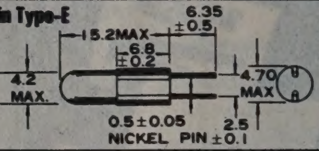
1.5-60V

11. T-1 1/4 Special Flanged


4.67 ±0.05
6.35
0.63
4.14 MAX
6.0 ±0.07
0.9
7.87
0.38
1.00 ±0.38
15.87

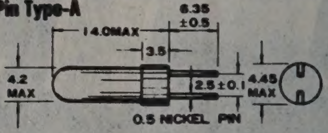
1.5-60V

12. T-1 1/4 Bi-Pin Type-E


6.35 ±0.5
15.2MAX
6.8 ±0.2
4.2 MAX.
4.70 MAX
0.5±0.05 NICKEL PIN
2.5 ±0.1

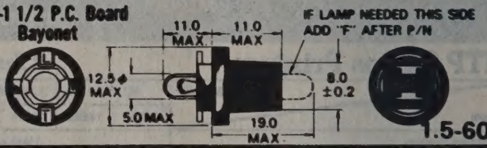
1.5-60V

13. T-1 1/4 Bi-Pin Type-A


6.35 ±0.5
14.0MAX
3.5
4.2 MAX
2.5±0.1
4.45 MAX
0.5 NICKEL PIN

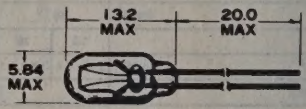
1.5-60V

14. T-1 1/2 P.C. Board Bayonet


11.0 MAX
11.0 MAX
IF LAMP NEEDED THIS SIDE ADD "F" AFTER P/N
12.5 MAX
8.0 ±0.2
5.0MAX
19.0 MAX

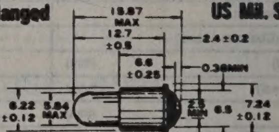
1.5-60V

15. T-1 3/4 Wire Terminals


13.2 MAX
20.0 MAX
5.84 MAX

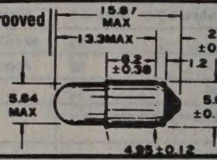
1.5-60V

16. T-1 3/4 Midget Flanged (MF6s/8) US Mil. Std. MS25237 JIS C7522


15.87 MAX
12.7 ±0.5
2.4±0.2
6.6 ±0.25
0.38MIN
6.22 ±0.12
5.84 MAX
2.5 MIN
6.5
7.24 ±0.12

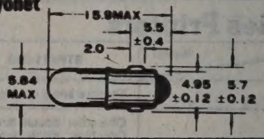
1.5-60V

17. T-1 3/4 Midget Grooved (MG6s/9)


15.87 MAX
13.3MAX
2.9 ±0.4
6.2 ±0.38
1.2
5.84 MAX
5.69 ±0.12
4.95±0.12

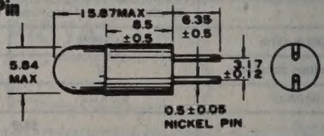
1.5-60V

18. T-1 3/4 Midget Bayonet (BA5s)


15.9MAX
5.5 ±0.4
2.0
5.84 MAX
4.95 ±0.12
5.7 ±0.12

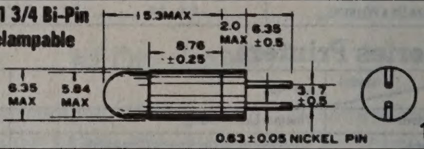
1.5-60V

19. T-1 3/4 Bi-Pin


15.87MAX
8.5 ±0.5
6.35 ±0.5
5.84 MAX
3.17 ±0.12
0.5±0.05 NICKEL PIN

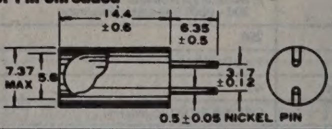
1.5-60V

20. T-1 3/4 Bi-Pin Relampable


15.3MAX
2.0 MAX
6.35 ±0.5
8.76 ±0.25
6.35 MAX
5.84 MAX
3.17 ±0.5
0.63±0.05 NICKEL PIN

1.5-60V

21. T-1 3/4 Bi-Pin Shrouded


14.4 ±0.6
6.35 ±0.5
7.37 MAX
5.8
3.17 ±0.12
0.5±0.05 NICKEL PIN

1.5-28V

OSHINO ELECTRIC LAMP WORKS, LTD.

Shinagawa, Tokyo, Japan.

For additional information contact:

WAMCO, INC.

11555-A Coley River Circle, Fountain Valley, California 92708
TEL: (714) 545-5560 TELEX: 678459 WAMCO INC

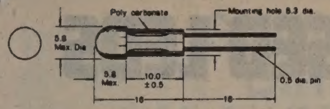
For More Information. Circle No. 172

OSHINO

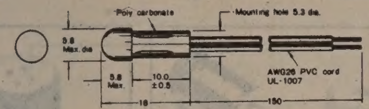
PANEL INDICATOR LIGHTS

unit in m/m

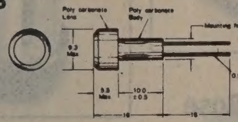
MBP Incandescent 5～28V


Poly carbonate
Mounting hole 5.3 dia.
5.8 Max. Dia
5.8 Max.
10.0 ±0.5
0.5 dia. pin
16
16

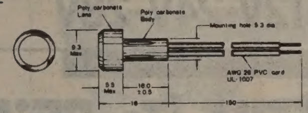
MBL Incandescent 5～28V


Poly carbonate
Mounting hole 5.3 dia.
5.8 Max. dia
5.8 Max.
10.0 ±0.5
AWG26 PVC cord UL-1007
16
150

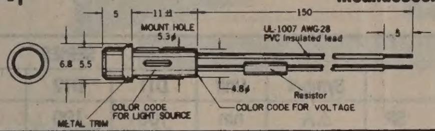
MFP Incandescent 5～28V


Poly carbonate Lens
Poly carbonate Body
Mounting hole 5.3 dia.
9.2 Max
0.5 dia. pin
5.5 Max
10.0 ±0.5
16
16

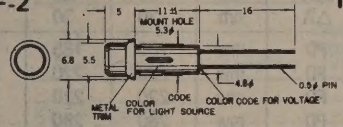
MFL Incandescent 5～28V


Poly carbonate Lens
Poly carbonate Body
Mounting hole 5.3 dia.
9.2 Max
AWG 26 PVC cord UL-1007
5.5 Max
10.0 ±0.5
16
150

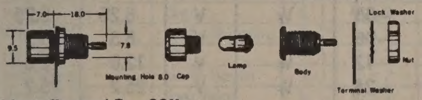
MTF-1 Incandescent 5～28V


5
11±
150
MOUNT HOLE 5.3φ
UL-1007 AWG 28 PVC insulated lead
5
6.8 5.5
4.8φ
Resistor
COLOR CODE FOR LIGHT SOURCE
COLOR CODE FOR VOLTAGE
METAL TRIM

MTF-2 Incandescent 5～28V

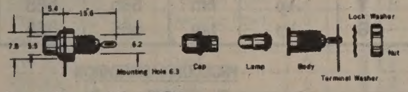

5
11±
16
MOUNT HOLE 5.3φ
6.8 5.5
4.8φ
0.5φ PIN
METAL TRIM
COLOR CODE FOR LIGHT SOURCE
COLOR CODE FOR VOLTAGE

MR-3 Incandescent Relampable


7.0
18.0
9.5
7.8
Mounting Hole 8.0
Cap
Lamp
Body
Lock Washer
Terminal Washer
Nut

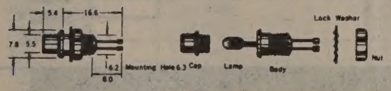
T-1 Submidget flanged 5～28V

MR-3A Incandescent Relampable


5.4
15.6
7.8 5.5
6.2
Mounting Hole 6.3
Cap
Lamp
Body
Lock Washer
Nut
Terminal Washer

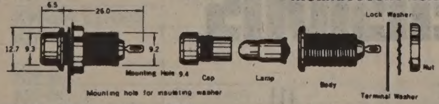
T-1 Submidget flanged 5～28V

MR-3AW Incandescent Relampable


5.4
16.6
7.8 5.5
6.2
6.0
Mounting Hole 6.3
Cap
Lamp
Body
Lock Washer
Nut

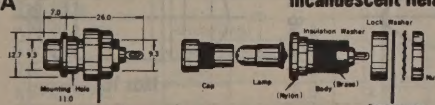
T-1 wire terminals 5～28V

MR-6 Incandescent Relampable


6.5
26.0
12.7 9.3
9.2
Mounting Hole 9.4
Mounting hole for mounting washer
Cap
Lamp
Body
Lock Washer
Nut
Terminal Washer

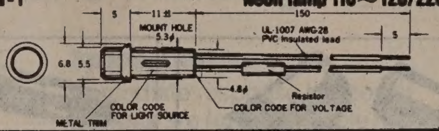
T-1 3/4 midget flanged 5～60V

MR-6A Incandescent Relampable

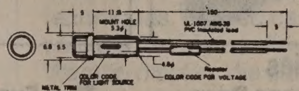

7.0
26.0
12.7 9.3
9.3
Mounting Hole 11.0
Cap
Lamp (Nylon)
Insulation Washer
Body (Brass)
Lock Washer
Nut
Terminal Washer

T-1 3/4 midget flanged 5～60V

MTN-1 Neon lamp 110～120/220～240V

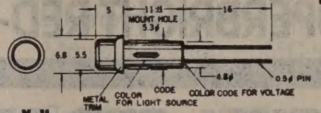

5
11±
150
MOUNT HOLE 5.3φ
UL-1007 AWG 28 PVC insulated lead
5
6.8 5.5
4.8φ
Resistor
COLOR CODE FOR LIGHT SOURCE
COLOR CODE FOR VOLTAGE
METAL TRIM

MTD-1 LED resistor incorporated


5
11±
150
MOUNT HOLE 5.3φ
UL-1007 AWG 28 PVC insulated lead
6.8 5.5
4.8φ
Resistor
COLOR CODE FOR LIGHT SOURCE
COLOR CODE FOR VOLTAGE
METAL TRIM

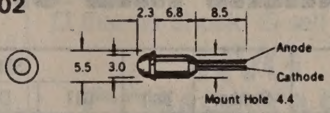
Red, Green, Yellow, 5～6/12～14/24～28V

MTD-2 LED without resistor


5
11±
16
MOUNT HOLE 5.3φ
6.8 5.5
4.8φ
0.5φ PIN
METAL TRIM
COLOR CODE FOR LIGHT SOURCE
COLOR CODE FOR VOLTAGE

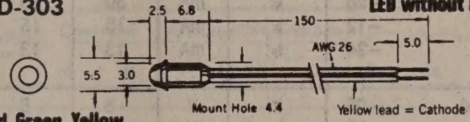
Red, Green, Yellow

MD-302 LED without resistor


2.3
6.8
8.5
Anode
5.5
3.0
Cathode
Mount Hole 4.4

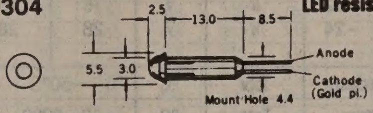
Red, Green, Yellow

MD-303 LED without resistor


2.5
6.8
150
AWG 26
5.0
5.5
3.0
Mount Hole 4.4
Yellow lead = Cathode

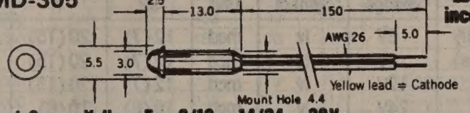
Red, Green, Yellow

MD-304 LED resistor incorporated


2.5
13.0
8.5
Anode
5.5
3.0
Cathode (Gold pl.)
Mount Hole 4.4

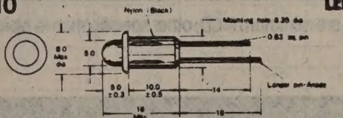
Red, Green, Yellow, 5～6/12～14/24～28V

MD-305 LED resistor incorporated


2.5
13.0
150
AWG 26
5.0
5.5
3.0
Yellow lead = Cathode
Mount Hole 4.4

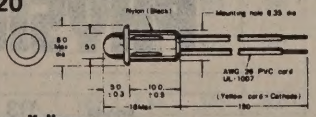
Red, Green, Yellow, 5～6/12～14/24～28V

MD-510 LED without resistor


Nylon (Black)
Mounting hole 6.35 dia.
0.63 sq. pin
8.0 Max dia
9.0
9.0 ±0.3
10.0 ±0.5
Longer pin=Anode
16 Max
16

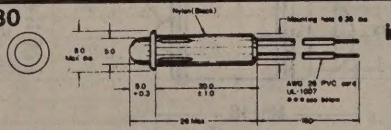
Red, Green, Yellow

MD-520 LED without resistor


Nylon (Black)
Mounting hole 6.35 dia.
8.0 Max dia
9.0
AWG 26 PVC cord UL-1007
9.0 ±0.3
10.0 ±0.5
(Yellow cord=Cathode)
16 Max
150

Red, Green, Yellow

MD-530 LED resistor incorporated


Nylon (Black)
Mounting hole 6.35 dia.
8.0 Max dia
9.0
AWG 26 PVC cord UL-1007
9.0 +0.3
20.0 ±1.0
26 Max
150

Red, Green, Yellow, 5～6/12～14/24～28V

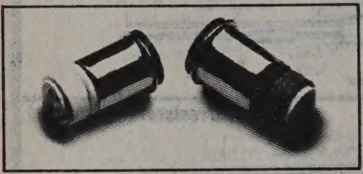
OSHINO ELECTRIC LAMP WORKS, LTD.

Shinagawa, Tokyo, Japan.

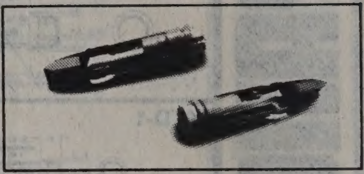
For additional information contact:

WAMCO, INC.
11555-A Coley River Circle, Fountain Valley, California 92708
TEL: (714) 545-5560 TELEX: 678459 WAMCO INC

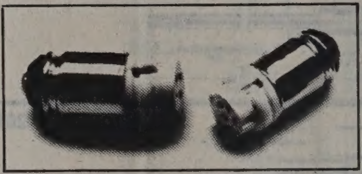
WAMCO'S MULTI-CHIP BASED LEDS



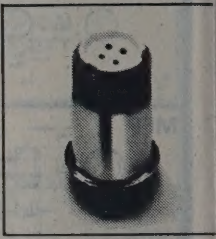
D12 Series
TI ¾ Midget Flange Base



D13
T5.5 European Slide Base



D11 Series
TI ¾ Midget Groove Base



SUPERBRIGHT RED-GREEN-YELLOW 5V-6V-12V-24V-28V

ELECTRICAL AND OPTICAL CHARACTERISTICS [Tc=25°C]

		Symbol	Unit	SERIES D11	SERIES D12	SERIES D13
DC forward current	−05	I_F	mA	30	30	30
	−06	I_F	mA	30	30	30
	−12	I_F	mA	15	15	15
	−24	I_F	mA	13	13	13
Reverse Voltage	−05	Ir	V	8	8	8
	−06	Ir	V	8	8	8
	−12	Ir	V	16	16	16
	−24	Ir	V	28	28	28
Operating temperature		Topr	°C	0−~50°C		
Storage temperature		Tstg	°C	−10~60°C		

	Voltage	Symbol	Unit	SR	Y	G
Luminosity (All Styles)	5V	Iv	mcd	12 (7)	20 (15)	30 (20)
	6V	Iv	mcd	12 (7)	20 (15)	30 (20)
	12V	Iv	mcd	12 (7)	20 (15)	30 (20)
	24V	Iv	mcd	10 (6)	10 (6)	30 (15)

Specifications in ( ) are minimum MCD; other specification is typical.

		Symbol	Unit	SERIES D11	SERIES D12	SERIES D13
Spectral line half width	SR	$\Delta\lambda$	nm	100	100	100
	Y	$\Delta\lambda$	nm	30	30	30
	G	$\Delta\lambda$	nm	30	30	30
Power dissipation	05	PD	mw	185	185	185
	06	PD	mw	220	220	220
	12	PD	mw	220	220	220
	24	PD	mw	280	280	280
Maximum forward voltage	−05	V_F	V	5.25	5.25	5.25
	−06	V_F	V	6.3	6.3	6.3
	−12	V_F	V	12.6	12.6	12.6
	−24	V_F	V	25.2	25.2	25.2
Peak wavelength	SR	λp	nm	635	635	635
	Y	λp	nm	585	585	585
	G	λp	nm	565	565	565

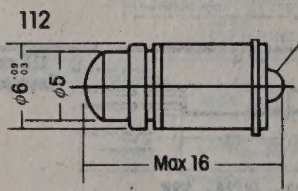
Standard
Life Rating
50,000 Hours Minimum

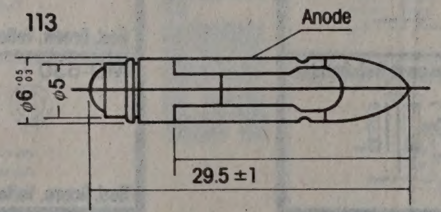
PRODUCT CLASSIFICATION

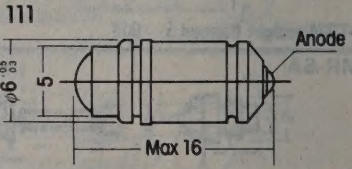
OL G D12 – 24

NAME
COLOR
SERIES *
VOLTAGE

PHYSICAL DIMENSIONS







Unit in mm

WAMCO
11555-A Coley River Circle Fountain Valley, Calif. 92708-4272 (714) 545-5560 Telex No. 678-459

For More Information. Circle No. 173

SUNLIGHT READABLE DISPLAYS DIRECT VIEW FILAMENT (DVF)

Alpha/Numeric, Bar Graph and Multidigit

Special Designs

Immediate response to special designs are made possible by our unique and proprietary production techniques. Wamco can provide sockets for any configuration of Wamco display. We can form packages to almost any configuration including circular.

Environmental Characteristics

Withstands temp −65°C to 125°C
Meets requirements of MIL STD 202:

☐ shock ☐ seal
☐ vibration ☐ moisture
☐ thermal shock ☐ salt spray

NVG COMPATABLE

Specifications

Part Number	Description	Voltage (V)	Current Per Segment (MA)	Brightness		Avg. Life Per Segment (HR)	Character		Package Dimensions			Remarks
				MCD	Approx FT/L		H.	W.	H.	W.	D.	
KW 100 SERIES	†											
KW-105S	Digit	5	15 ± 2	52.5 ± 9.5	13,000	100,000	.300	.155	.468	.306	.312	7 Segment
KW-105G-H	Digit	5	15 ± 2	40 ± 8	10,000	100,000	.300	.155	.468	.306	.185	7 Segment
KW-105-TB	Digit	5	15 ± 2	52.5 ± 9.5	13,000	100,000	.300	.155	.468	.306	.312	7 Segment
KW-105 AL	Alpha Numeric	5	15 ± 2	109 ± 23	13,000	100,000	.300	.200	.468	.375	.312	16 Segment
KW-105 XY	XY	5	15 ± 2	*	13,000	100,000	.300	.155	.468	.306	.312	4 Segment
KW-105 NS	North South	5	15 ± 2	*	13,000	100,000	.300	.155	.468	.306	.312	7 Segment
KW-105 EW	East West	5	15 ± 2	*	13,000	100,000	.300	.155	.468	.306	.312	9 Segment
KW-105 LR	Left Right	5	15 ± 2	*	13,000	100,000	.300	.155	.468	.306	.312	7 Segment
KW-105 PM	Plus Minus	5	15 ± 2	*	13,000	100,000	.155	.155	.468	.306	.312	4 Segment
KW-105 S-DP	Decimal Point	5	13 ± 2	*	*	1,000	N/A	N/A	.468	.100	.312	
KW-105 S-DP-TB	Decimal Point	5	13 ± 2	*	*	1,000	N/A	N/A	.469	.100	.312	
KW 200 SERIES	†											
KW-205S	Digit	5	12 ± 2	40 ± 5	13,000	100,000	.225	.115	.375	.275	.312	7 Segment
KW-205-TB	Digit	5	12 ± 2	40 ± 5	13,000	100,000	.225	.115	.375	.275	.312	7 Segment
KW-205 AL	Alpha Numeric	5	12 ± 2	89 ± 16	13,000	100,000	.225	.187	.375	.335	.312	16 Segement
KW-205 XY	XY	5	12 ± 2	*	13,000	100,000	.225	.115	.375	.275	.312	4 Segment
KW-205 NS	North South	5	12 ± 2	*	13,000	100,000	.225	.115	.375	.275	.312	7 Segment
KW-205 EW	East West	5	12 ± 2	*	13,000	100,000	.225	.115	.375	.275	.312	9 Segment
KW-205 LR	Left Right	5	12 ± 2	*	13,000	100,000	.225	.115	.375	.275	.312	7 Segment
KW-205 PM	Plus Minus	5	12 ± 2	11 ± 2.5	13,000	100,000	.115	.115	.375	.275	.312	4 Segment
KW-205 S-DP	Decimal Point	5	10 ± 1.5	*	*	1,000	N/A	N/A	.375	.075	.312	
KW-205 S-DP-TB	Decimal Point	5	10 ± 1.5	*	*	1,000	N/A	N/A	.375	.075	.312	
KW 300 SERIES												
KW-304S	Digit	4	12 ± 2	25 ± 6		50,000	.167	.086	.305	.225	.185	7 Segment
KW-500 SERIES												
KW-515	Digit	5 D.P.	15 ± 2 13 ± 2	60 ± 15	10,000	100,000	.472	.236	.886	.473	.227	7 Segment With D.P.
KW-BG												
KW-BG-30	Bar Graph	4	10 Max	*	9,000	100,000	N/A	.180	1.44	.300	.300	30 Segment
KW-BG-50	Bar Graph	4	10 Max	*	9,000	100,000	N/A	.180	2.24	.300	.300	50 Segment
KW-BG-100	Bar Graph	4	10 Max	*	9,000	100,000	N/A	.180	4.24	.300	.300	100 Segment
KW-MLX				Per Digit								
KW-ML3-215	Multi-Digit	5	12 ± 2	40 ± 6	13,000	100,000	.225	.115	.850	.378	.394	3 Digit
KW-ML4-215	With Decimal	5	12 ± 2	40 ± 6	13,000	100,000	.225	.115	1.100	.378	.394	4 Digit
KW-ML5-215	Point	5	12 ± 2	40 ± 6	13,000	100,000	.225	.115	1.346	.378	.394	5 Digit
KW-ML6-215		5	12 ± 2	40 ± 6	13,000	100,000	.225	.115	1.594	.378	.394	6 Digit

* Contact the Factory for Detailed Specifications.
†Also available in 4 Volt.

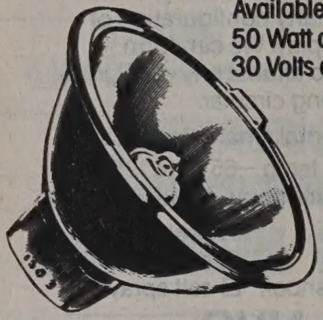
FSN 58774

This is not a complete list of all Wamco Readcuts. Contact the Factory if you don't find the display to fit your needs.

WAMCO SALES, INC.
11555-A Coley River Circle • Fountain Valley, CA 92708-4272
Phone: (714) 545-5560 • Telex No. 678-459

"EYE" HALOGEN LAMPS

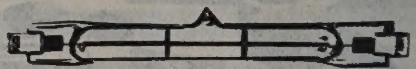
PHOTOGRAPHIC HALOGEN LAMPS WITH REFLECTOR JCR TYPE



Available in Aluminum Reflector 8V, 50 Watt or Dichroic Reflector 12 thru 30 Volts and 75 thru 250 Watts.

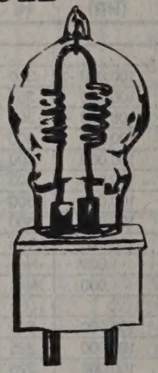
TUNGSTEN HALOGEN LAMPS FOR GENERAL & PHOTOGRAPHIC USE

Available in Voltages from 120 thru 24, with 200 to 1250 Watts.



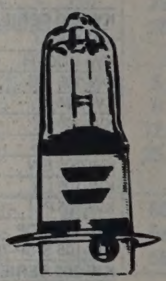
HALOGEN SPHERICAL BULB LAMPS JCD TYPE

A large selection from 120 to 230 Volts with 420 thru 650 Watts.



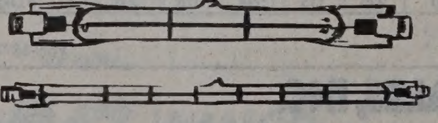
HALOGEN LAMPS FOR AIRCRAFT

Available in 12, 24, 26 & 28 Volts, 125 or 150 Watts.



TUNGSTEN HALOGEN LAMPS FOR GENERAL LIGHTING

Most Common Sizes and Wattages Available 120 to 250 Volts and 250-2000 Watts.



Call us for any of your Halogen Lamp needs.

WAMCO

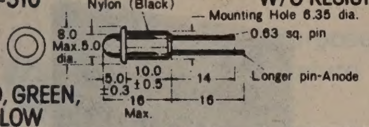
11555-A Coley River Circle
Fountain Valley, Calif. 92708-4272
(714) 545-5560 Telex No. 678-459

LED INDICATORS

OSHINO LAMPS

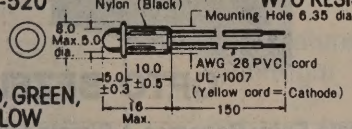
- ☐ Available with Standard Bright or Ultra Bright LEDs
- ☐ Snap In Panel Mount
- ☐ Luminous Intensity Up To 200 MCD + at 20mA
- ☐ Hard Wire Leads or Insulated Lead Wires
- ☐ Internal Resistors -5V -6V 12-14V 24-28V
- ☐ Low Cost

MD-510 **W/O RESISTOR**


Nylon (Black)
Mounting Hole 6.35 dia.
0.63 sq. pin
8.0 Max.
5.0 dia.
5.0 ±0.3
10.0 ±0.5
14
Longer pin-Anode
16 Max.
16

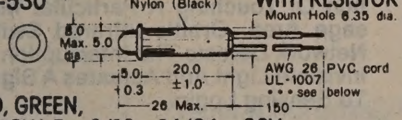
RED, GREEN, YELLOW

MD-520 **W/O RESISTOR**


Nylon (Black)
Mounting Hole 6.35 dia.
8.0 Max.
5.0 dia.
5.0 ±0.3
10.0 ±0.5
AWG 26 PVC cord
UL-1007
(Yellow cord = Cathode)
16 Max.
150

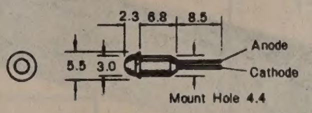
RED, GREEN, YELLOW

MD-530 **WITH RESISTOR**


Nylon (Black)
Mount Hole 6.35 dia.
8.0 Max.
5.0 dia.
5.0 ±0.3
20.0 ±1.0
AWG 26 PVC cord
UL-1007
• • • see below
26 Max.
150

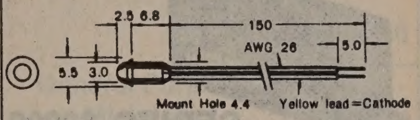
RED, GREEN, YELLOW, 5~6/12~14/24~28V

MD-302 **W/O RESISTOR**


2.3
6.8
8.5
Anode
Cathode
5.5
3.0
Mount Hole 4.4

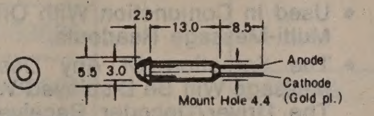
RED, GREEN, YELLOW

MD-303 **W/O RESISTOR**


2.5
6.8
150
AWG 26
5.0
5.5
3.0
Mount Hole 4.4
Yellow lead=Cathode

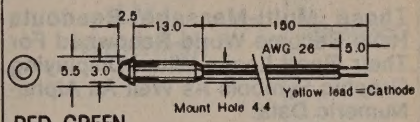
RED, GREEN, YELLOW

MD-304 **WITH RESISTOR**


2.5
13.0
8.5
Anode
Cathode (Gold pl.)
5.5
3.0
Mount Hole 4.4

RED, GREEN, YELLOW, 5~6/12~14/24~28V

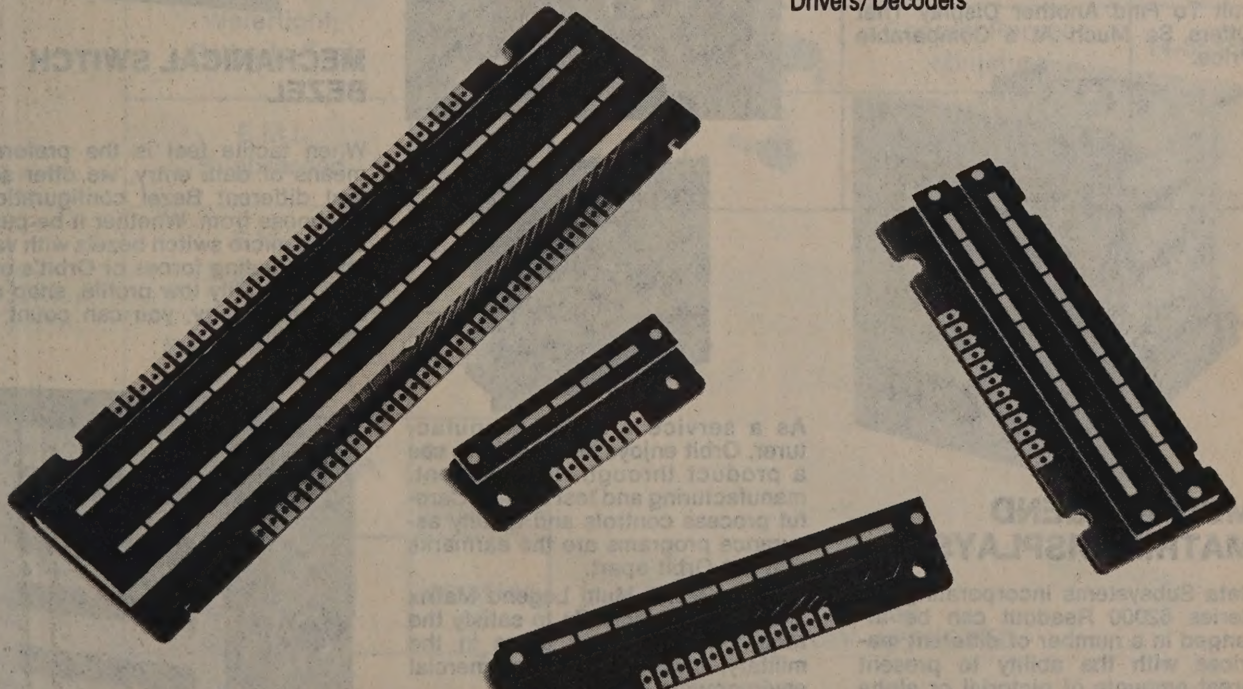
MD-305 **WITH RESISTOR**


2.5
13.0
150
AWG 26
5.0
5.5
3.0
Yellow lead=Cathode
Mount Hole 4.4

RED, GREEN, YELLOW, 5~6/12~14/24~28V

LED BAR GRAPHS

- ☐ Multi Color (Red, Green, Yellow)
- ☐ Long Life
- ☐ 5 to 40 Segments
- ☐ Low Voltage/Current
- ☐ High Reliability
- ☐ Compatible with Standard LED Drivers/Decoders



WAMCO

11555-A Coley River Circle Fountain Valley, Calif. 92708-4272 (714) 545-5560 Telex No. 678-459

For More Information. Circle No. 173

PROJECTION READOUT DISPLAYS
“The Link Between Man and Machine”

ORBIT INSTRUMENT CORP.

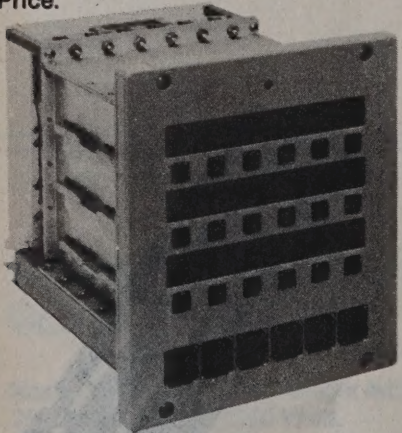
CORPORATE FACILITIES:
80 CABOT COURT, HAUPPAUGE, L.I., NY 11788, TELEPHONE: (516) 435-8300
6431 GLOBAL DRIVE, CYPRESS, CA 90630, TELEPHONE: (714) 527-0561

SERIES 62000 REAR PROJECTION READOUTS

These Multi-Message Readouts Have Become World Renowned For Their Good Looks When Displaying Graphic Symbols As Well As Alpha-Numeric Data.

- The Series 62000 Is Capable Of Displaying 24 Or 48 Projected Images.
- Only 5 VDC Required.
- Time Tested To Withstand Humidity, Temperature, Shock And Vibration.
- A Distinct Advantage In Areas Of Limited Space.
- Switches Can Be Made An Integral Member Of Each Readout.

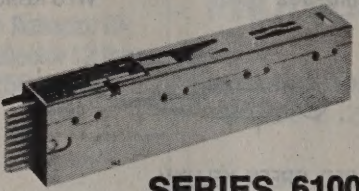
Features Like These Make It Difficult To Find Another Display That Offers So Much At a Comparable Price.



MULTI-LEGEND MATRIX DISPLAYS

Data Subsystems incorporating the Series 62000 Readout can be arranged in a number of different matrices with the ability to present great amounts of pictorial or alpha numeric information.

Typically a 4 row by 8 column matrix can display over 1500 different legends.



SERIES 61000 DRIVER DECODERS

- Used In Conjunction With Orbit's Multi-Message Readouts.
- The Selection Of Any Desired Message Will Be Displayed When The Driver/Decoder Receives A (BCD) Binary Coded Decimal Signal From A C.P.U. Or External Logic Source.
- Orbit Driver/Decoders Assure Our Customers That Proper Voltage Levels Will Be Maintained Thus Extending The Life Of Orbit Rear Projection Readouts.

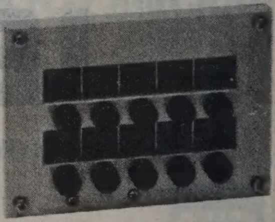
As a service oriented manufacturer, Orbit enjoys being able to see a product through development, manufacturing and test cycles. Careful process controls and quality assurance programs are the earmarks that set Orbit apart.

Each (MLM) Multi Legend Matrix is tailored specifically to satisfy the requirements of end users in the military, industrial and commercial environments.

Orbit Engineering Services have designed a variety of display subsystems integrating both hardware and software.

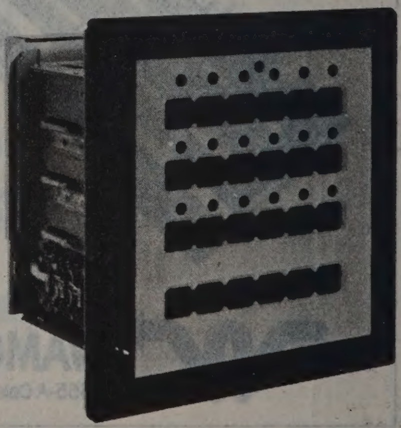
OPTO BEZELS

Data Entry Becomes A Simple Function Of Touching A Particular Message Area. Orbit's Infrared Switch Network Detects The Interruption Of Invisible Light And Actuates A Signal To Sensing Logic.



MECHANICAL SWITCH BEZEL

When tactile feel is the preferred means of data entry, we offer several different Bezel configurations to choose from. Whether it be push-button micro switch bezels with variable actuating forces or Orbit's own high reliability low profile, snap action technology, you can count on the quality!



For More Information. Circle No. 174

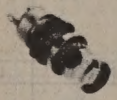
OAK INDICATORS

INDICATOR SELECTION GUIDE

INCANDESCENT

SIZE	DESCRIPTION	SERIES
T-1	General Purpose, Sub-Miniature	99-33180
		99-33080
	Sub-Miniature, Watertight	95-33180
T-1¾	General Purpose, Miniature	14-33880
		14-33881
		14-33882
		14-30380
		14-30080
	Watertight	15-30083
	Watertight, Press-to-Test	05-91182
		05-90880
	E.M.I. Suppressed	18-36880
	E.M.I., Watertight	18-36680
	E.M.I., Watertight, Press-to-Test	08-83283
T-3¼	General Purpose, Press-to-Test	04-VM905
		02-91180
	Watertight, Press-to-Test	06-91182

NEON

SIZE	DESCRIPTION	SERIES
T-1	Sub-Miniature	99-33080
T-2 	General Purpose, Miniature	22-35380
		33-30880
		33-30881
	E.M.I. Watertight	38-36680
T-3¼	E.M.I. Suppressed	38-83681
		38-83682

LIGHT EMITTING DIODE (L.E.D.)

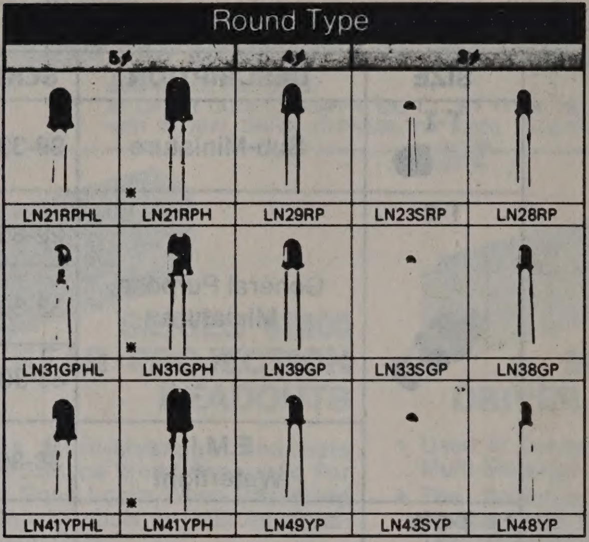
SIZE	DESCRIPTION	SERIES
	General Purpose, Miniature	14-35380
	Low Cost, Hi-Rel Specifications, Easy Mounting	T-1¾

* UL Recognized
☐ MILITARY APPROVED

OAK SWITCH SYSTEMS INC. P.O. Box 517, Crystal Lake, IL 60014
(815) 459-5000 • TWX 910-634-3353 • TLX 72-2447

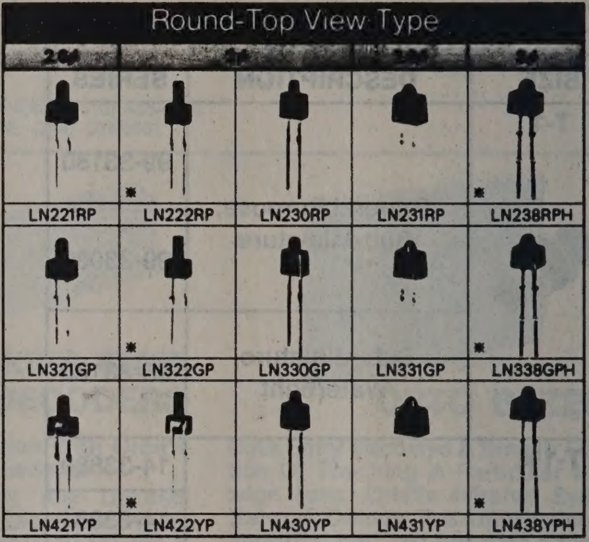
Panasonic
Industrial Company

OPTOELECTRONIC DEVICES



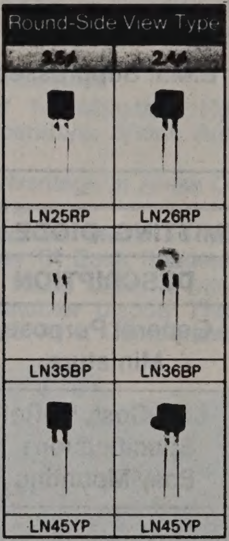
Round Type

5ϕ		4ϕ	3ϕ	
LN21RPHL	* LN21RPH	LN29RP	LN23SRP	LN28RP
LN31GPHL	* LN31GPH	LN39GP	LN33SGP	LN38GP
LN41YPHL	* LN41YPH	LN49YP	LN43SYP	LN48YP



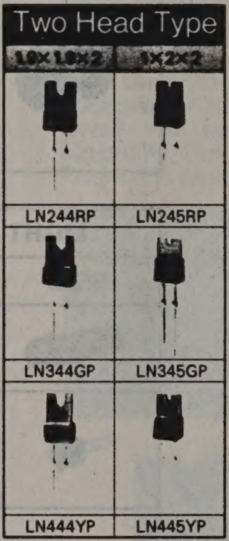
Round-Top View Type

[illegible]	3ϕ		[illegible]	3ϕ
LN221RP	* LN222RP	LN230RP	LN231RP	* LN238RPH
LN321GP	* LN322GP	LN330GP	LN331GP	* LN338GPH
LN421YP	* LN422YP	LN430YP	LN431YP	* LN438YPH



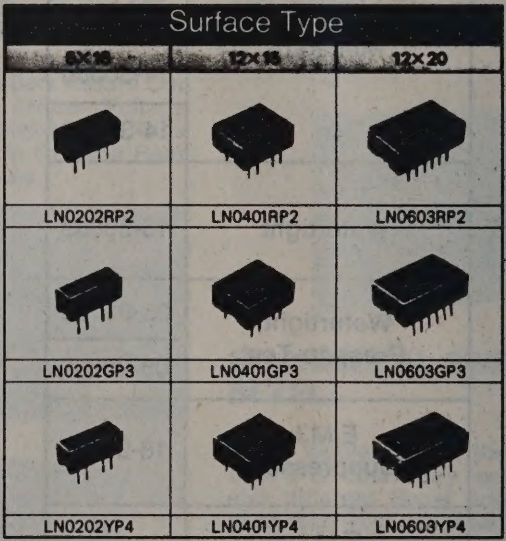
Round-Side View Type

3.5ϕ	2.4ϕ
LN25RP	LN26RP
LN35BP	LN36BP
LN45YP	LN45YP



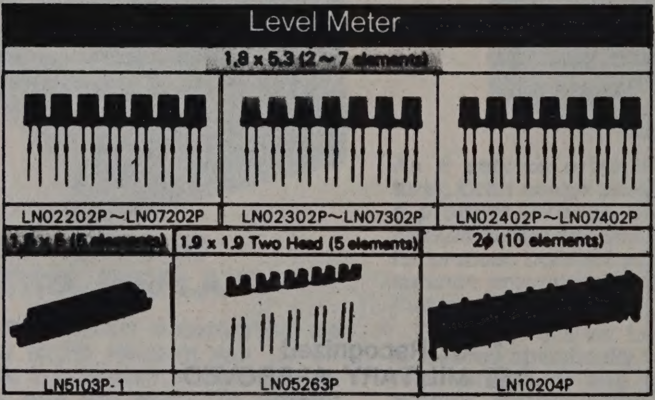
Two Head Type

1.9×1.9×2	1×2×2
LN244RP	LN245RP
LN344GP	LN345GP
LN444YP	LN445YP



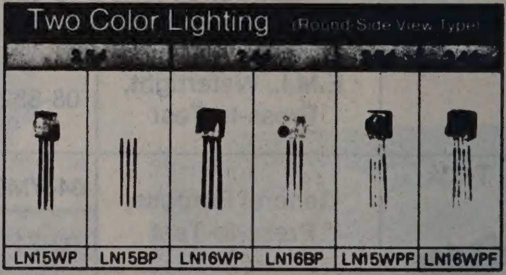
Surface Type

8×16	12×16	12×20
LN0202RP2	LN0401RP2	LN0603RP2
LN0202GP3	LN0401GP3	LN0603GP3
LN0202YP4	LN0401YP4	LN0603YP4



Level Meter

1.8 x 5.3 (2 ~ 7 elements)		
LN02202P~LN07202P	LN02302P~LN07302P	LN02402P~LN07402P
1.5 x 5 (5 elements)	1.9 x 1.9 Two Head (5 elements)	2ϕ (10 elements)
LN5103P-1	LN05263P	LN10204P



Two Color Lighting (Round-Side View Type)

3.5ϕ		2.4ϕ		[illegible]	
LN15WP	LN15BP	LN16WP	LN16BP	LN15WPF	LN16WPF

LEGEND: Y= Yellow, R= Red, G = Green

- ● Long lead wire version except LN21RPH is available for * type.
- ● We are available for custom product such as level meter and module.

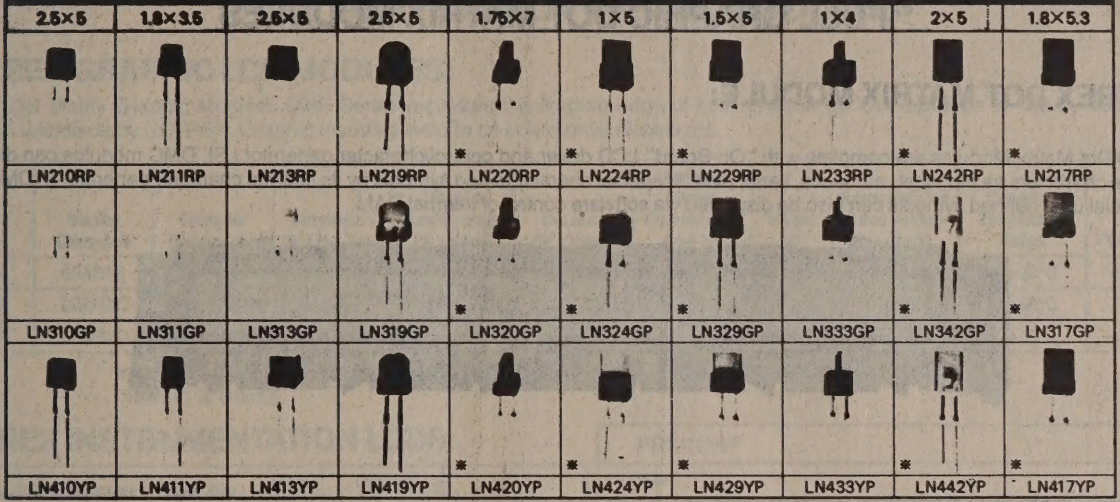
Panasonic Industrial Company ● Electronic Components Division
One Panasonic Way, Secaucus, N.J. 07094 (201) 392-4496

For More Information. Circle No. 176

Panasonic Industrial Company

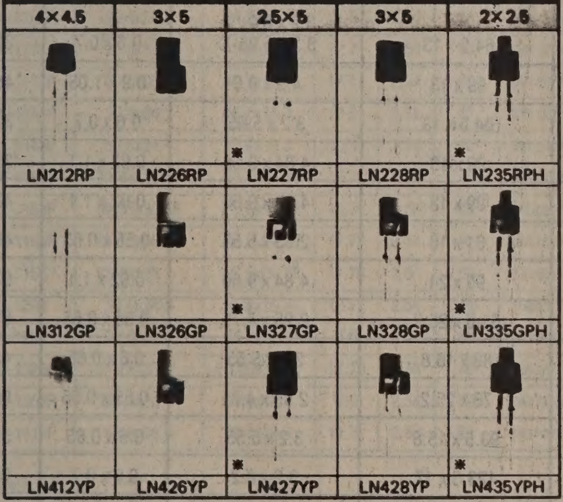
OPTOELECTRONIC DEVICES

Square Type



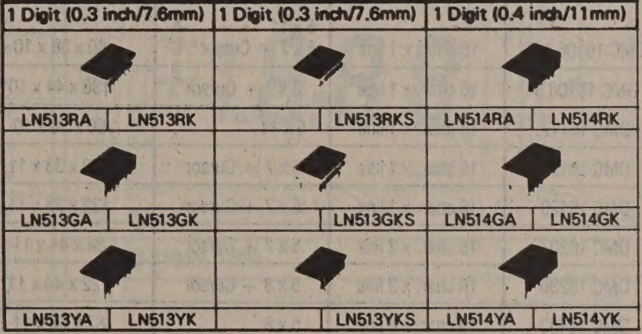
2.5×5	1.8×3.5	2.5×5	2.5×5	1.75×7	1×5	1.5×5	1×4	2×5	1.8×5.3
LN210RP	LN211RP	LN213RP	LN219RP	* LN220RP	* LN224RP	* LN229RP	LN233RP	* LN242RP	* LN217RP
LN310GP	LN311GP	LN313GP	LN319GP	* LN320GP	* LN324GP	* LN329GP	LN333GP	* LN342GP	* LN317GP
LN410YP	LN411YP	LN413YP	LN419YP	* LN420YP	* LN424YP	* LN429YP	LN433YP	* LN442YP	* LN417YP

Triangle Type



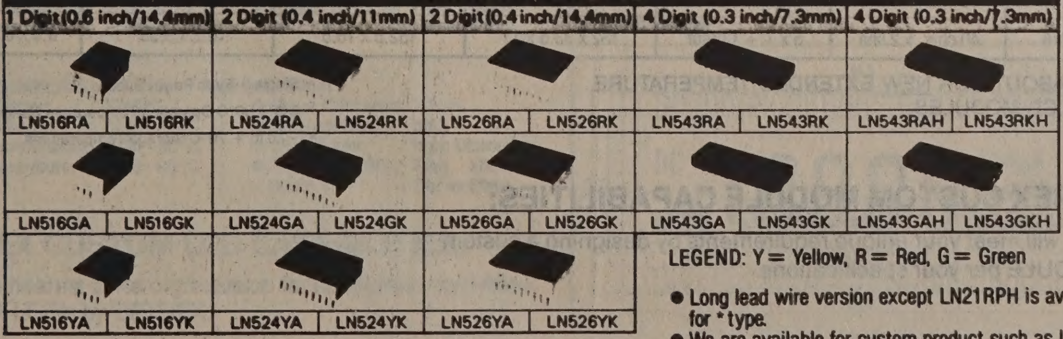
4×4.5	3×5	2.5×5	3×5	2×2.5
LN212RP	LN226RP	* LN227RP	LN228RP	* LN235RPH
LN312GP	LN326GP	* LN327GP	LN328GP	* LN335GPH
LN412YP	LN426YP	* LN427YP	LN428YP	* LN435YPH

Numeric Display



1 Digit (0.3 inch/7.6mm)		1 Digit (0.3 inch/7.6mm)	1 Digit (0.4 inch/11mm)	
LN513RA	LN513RK	LN513RKS	LN514RA	LN514RK
LN513GA	LN513GK	LN513GKS	LN514GA	LN514GK
LN513YA	LN513YK	LN513YKS	LN514YA	LN514YK

Numeric Display



1 Digit (0.6 inch/14.4mm)		2 Digit (0.4 inch/11mm)		2 Digit (0.4 inch/14.4mm)		4 Digit (0.3 inch/7.3mm)		4 Digit (0.3 inch/7.3mm)	
LN516RA	LN516RK	LN524RA	LN524RK	LN526RA	LN526RK	LN543RA	LN543RK	LN543RAH	LN543RKH
LN516GA	LN516GK	LN524GA	LN524GK	LN526GA	LN526GK	LN543GA	LN543GK	LN543GAH	LN543GKH
LN516YA	LN516YK	LN524YA	LN524YK	LN526YA	LN526YK				

LEGEND: Y= Yellow, R= Red, G= Green

- Long lead wire version except LN21RPH is available for * type.
- We are available for custom product such as level meter and module.

Panasonic Industrial Company ● Electronic Components Division
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OPTREX A LEADER IN LCD TECHNOLOGY:

* STANDARD AND CUSTOM LCD's OR MODULES * LCD COLOR TECHNOLOGIES * DOT MATRIX LCD's * DOT MATRIX CHARACTER MODULES * FULL GRAPHIC DOT MATRIX MODULES

• OPTREX DOT MATRIX MODULE:

LCD Dot Matrix Modules are complete with "On-Board" LCD driver and control/character generator LSI. DMC modules can display 160 J.I.S. type characters as alphabet, numerics, kana, plus 32 special characters and symbols by its internal character generator (ROM). Special user defined symbols can also be displayed via software control of internal RAM.

*** OPTREX CORPORATION ***
DOT MATRIX LCD MODULE DMC-40218

MODEL #	DISPLAY CHARACTERS	DOT FORMAT	DIMENSIONS (WxHxT mm)	ACTIVE VIEWING AREA (WxH mm)	CHARACTER SIZE (WxH mm)	DOT SIZE (WxH mm)	WEIGHT (g)
DMC 16106 A,C	16 char. x 1 line	5 x 11 A 5 x 7 + Cursor C	80 x 36 x 10	64.5 x 13	3.2 x 8.2 A 3.2 x 5.95 C	0.6 x 0.7	30
DMC 16106 B	16 char. x 1 line	5 x 7 + Cursor	130 x 44 x 10	99 x 13	4.9 x 9.5	0.9 x 1.05	45
DMC 16117	16 char. x 1 line	5 x 11	80 x 36 x 10	64.5 x 13	3.2 x 5.95	0.6 x 0.7	30
DMC 16128	16 char. x 1 line	5 x 7 + Cursor	122 x 33 x 11	99 x 13	4.84 x 9.66	0.92 x 1.1	35
DMC 16129	16 char. x 1 line	5 x 7 + Cursor	122 x 33 x 11	99 x 13	4.84 x 9.66	0.92 x 1.1	40
DMC 16207	16 char. x 2 line	5 x 7 + Cursor	84 x 44 x 11	61 x 16	2.95 x 5.55	0.55 x 0.65	40
DMC 16230	16 char. x 2 line	5 x 8 + Cursor	122 x 44 x 11	99 x 24	4.84 x 9.66	0.92 x 1.1	60
DMC 16433	16 char. x 4 line	5 x 8	87 x 60 x 11	61.8 x 25.2	2.95 x 4.75	0.55 x 0.55	60
DMC 20215	20 char. x 2 line	5 x 7 + Cursor	116 x 44 x 11	83 x 16.8	3.2 x 5.55	0.6 x 0.65	45
DMC 20434	20 char. x 4 line	5 x 8	98 x 60 x 11	76 x 25.2	2.95 x 4.75	0.55 x 0.55	65
DMC 24227	24 char. x 2 line	5 x 8	118 x 36 x 11	93.5 x 15.8	3.2 x 5.55	0.6 x 0.65	55
DMC 32132	32 char. x 1 line	5 x 11	174.5 x 31 x 11	123.5 x 17	3.2 x 8.2	0.6 x 0.7	60
DMC 32216	32 char. x 2 line	5 x 7 + Cursor	175 x 44 x 11	130 x 18.6	3.2 x 5.55	0.6 x 0.65	75
DMC 40131	40 char. x 1 line	5 x 11	182 x 33.5 x 11	152.5 x 16.5	3.2 x 8.2	0.6 x 0.7	65
DMC 40218	40 char. x 2 line	5 x 7 + Cursor	182 x 33.5 x 11	152.5 x 16.5	3.2 x 5.55	0.6 x 0.65	75

*ASK US ABOUT OUR NEW EXTENDED TEMPERATURE RANGE LCD MODULES.

- Single +5Vdc Power Supply
- 0 to +50°C Operating Temperature Range is Standard.
- −20 to + 70°C Storage Temperatures

• OPTREX CUSTOM MODULE CAPABILITIES:

OPTREX will meet your unique requirements by designing a custom LCD MODULE per your specifications.

FOR FURTHER INFORMATION OF OPTREX'S TOTAL CAPABILITIES; CONTACT:

SATORI ELECTRIC (AMERICA) INC. Tel. (213) 378-9478
23717 Hawthorne Blvd., Suite 201
Torrance, CA 90505
Telex. 182536 SATORITRNC
FAX. (213) 375-8565

ASAHI GLASS EMP. CORP.
26533 Evergreen Road, Room 533
Southfield, Michigan 48076
Tel. (313) 557-0018 FAX. (313) 557-0025

For More Information. Circle No. 177

OPTREX A LEADER IN LCD TECHNOLOGY:

* STANDARD AND CUSTOM LCD's OR MODULES * LCD COLOR TECHNOLOGIES * DOT MATRIX LCD's * DOT MATRIX CHARACTER MODULES * FULL GRAPHIC DOT MATRIX MODULES

• OPTREX GRAPHIC LCD MODULES:

LCD Dot Matrix Graphic Modules DMF Series represent the leading edge of LCD technology. Dot densities of 128 by 480 are now production standards by OPTREX. Graphic modules include on-board drive electronics.

Items Model	Display Characters	Character Composition	Dimensions (W x H x Tmm)	Effective Viewing Angle (W x Vmm)	Dot Size (W x Vmm)	Maximum Current Consumption (ma) IDD	Weight (g)	Recommended Power Voltage VDD-VSS(V)	Operating Temperature Range	Storage Ambient Temperature
DMF608	GRAPHIC	128 x 160 Dots	129 x 102 x 11.2	96 x 77	0.55 x 0.55	5	~200	+5V ±5%	0 ~ 50°C	– 20 ~60°C
DMF605	GRAPHIC	128 x 480 Dots	264 x 94 x 20	236 x 67	0.42 x 0.42	20	~320	+5V ±5%	0 ~ 50°C	– 20 ~60°C
*DMF611	GRAPHIC	200 x 640 Dots	*287 x 114 x 11	*267 x 88	0.35 x 0.35	~20	~300	+5V ±5%	0 ~ 50°C	– 20 ~60°C

*DMF611 WILL BE AVAILABLE BY 1ST QTR. '85.
*SUBJECT TO CHANGE.

• OPTREX INSTRUMENTATION LCDS:

Type No.	Glass Dimension (W x Hmm)	View Area (W x Hmm)	Digits Height (mm)	Terminal		Notes
				Pitch	Number	
FRS-1080P	50.8x30.5	45.8x18.4	12.7	2.54	40	pin connector
FRS-1103P	69.9x30.5	64.9x18.4	11.0	2.54	48	pin connector
FRS-1105P	50.8x30.5	45.8x18.4	12.7	2.54	40	pin connector
FRS-1117P	50.8x30.5	45.8x18.4	12.7	2.54	40	pin connector
FRS-1141P	50.8x24.1	45.8x13.3	10.0	2.54	40	pin connector
FRS-1143P	50.8x24.1	45.8x13.3	10.0	2.54	40	pin connector
FRS-1153P	69.85x38.1	63.5x24.38	17.78	2.54	40	pin connector
FRS-1154P	69.85x30.48	63.5x16.51	12.7	2.54	48	pin connector
FRS-1155P	69.85x38.1	63.5x24.38	17.78	2.54	40	pin connector
FRS-1156P	93.85x38.1	87.5x24.38	17.78	2.54	50	pin connector
FRS-1200	50.8x30.5	45.8x18.4	12.7	2.54	40	rubber connector
FRD-1266	70.0x22.0	65.0x12.0	7.0	1.2	53	rubber connector
FRS-1320P	81.28x38.1	75.28x24.48	17.78	2.54	40	pin connector
FRD-1352P	104.6x22.0	99.6x12.0	7.0	2.54	72	pin connector
FRS-1412P	93.8x30.4	89.8x18.4	12.7	2.54	68	pin connector

(CONSUMER)

● Operating Method:	STATIC	● Glass Thickness	1.1mm
● Operating Voltage:	3.1V	● Terminal Side:	both
● Power Consumption:	2μA	● View Angle:	from Down-Side
● Operating Temperature:	– 5~55°C	● Response Time: (at 25°C)	Rise 50ms Decay 70ms
● Storage Temperature:	– 25~70°C		

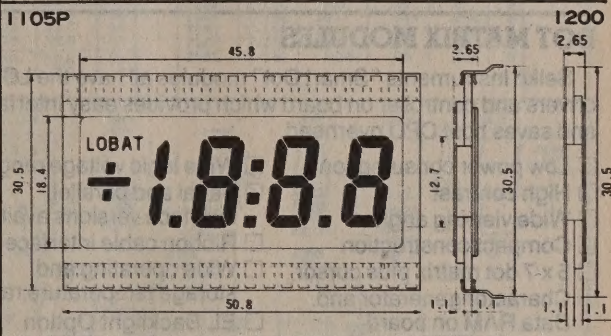
(EXTENDED TEMPERATURE USE = High Reliability)

● Operating Method:	STATIC	● Glass Thickness	1.1mm
● Operating Voltage:	5.0V	● Terminal Side:	both
● Operating Temperature:	– 30~80°C	● View Angle:	from Down-Side
● Storage Temperature:	– 40~90°C	● Response Time: (at 25°C)	Rise 20ms Decay 60ms

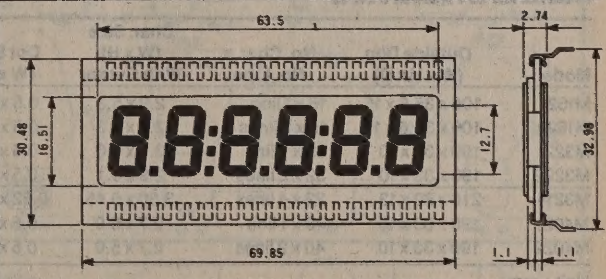
• OPTREX CUSTOM LCD CAPABILITIES:

Contact the nearest sales organization for additional information of CUSTOM LCD's by OPTREX.

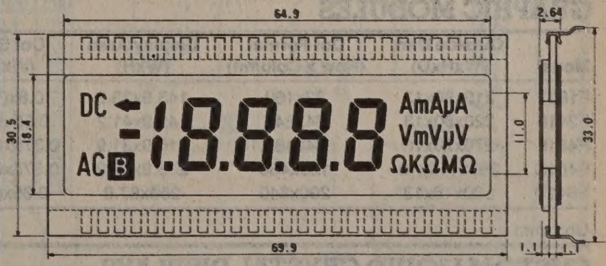
FRS-1154P



FRS-1105P, 1200



FRS-1103P



FOR FURTHER INFORMATION OF OPTREX'S TOTAL CAPABILITIES; CONTACT:

SATORI ELECTRIC (AMERICA) INC. Tel. (213) 378-9478
23717 Hawthorne Blvd., Suite 201
Torrance, CA 90505
Telex. 182536 SATORITRNC
FAX. (213) 375-8565

ASAHI GLASS EMP. CORP.
26533 Evergreen Road, Room 533
Southfield, Michigan 48076
Tel. (313) 557-0018 FAX. (313) 557-0025

SEIKO INSTRUMENTS

LIQUID CRYSTAL DISPLAYS

As one of the oldest and largest manufacturer's of Liquid Crystal Displays in the world, Seiko Instruments can meet your needs for standard LCD's, dot matrix modules and custom displays. We exceed your expectations in quality, reliability, delivery, and cost. Contact Seiko Instruments when your design calls for LCD's, you will like the results.

INDUSTRY STANDARD LIQUID CRYSTAL DISPLAYS

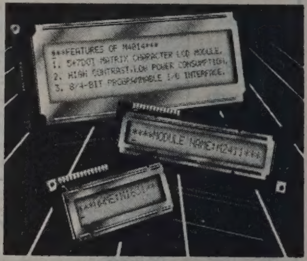
- ☐ Wide viewing angle
- ☐ Excellent contrast
- ☐ Wide operating voltage range
- ☐ CMOS compatible
- ☐ High Quality—long life
- ☐ Low Cost
- ☐ Standard Operating Temperature −10°C to 60°C
- ☐ Extended Operating Temperature −30°C to 85°C
- ☐ Various polarizer and reflectors including color
- ☐ Attached pins or elastomer versions are available
- ☐ Compatible with other manufacturer's LCD's

Model No.	Digit Ht. (Inch)	Glass Size (Inch)	Description
SP-530	0.35	2.00 x 0.90 x 0.103	3½ DIGIT, +, ←, :
SP-531	0.35	2.00 x 0.90 x 0.103	4 DIGIT, :
SP-516	0.30	2.00 x 0.90 x 0.103	4½ DIGIT, +, ←, :
SP-521	0.50	2.00 x 1.20 x 0.103	3½ DIGIT, —, LO BAT, :
SP-503	0.50	2.00 x 1.20 x 0.103	3½ DIGIT, +, ←, :
SP-505	0.50	2.00 x 1.20 x 0.103	4 DIGIT, :
SP-501	0.47	2.00 x 1.20 x 0.103	4½ DIGIT, +, LO BAT, :
SP-532	0.50	2.75 x 1.20 x 0.103	6 DIGIT, :, :
SP-535	0.50	3.70 x 1.20 x 0.103	8 DIGIT, :, :, :
SP-537	0.70	2.75 x 1.50 x 0.103	4 DIGIT, :
SP-508	0.70	2.75 x 1.50 x 0.103	3½ DIGIT, :, +, ←
SP-538	0.70	3.20 x 1.50 x 0.103	5 DIGIT, :
SP-511	0.70	3.70 x 1.50 x 0.103	6 DIGIT, :, :
SP-540	1.0	3.70 x 1.80 x 0.103	4 DIGIT, :
SP-541	1.0	4.50 x 1.80 x 0.103	5 DIGIT, :
SP-542	1.0	5.35 x 1.80 x 0.103	6 DIGIT, :, :
SP-533	—	2.75 x 1.20 x 0.103	101 bar graph
SP-539	—	3.70 x 1.50 x 0.103	2 column, 20 bars each

DOT MATRIX MODULES

Seiko Instruments "Smart Dot" modules all have the LCD drivers and controller on board which provides easy interface and saves host CPU overhead.

- ☐ Low power consumption
- ☐ High contrast
- ☐ Wide viewing angle
- ☐ Compact construction
- ☐ 5 x 7 dot matrix plus cursor
- ☐ Character generator and Data RAM on board
- ☐ Wide logic voltage range
- ☐ Serial and parallel interface versions available
- ☐ Ribbon cable interface
- ☐ Wide operating and storage temperature range
- ☐ EL Backlight Option



SERIAL INTERFACE

Model	Outside Dim. (W x H x D)	No. Char. x No. Line	Char. Size (W x H) With Cursor	Dot Size (W x H)
M1621	106 x 35.6 x 11	16 x 1 line	2.9 x 5.3	0.5 x 0.5
M1622	106 x 35.6 x 11	16 x 2 lines	2.9 x 5.3	0.5 x 0.5
M3221	190 x 33 x 10	32 x 1 line	3.4 x 6.0	0.6 x 0.6
M3222	190 x 33 x 10	32 x 2 lines	2.9 x 5.1	0.5 x 0.5
M3214	210 x 80 x 13	32 x 4 lines	3.50 x 6.45	0.62 x 0.65
M4021	190 x 33 x 10	40 x 1 line	2.7 x 5.0	0.5 x 0.5
M4022	190 x 33 x 10	40 x 2 lines	2.7 x 5.0	0.5 x 0.5

Unit : mm

PARALLEL INTERFACE

Model	Outside Dim. (WxHxD)	No. Char. x No. Lines	Char. Size (WxH) With Cursor	Dot Size (WxH)
M1611	85x30x10	16x1 line	2.9x5.3	0.5x0.5
M1631	80x36x10	16x1 line	3.2x8.7	0.55x0.7
M1612	106x30x10	16x2 lines	2.9x5.3	0.5x0.5
M2411	126x36x10	24x1 line	3.2x8.7	0.55x0.7
M3211	186x33x10	32x1 line	3.4x6.0	0.6x0.6
M3212	186x33x10	32x2 lines	2.9x5.1	0.5x0.5
M4011	186x33x10	40x1 line	2.7x5.0	0.45x0.45
M4012	186x33x10	40x2 lines	2.7x5.0	0.45x0.45
M4014	200x70x13	40x4 lines	3.1x5.9	0.54x0.57
M8011	260x43x9.4	80x1 line	2.3x4.5	0.39x0.43

Unit: mm

GRAPHIC MODULES

Model	Outside Dim. (WxHxD)	Dot Format (Row x Column)	Display Area (WxH)	Dot Size (WxH)
F1632	210x80x13	32x160	143.9x33.8	0.8x0.96
F2416	220x80x13	64x240	149.9x41.2	0.55x0.57
F4816	270x70x13	64x480	215.9x31.9	0.375x0.425
F481C	290x110x13	128x480	215.9x63.9	0.375x0.425
F641D	300x16x13	200x640	256x87.9	0.35x0.38

Unit: mm

CUSTOM LIQUID CRYSTAL DISPLAYS

- ☐ Satisfy Your Specific Needs
- ☐ Create Your Own Graphics
- ☐ Glass size ¼" x ½" up to 10" x 5"
- ☐ Static Drive up to 1/100 Duty Cycle
- *NEW* ☐ Exclusive Electrodeposition Process for *Multicolor Displays*
- ☐ Silk Screening for Symbols
- ☐ Colored Polarizer and Reflectors
- ☐ Selectively Colored Polarizers

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For More Information. Circle No. 178

SYLVANIA **Miniature Lighting** **GTE**

GTE Sylvania Incorporated
West Main Street, Dept. G, Hillsboro, NH 03244
603-464-5533

MINIATURE, SUBMINIATURE AND MICROMINIATURE LAMPS

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.
PR2	B-3½	2.38	.50	.80	15
PR3	B-3½	3.57	.50	1.50	15
PR4	B-3½	2.33	.27	.40	15
PR6	B-3½	2.47	.30	.45	15
PR7	B-3½	3.7	.30	.90	15
PR12	B-3½	5.95	.50	3.10	15
PR13	B-3½	4.75	.50	2.20	15
PR18	B-3½	7.2	.55	5.5	15
6S6	S-6	120	6W	......	25
7C7	C-7	115–125	7W	......	30
12	G-3½	6.3	.15	.35	16
13	G-3½	3.7	.30	.98	17
14	G-3½	2.47	.30	.50	17
19	G-3½	14.4	.10	.90	16
27	G-4½	4.9	.30	1.4	19
31	G-4½	6.15	.30	2.0	19
41	T-3¼	2.5	.50	.50	12
43	T-3¼	2.5	.50	.50	13
44	T-3¼	6.3	.25	.90	13
45	T-3¼	3.2	.35	.50	13
46	T-3¼	6.3	.25	.90	12
47	T-3¼	6.3	.15	.52	13
48	T-3¼	2.0	.06	.04	12
49	T-3¼	2.0	.06	.04	13
51	G-3½	7.5	.22	1.0	18
53	G-3½	14.4	.12	1.0	18
53X	G-3½	14.4	.12	1.0	18
55	G-4½	7.0	.41	2.0	20
57	G-4½	14.0	.24	2.0	20
57X	G-4½	14.0	.24	2.0	20
63	G-6	7.0	.63	3.0	21
67	G-6	13.5	.59	4.0	21
81	G-6	6.5	1.02	6.0	21
82	G-6	6.5	1.02	6.0	26
87	S-8	6.8	1.91	15.0	31
88	S-8	6.8	1.91	15.0	29
89	G-6	13.0	.58	6.0	21
93	S-8	12.8	1.04	15.0	31
112	TL-3	1.2	.22	......	11
123	G-3½	1.25	.30	.10	17
136	G-4½	1.25	.60	.20	19

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.
158	T-3¼	14.0	.24	2.0	14
161	T-3¼	14.0	.19	1.0	14
168	T-3¼	14.0	.35	3.0	14
194	T-3¼	14.0	.27	2.0	14
222	TL-3	2.25	.25	......	11
301	G-5	28.0	.17	3.0	23
302	G-5	28.0	.17	3.0	24
303	G-6	28.0	.30	6.0	21
305	S-8	28.0	.51	15.0	31
307	S-8	28.0	.67	21.0	31
308	S-8	28.0	.67	21.0	29
309	S-11	28.0	.9	32.0	33
313	T-3¼	28.0	.17	3.5	13
327	T-1¾	28.0	.04	.34	6
328	T-1¾	6.0	.20	.34*	6
330	T-1¾	14.0	.08	.5	6
331	T-1¾	1.35	.06	.006	6
334	T-1¾	28.0	.04	.34	7
344	T-1¾	10.0	.014	.004	6
382	T-1¾	14.0	.08	.30	6
387	T-1¾	28.0	.04	.30	6
388	T-1¾	28.0	.04	.30	6
680	T-1	5.0	.06	.03	3
682	T-1	5.0	.06	.029	4
683	T-1	5.0	.06	.05	3
685	T-1	5.0	.06	.048	4
713	T-1	5.0	.075	.09	3
714	T-1	5.0	.075	.08	4
715	T-1	5.0	.115	.15	3
718	T-1	5.0	.115	.132	4
1003	B-6	12.8	.94	15.0	27
1004	B-6	12.8	.94	15.0	28
1034	S-8	12.8 14.0	1.80 .59	32.0 3.0	32
1076	S-8	12.8	1.80	32.0	29
1133	RP-11	6.2	3.91	32.0	34
1156	S-8	12.8	2.10	32.0	31
1157	S-8	12.8 14.0	2.10 .59	32.0 3.0	32

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.
1176	S-8	12.8 14.0	1.34 .59	21.0 6.0	29
1183	RP-11	5.5	6.25	50.0	34
1195	RP-11	12.5	3.0	50.0	34
1445	G-3½	14.4	.135	.7	18
1447	G-3½	18.0	.15	1.5	17
1495	T-4½	28.0	.30	6.0	22
1764	T-1¾	28.0	.04	.34	5
1784	T-1¾	6.0	.20	.60	5
1813	T-3¼	14.4	.10	.86	13
1815	T-3¼	14.0	.20	1.4	13
1816	T-3¼	13.0	.33	3.0	13
1819	T-3¼	28.0	.04	.34	13
1820	T-3¼	28.0	.10	1.6	13
1829	T-3¼	28.0	.07	1.0	13
1847	T-3¼	6.3	.15	.38	13
1850	T-3¼	5.0	.09	.25	13
1864	T-3¼	28.0	.17	3.0	13
1869	T-1¾	10.0	.014	.004	5
1888	T-3¼	7.0	.50	2.0	13
1889	T-3¼	14.0	.27	2.0	13
1891	T-3¼	14.0	.24	2.0	13
1893	T-3¼	14.0	.33	2.0	13
1895	G-4½	14.0	.27	2.0	20
2162	T-1¾	14.0	.10	.5	5
2182	T-1¾	14.0	.08	.30	5
2187	T-1¾	28.0	.04	.30	5
6832	T-1	5.0	.06	.05	2
6833	T-¾	5.0	.06	.05	1
6838	T-1	28.0	.024	.15	3
6839	T-1	28.0	.024	.15	4
7152	T-1	5.0	.115	.15	2
7327	T-1¾	28.0	.04	.34	8
7328	T-1¾	6.0	.20	.6	8
7344	T-1¾	10.0	.014	.004	8
7382	T-1¾	14.0	.08	.30	8
7387	T-1¾	28.0	.04	.30	8
7931	T-1¾	1.35	.06	.006	8

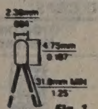


Fig. 1
2.38mm
.094"
4.75mm
0.187"
31.8mm MIN
1.25"

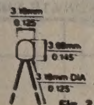


Fig. 2
3.18mm
0.125"
3.68mm
0.145"
3.18mm DIA
0.125"

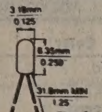


Fig. 3
3.18mm
0.125
6.35mm
0.250"
31.8mm MIN
1.25"

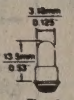


Fig. 4
3.18mm
0.125"
13.5mm
0.53"

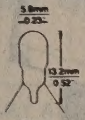


Fig. 5
5.8mm
0.23
13.2mm
0.52"

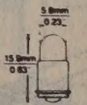


Fig. 6
5.8mm
0.23
15.9mm
0.63"

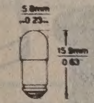


Fig. 7
5.8mm
0.23
15.9mm
0.63"

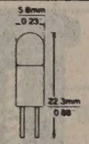


Fig. 8
5.8mm
0.23
22.3mm
0.88"

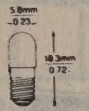


Fig. 9
5.8mm
0.23
18.3mm
0.72"

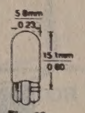


Fig. 10
5.8mm
0.23
15.1mm
0.60"

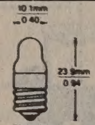


Fig. 11
10.1mm
0.40
23.9mm
0.94"

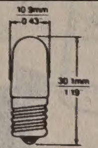


Fig. 12
10.9mm
0.43
30.1mm
1.19"

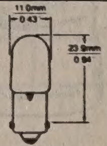


Fig. 13
11.0mm
0.43
23.9mm
0.94"

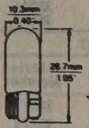


Fig. 14
10.3mm
0.40
26.7mm
1.05"

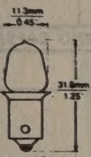


Fig. 15
11.3mm
0.45
31.8mm
1.25"

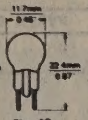


Fig. 16
11.7mm
0.46
22.4mm
0.87"

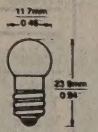


Fig. 17
11.7mm
0.46
23.9mm
0.94"

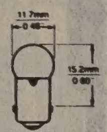


Fig. 18
11.7mm
0.46
15.2mm
0.60"

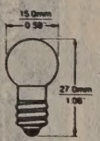


Fig. 19
15.0mm
0.59"
27.0mm
1.06"

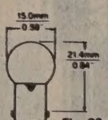


Fig. 20
15.0mm
0.59"
21.4mm
0.84"

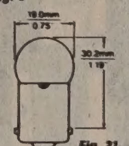


Fig. 21
19.0mm
0.75"
30.2mm
1.19"

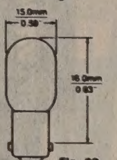


Fig. 22
15.0mm
0.59"
16.0mm
0.63"

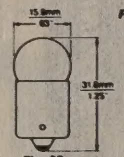


Fig. 23
15.9mm
.63"
31.8mm
1.25"

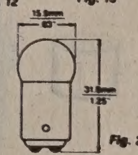


Fig. 24
15.9mm
.63"
31.8mm
1.25"

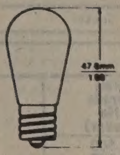


Fig. 25

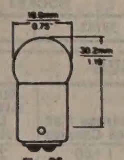


Fig. 26
19.0mm
0.75"
30.2mm
1.19"

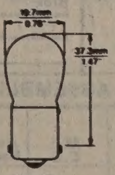


Fig. 27
19.7mm
0.78"
37.3mm
1.47"

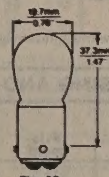


Fig. 28
19.7mm
0.78"
37.3mm
1.47"

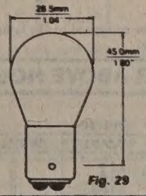


Fig. 29
26.5mm
1.04"
45.0mm
1.80"

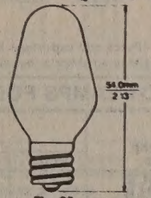


Fig. 30

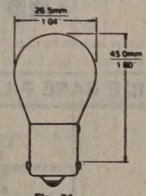


Fig. 31
26.5mm
1.04"
45.0mm
1.80"

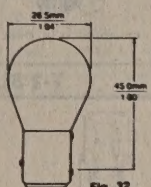


Fig. 32
26.5mm
1.04"
45.0mm
1.80"

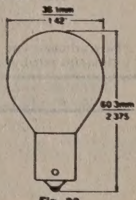


Fig. 33
36.1mm
1.42"
60.3mm
2.375

NEON GLOW INDICATOR LAMPS

Lamp No.	Bulb	Circuit Volts	Ext. Res. (K-ohms)	Fig.
NE-2 (A1A)	T-2	105–125	150	38
NE-2A (A2A)	T-2	105–125	220	38
NE-2V (A2B)	T-2	105–125	100	38
NE-2E (A9A)	T-2	105–125	100	38
NE-51 (B1A)	T-3¼	105–125	220	39
NE-51H (B2A)	T-3¼	105–125	27	39
NE-17 (B5A)	T-4½	105–125	30	45
NE-45 (B7A)	T-4½	105–125	None	43
NE-47 (B8A)	T-4½	105–125	30	44
NE-48 (B9A)	T-4½	105–125	30	45
NE-2H (C2A)	T-2	105–125	30	38
NE-2D (C7A)	T-2	105–125	100	40
NE-2J (C9A)	T-2	105–125	30	40
NE-57 (F3A)	T-4½	105–125	None	43
NE-58 (F4A)	T-4½	210–150	None	43
NE-30 (J5A)	S-11	105–125	None	47
NE-56 (J9A)	S-11	210–150	None	47
NE-84 (K1AS)	T-2	105–125	30	41
NE-32 (L5A)	G-10	105–125	4.8	48

NEON GLOW CIRCUIT COMPONENT LAMPS

Lamp No.	Bulb	Start. Volts (DC)	Nom. Cur. (mA)	Fig.
NE-96 (4AB)	T-2	120–150	0.5	38
NE-97 (4AC)	T-2	110–140	0.5	38
NE-23 (5AB)	T-2	60–90	0.3	38
NE-68 (5AC)	T-2	60–90	0.3	38
NE-81 (5AG)	T-2	64–80	0.3	38
NE-76 (5AG-A)	T-2	68–76	0.4	38
NE-83 (5AH)	T-2	60–100	5.0	38
NE-86 (5AJ)	T-2	55–90	1.5	38
NE-67 (6AC)	T-3¼	55–90	0.2	39
NE-16 (7AA)	T-4½	67–87	1.5	45
NE-3 (8AA)	T-2	55–90	0.3	46
NE-4 (8AB)	T-2	60–90	0.3	42
NE-75	T-2	60–90	0.4	38

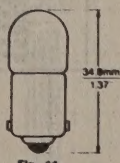


Fig. 44

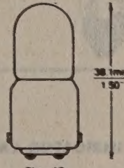


Fig. 45

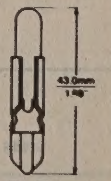


Fig. 46

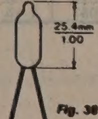


Fig. 38

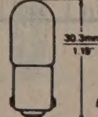


Fig. 39

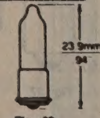


Fig. 40

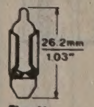


Fig. 41

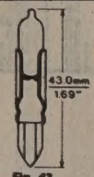


Fig. 42

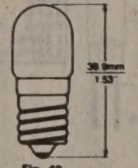


Fig. 43

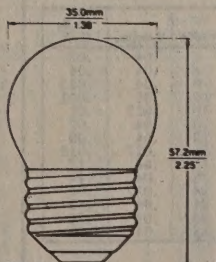


Fig. 47
35.0mm
1.38"
57.2mm
2.25"

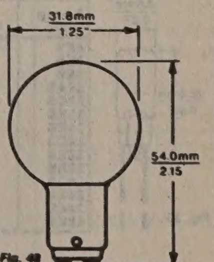


Fig. 48
31.8mm
1.25"
54.0mm
2.15

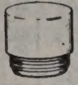
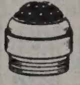
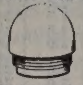
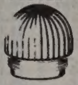
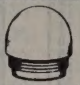
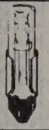
For More Information. Circle No. 179

SYLVANIA **Miniature Lighting** **GTE**

GTE Sylvania Incorporated
West Main Street, Dept. G, Hillsboro, NH 03244
603-464-5533

UNIVERSAL PILOT LAMP HOUSING FOR T-2 SLIDE BASE PILOT LAMPS

A variety of lens styles, each available in a choice of colors, plus a standard socket (P N 30099) provide a wide choice of configurations for virtually every application when used with T-2 slide base Pilot Lamps rated at 5, 6, 12, 28, 48, 60 or 120 volts. **Dimensions: Lenses**—Height, .38"; diameter, .63". **Socket**—Front of panel to end of terminals, .91"; mounting hole, .75" dia.

	FLAT TOP	JEWELED	TRANSPARENT	FLUTED	TRANSLUCENT
Choose your lens & color . . .					
add a T-2 Pilot Lamp . . .					
and insert into socket # 30099					

LENSE PART NO'S.

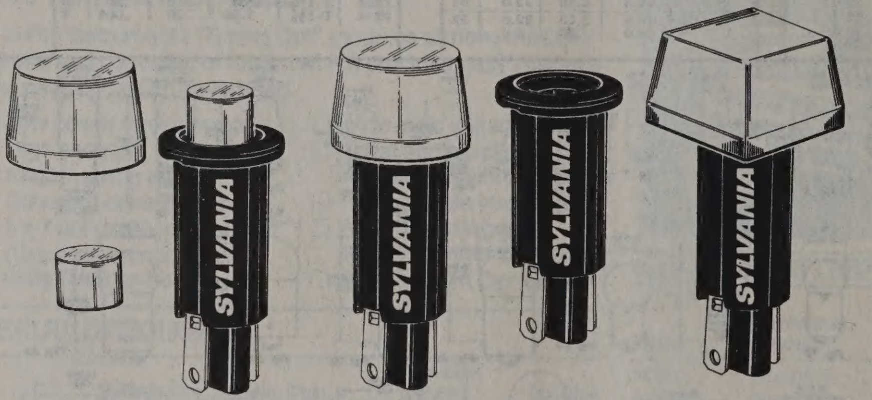
30200	Flat Top Translucent—Red
30212	Flat Top Translucent—Green
30213	Flat Top Translucent—Blue
30214	Flat Top Translucent—Yellow
30100	Jeweled—Red
30102	Jeweled—Green
30103	Jeweled—Blue
30106	Jeweled—Amber
30110	Transparent—Red
30112	Transparent—Green
30113	Transparent—Blue
30111	Transparent—Amber
30114	Transparent—Yellow
30116	Transparent—Clear
30120	Fluted—Red
30122	Fluted—Green
30124	Fluted—Blue
30126	Fluted—Amber
30125	Fluted—Clear
30130	Dome Translucent—Red
30132	Dome Translucent—Green
30131	Dome Translucent—Yellow
30133	Dome Translucent—White

SOCKET

30099	Socket

SINGLE SOCKET ASSEMBLIES FOR T-2 SLIDE BASE PILOT LAMPS

Socket P N 30152 plus round (.70" dia. x .48" high) or square (.70" x .70" x .48" high) lens also uses T-2 slide base Pilot Lamps rated at 5, 6, 12, 24, 28, 48, 60 or 120 volts. Sockets can also be used without lens, with or without colored end cap covering end of bulb which extends .18" beyond .09" socket flange. **Dimensions:** Socket 1.31" M.O.L.; mounting hole .50" dia.



*Polycarbonate end caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts.

#Pyrex end caps must be cemented to the lamp with a translucent silicone rubber adhesive.

LENSES

Color	Ordering Number Round Lens	Ordering Number Square Lens
Red	30160	30170
Clear	30161	30171
Amber	30162	30172
White	30163	30173
Green	30164	30174
Blue	30165	30175

POLYCARBONATE END CAPS*

Color	Ordering Number
Red	38001
Yellow	38002
White	38003
Green	38004
Blue	38005
Pearl White	38006
Orange	38007

PYREX END CAPS#

Color	Ordering Number
Red	38071
Yellow	38072
White	38073
Green	38074
Blue	38075

SOCKET

30152	Socket

T-2 SLIDE BASE PILOT LAMPS FOR ABOVE HOUSING AND ASSEMBLIES

Lamp No.	Design Volts	Design Amps	Design Watts	Filament	M.S. C.D.	Average End Foot Candles	Rated Average Life (Hours)
5SLB	5	.12	.6	C-2V	...	1,600	2,500
6PSB	6	.14	.8	C-2F	.12	500	20,000
6SLB	6	.144	.6	C-2V	...	1,700	2,500
12PSB	12	.17	2.0	C-2F	.35	2,000	12,000
24PSB	24	.073	1.7	C-2F	.50	3,000	10,000
28PSB	28	.04	1.1	C-2F	.29	1,600	5,000
48PSB	48	.053	2.5	C-7A	.7	1,800	7,500
60PSB	60	.05	3.0	C-7A	.73	2,600	7,500
120PSB	120	.025	3.0	CC-7A	.36	1,200	10,000

WIRE LEAD INDICATOR LAMPS

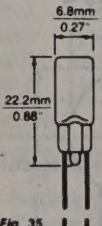


Fig. 35

Lamp No.	Volts	Amps.	M.S. C.P.
4ES	4	.04	.03
5ES	5	.04	.04
6ES	6	.04	.025
10AS	10	.01	.001
10CS	10	.017	.01
10ES	10	.04	.07
12ES	12	.04	.09
16CS	16	.017	.016
16ES	16	.04	.17
18ES	18	.04	.14
24CS	24	.017	.02
24ES	24	.04	.12
28ES	28	.04	.25
48ES	28	.04	.44

WIRE LEAD PILOT LAMPS

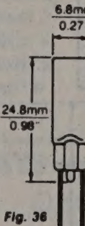


Fig. 36

Lamp No.	Volts	Amps	M.S. C.P.
6PS	6	.14	.12
12PS	12	.17	.35
24PS	24	.073	.5
28PS	28	.04	.29
48PS	48	.053	.7
60PS	60	.05	.73
120PS	120	.025	.36
120PS/6	120	.052	1.43

MINIATURE BAYONET BASE PILOT LAMPS

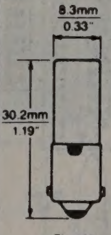


Fig. 37

Lamp No.	Volts	Amps	M.S. C.P.
6MB	6	.140	.12
12MB	12	.170	.35
24MB	24	.073	.50
28MB	28	.040	.29
48MB	48	.053	.70
60MB	60	.050	.73
90MB	90	.033	.37
120MB	120	.025	.36
120MB/6	120	.052	1.43

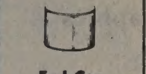
For More Information. Circle No. 179

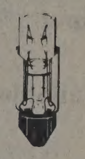
SYLVANIA **Miniature Lighting** GTE

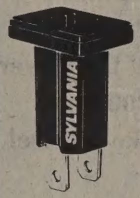
GTE Sylvania Incorporated
West Main Street, Dept. G, Hillsboro, NH 03244
603-464-5533

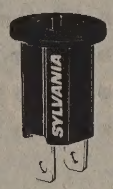
SINGLE SOCKET ASSEMBLIES FOR T-2 SLIDE BASE INDICATOR LAMPS

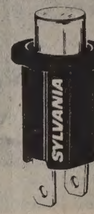
Available sockets include P/N 30153 (round flange) and P/N 30151 (rectangular flange). Sockets may be used with or without colored lens cap covering end of bulb which extends .18" beyond .09" flange. Socket P/N 30153 (round-flange) can also be used with round (.70" dia. x .48" high) or square (.70" x .70" x .48" high) lenses. Both sockets 1.14" M.O.L., Mounting hole, .50" dia. Sockets accept T-2 lamps rated at 4, 5, 6, 10, 12, 14, 16, 18, 24, 28 or 48 volts.

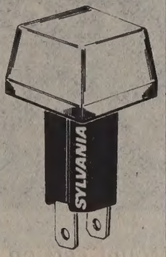

End Cap

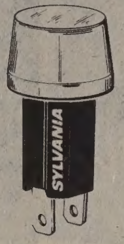

Indicator Lamp


P/N 30151


P/N 30153


With End Cap


With Square Lens


With Round Lens

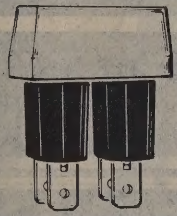
*Polycarbonate end caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts. Pyrex end caps must be cemented to the lamp with a translucent silicone rubber adhesive.

Part Number	Description
30151	Socket, rectangular flange
30153	Socket, round flange
38001	End cap, (*), red
38002	End cap, (*), yellow
38003	End cap, (*), white
38004	End cap, (*), green
38005	End cap, (*), blue
38006	End cap, (*), pearl white
38007	End cap, (*), orange
38071	End cap, Pyrex, red
38072	End cap, Pyrex, yellow
38073	End cap, Pyrex, white
38074	End cap, Pyrex, green
38075	End cap, Pyrex, blue
30160	Lens, round, red
30161	Lens, round, clear
30162	Lens, round, amber
30163	Lens, round, white
30164	Lens, round, green
30165	Lens, round, blue
30170	Lens, square, red
30171	Lens, square, clear
30172	Lens, square, amber
30173	Lens, square, white
30174	Lens, square, green
30175	Lens, square, blue

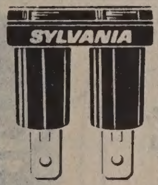
TWIN LIGHT ASSEMBLIES FOR T-2 SLIDE BASE INDICATOR LAMPS

T-2 lamp

Complete Ass'y.

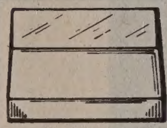


TWIN LIGHT SOCKETS



Ordering Number	Description	No. of Contacts
31351	Both sides common	2
31352	One side common	3
31353	Individual contacts	4

TWIN LIGHT LENSES



Ordering Number	Color
30180	Red
30182	Amber
30183	White
30184	Green
30185	Blue

STRIP SOCKET ASSEMBLIES FOR T-2 SLIDE BASE INDICATOR LAMPS

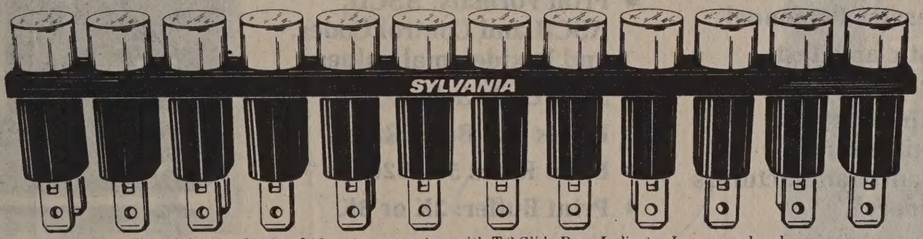


Illustration is of strip of 12 sockets complete with T-2 Slide Base Indicator Lamps and end caps.

Strip socket assemblies may be used with or without end caps listed above. Polycarbonate caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts. Pyrex caps must be cemented to the lamp with a translucent silicone rubber adhesive. Strip socket assemblies are available with 2 thru 12 sockets on 1/2" or 3/4" centers; common ground or individual contacts. Sockets accept T-2 indicator lamps rated at 4, 5, 6, 10, 12, 14, 16, 18, 24, 28 or 48 volts.

INDICATOR LAMP STRIP SOCKETS

Number of Sockets	Ordering Number			
	1/2" Centers		3/4" Centers	
	Common Ground	Individual Contacts	Common Ground	Individual Contacts
2	31301	31311	31321	31337
3	31302	31312	31322	31338
4	31303	31313	31323	31334
5	31304	31314	31324	31339
6	31305	31315	31325	31333
7	31306	31316	31326	31340
8	31307	31317	31327	31341
9	31308	31318	31328	31342
10	31309	31319	31329	31343
11	31310	31320	31330	31344
12	31250	33250	31275	33275

T-2 SLIDE BASE INDICATOR LAMPS FOR ABOVE ASSEMBLIES

Lamp Number	Design			Filament	M.S.C.D.	Average End Foot Candles	Rated Average Life (Hrs.)
	Volts	Amperes	Watts				
4ESB	4.0	.040	.16	C-6	.03	200	10,000
5ESB	5.0	.040	.20	C-6	.04	225	8,000
6ESB	6.0	.040	.24	C-2V	.025	250	10,000
53B	6.0	.240	1.44	C-2V	.24	2,000	5,000
10ASB	10.0	.010	.10	C-2F	.001	.....	50,000
10CSB	10.0	.017	.17	C-2V	.01	60	20,000
10ESB	10.0	.040	.40	C-2V	.07	450	10,000
12ESB	12.0	.040	.48	C-2V	.09	650	10,000
14FSB	14.0	.080	1.12	C-2F	.50	4,000	500
16CSB	16.0	.017	.27	C-2F	.016	80	15,000
16ESB	16.0	.040	.64	C-2F	.17	800	7,500
18ESB	18.0	.040	.72	C-2F	.14	850	5,000
24CSB	24.0	.017	.42	C-2F	.02	100	15,000
24ESB	24.0	.040	.96	C-2F	.12	850	8,000
28ESB	28.0	.040	1.12	C-2F	.25	1,500	6,000
48ESB	48.0	.040	1.92	CC-2F	.44	3,000	5,000

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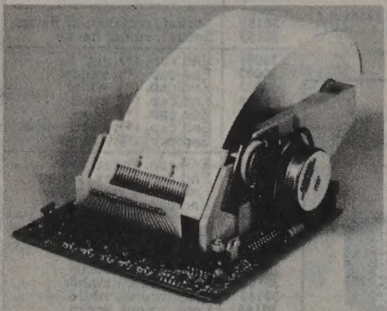
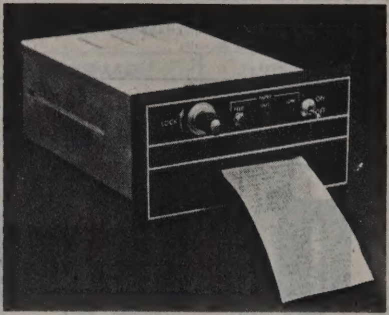
Thermal Printers for the OEM


OEM Version*


Rack Mount Version

*Mechanism alone available

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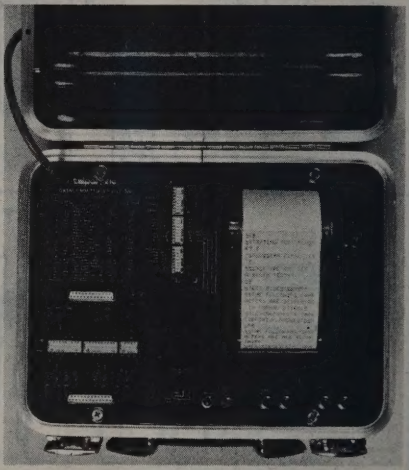

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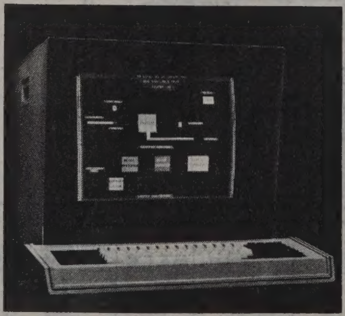

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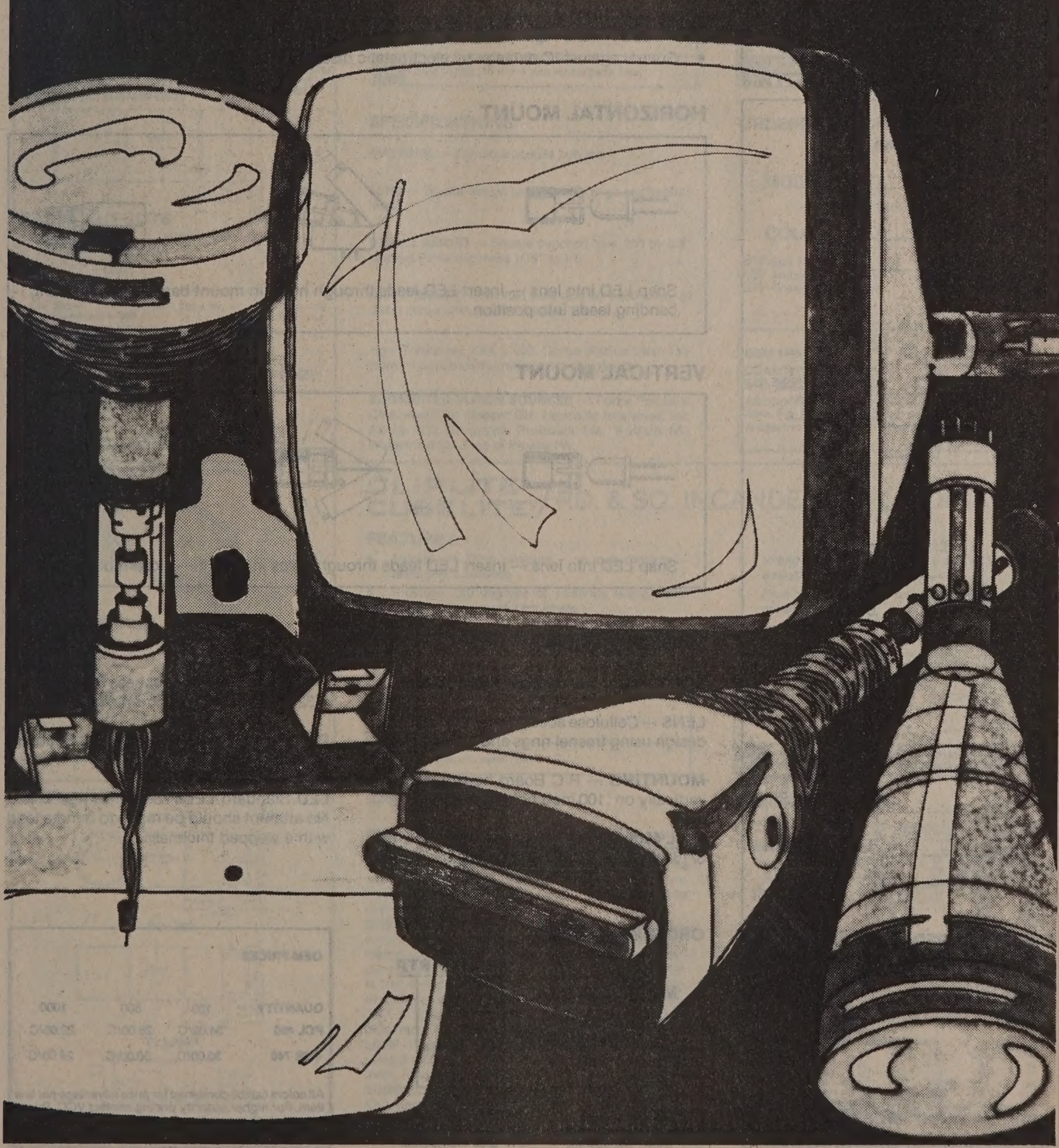

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VCC
MINIATURE
INDICATORS

VISUAL COMMUNICATIONS COMPANY

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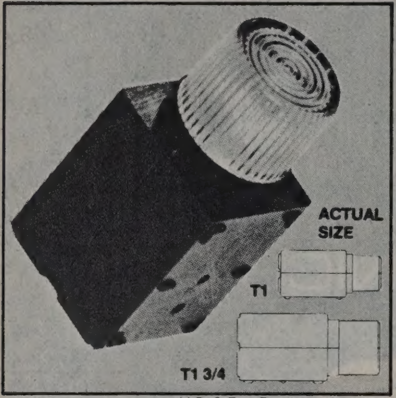
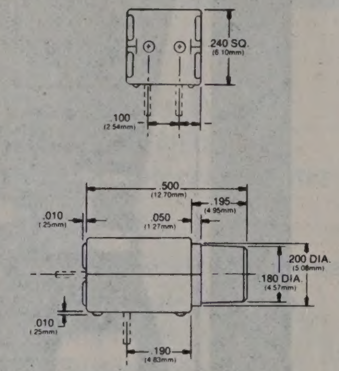
P-C-LITE® PCB MOUNTS FOR T1 & T1 3/4 LEDs


ACTUAL SIZE
T1
T1 3/4

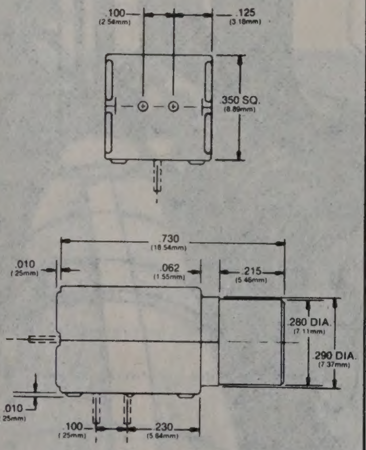
U.S. & For. Pat. Issued & Pend.

OUTLINE DRAWING

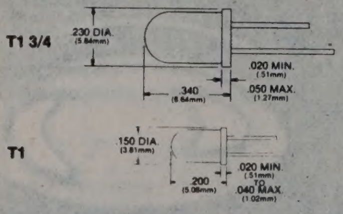
PCL 490


.240 SQ. (6.10mm)
.100 (2.54mm)
.500 (12.70mm)
.195 (4.95mm)
.010 (.25mm)
.050 (1.27mm)
.200 DIA. (5.08mm)
.180 DIA. (4.57mm)
.010 (.25mm)
.190 (4.83mm)

PCR 740


.100 (2.54mm)
.125 (3.18mm)
.350 SQ. (8.89mm)
.730 (18.54mm)
.010 (.25mm)
.062 (1.55mm)
.215 (5.46mm)
.280 DIA. (7.11mm)
.290 DIA. (7.37mm)
.010 (.25mm)
.100 (.25mm)
.230 (5.84mm)

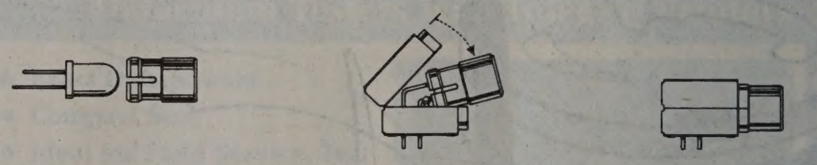
RECOMMENDED LEDs


T1 3/4
.230 DIA. (5.84mm)
.020 MIN. (.51mm)
.340 (8.64mm)
.050 MAX. (1.27mm)
T1
.150 DIA. (3.81mm)
.020 MIN. (.51mm) TO
.200 (5.08mm)
.040 MAX (1.02mm)

FEATURES

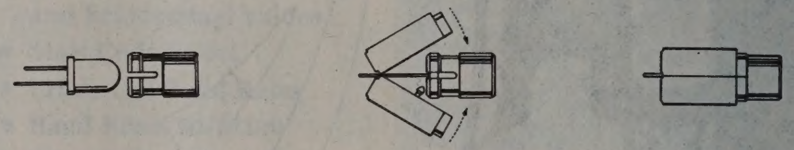
- Wave solders horizontally or vertically without special jigs or fixtures
- Stabilizes LED during packaging and physically protects after assembly
- Mounts flush, recessed or fully extended thru display panel without attachments
- Height compatible with switches and other circuit board mounted components
- Increases LED apparent brightness and viewing angle up to 180 degrees
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

HORIZONTAL MOUNT



Snap LED into lens — insert LED leads through holes in mount base — close mount, bending leads into position.

VERTICAL MOUNT



Snap LED into lens — insert LED leads through holes in mount — close mount.

SPECIFICATIONS

BODY — General purpose nylon (black)

LENS — Cellulose acetate butyrate. Flat top design using fresnel rings and striated lines

MOUNTING — P C Board horizontally or vertically on .100 inch hole centers

(PCL 490) — Panel thickness from 1/64" to 3/16" thru a 7/32" (5.56mm) clearance hole

(PCR 740) — Panel thickness from 1/32" to 9/32" thru a 5/16" (7.94mm) clearance hole

Permits full projection to flush mounting of the lens portion thru the panel

LED Standard LEDs. See drawings to left. No attempt should be made to bend a lead with a stepped thickness

ORDERING CODES

PCL 490 RTP

MODEL
PCL 490 (T1 SIZE)
PCR 740 (T1 3/4 SIZE)

COLOR
RTP Red Transparent
ATP Amber Transparent
GTP Green Transparent
YTP Yellow Transparent
CTP Clear Transparent
BTP Blue Transparent

OEM PRICES

QUANTITY	100	500	1000
PCL 490	34.00/C	28.00/C	22.00/C
PCR 740	36.00/C	30.00/C	24.00/C

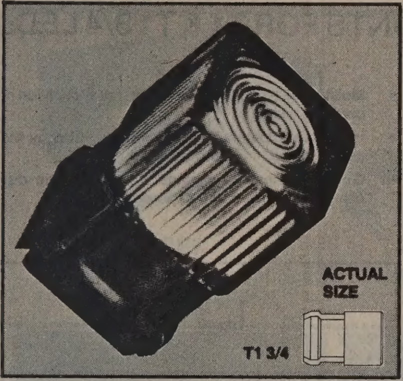
All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.

For More Information. Circle No. 182

VCC MINIATURE INDICATORS

VISUAL COMMUNICATIONS COMPANY

P.O. BOX 986 EL SEGUNDO, CALIFORNIA 90245 U.S.A. (213) 822-4727



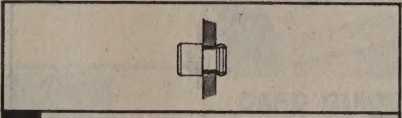
U.S. & For. Pat. Issued & Pend.

CUBELITE® SQUARE LENS/MOUNTS FOR LEDs

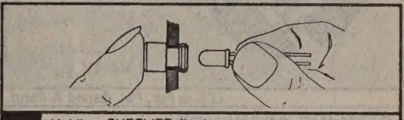
FEATURES

- Enhances aethestics — eliminates "dark corners"— produces a completely even light pattern
- Mounts either as a single square lens or stacks — gangs in bar configuration
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Intensifies apparent brightness up to 140% by the use of striated lines and fresnel rings
- Installs with finger pressure — no tools required —takes only six seconds
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

EASY TWO-STEP INSTALLATION



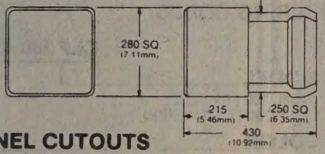
1 Snap CUBELITE in a ¼ inch square panel hole.



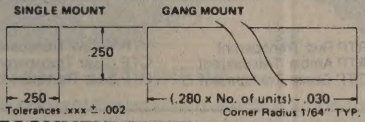
2 Holding CUBELITE firmly to panel, insert LED into CUBELITE from the back. Installs in just 6 seconds.

OUTLINE DRAWING

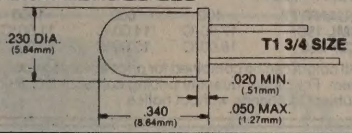
SQL 360



PANEL CUTOUTS



RECOMMENDED LED



SPECIFICATIONS

MATERIAL — Cellulose acetate butyrate

LENS — Square design using fresnel rings and striated lines

SINGLE MOUNT — Square punched hole .250 on 3/8" centers. Panel thickness 1/16" to 1/8"

GANG MOUNT — Slotted hole .250 by (.280 x No. of units) minus .030. Panel thickness 1/8"

Hole Tolerance: .XXX ± .002. Corner Radius 1/64" TYP Holes should be deburred but not chamfered

SUGGESTED PUNCH SOURCES — Porter Precision Cincinnati OH; Strippet Div. Houdaille Industries, Inc. Akron NY; Unipunch Products Inc. Buffalo NY; Wiederman Co. King of Prussia PA

ORDERING CODES

SQL 360 RTP

MODEL

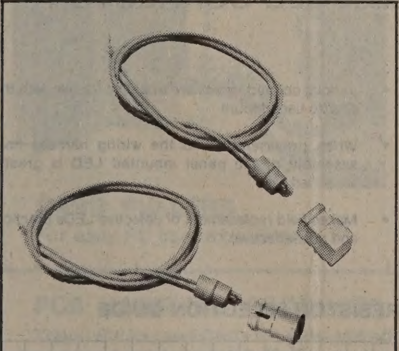
COLOR

RTP Red Transparent	YTP Yellow Transparent
ATP Amber Transparent	CTP Clear Transparent
GTP Green Transparent	BTP Blue Transparent

OEM PRICES

QUANTITY	100	500	1000
SQL 360	20.00/C	17.00/C	14.00/C

All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.



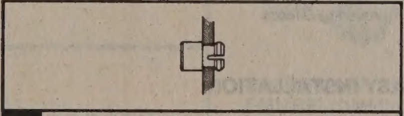
U.S. & For. Pat. Issued & Pend.

CLIPLITE® CUBELITE®/RD. & SQ. INCANDESCENT INDICATORS

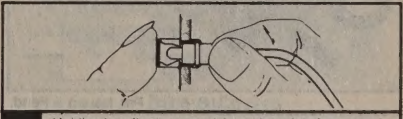
FEATURES

- Installs with finger pressure — no tools required — takes only 6 seconds
- Provides 180 degrees of visability using either transparent or translucent lenses
- Voltages vary from 5 to 28 — a special 5 volt lamp is available for IC compatibility
- Produces a brighter display than LEDs — provides extremely long life.

SIMPLE TWO-STEP INSTALLATION



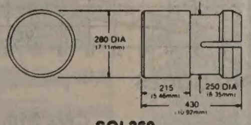
1 Snap lens into panel hole.



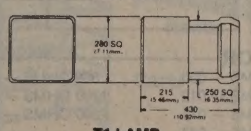
2 Holding lens firmly to panel, insert lamp into lens mount from the back. Installs in just 6 seconds.

OUTLINE DRAWINGS

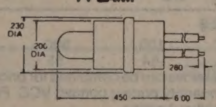
CIF 280



SQI 360



T1 LAMP



SPECIFICATIONS

CLIPLITE (CIF 280) — Produced from cellulose acetate butyrate plastic. Round design with flat top using fresnel rings and striated lines. Mounts from the front of the panel in a .250 ± .002 (6.35mm) hole on 3/8" centers. Panel thickness from 1/16" to 1/8". Holes should be deburred but not chamfered.

CUBELITE (SQI 360) — Produced from cellulose acetate butyrate plastic. Square shape with flat top using fresnel rings and striated lines. Single mount in a square punched hole .250 on 3/8" centers. Panel thickness 1/16" to 1/8". Gang mounts in a slotted hole .250 by (.280 X No. of units) minus .030. Panel thickness 1/8". Hole tolerance: .XXX ± .002; Corner Radius 1/64". Holes should be deburred but not chamfered.

LAMP — Aged and selected, fitted with a plastic base and using 6 inch 28 AWG stranded U.L. approved insulated leads. Available from 5 to 28 volts.

SUGGESTED PUNCH SOURCES — Porter Precision Cincinnati OH; Strippet Div. Akron NY; Unipunch Products Inc. Buffalo NY; Wielderman Co. King of Prussia PA

ORDERING CODES

CIF 280 RTL 05 020

MODEL

CIF 280 (CLIPLITE)
SQI 360 (CUBELITE)

COLOR

LAMP NO.

VOLTS	/AMPS
05	020
05	060
14	040
28	024

RTL Red Translucent	RTP Red Transparent
GTL Green Translucent	ATP Amber Transparent
ATL Amber Translucent	GTP Green Transparent
WTL White Translucent	YTP Yellow Transparent
BTL Blue Translucent	CTP Clear Transparent
	BTP Blue Transparent

OEM PRICES — LAMP & LENS ASSEMBLY

QUANTITY		1	50	100	500	1000
CIF 280	05 020	1.32	1.21	1.10	.95	.81
&	05 060	1.25	1.14	1.04	.90	.77
SQI 360	14 040	1.55	1.41	1.28	1.11	.95
	28 024	2.42	2.20	1.98	1.72	1.47

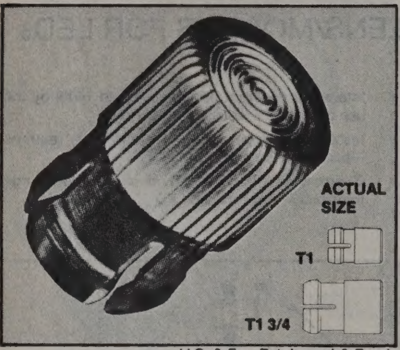
Lens colors can be combined for price advantage per line item only. For higher quantity pricing contact VCC. Prices subject to change without notice.

For More Information. Circle No. 182

VCC MINIATURE INDICATORS

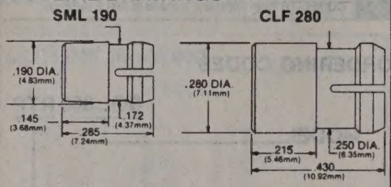
VISUAL COMMUNICATIONS COMPANY

P.O. BOX 986 EL SEGUNDO, CALIFORNIA 90245 U.S.A. (213) 822-4727

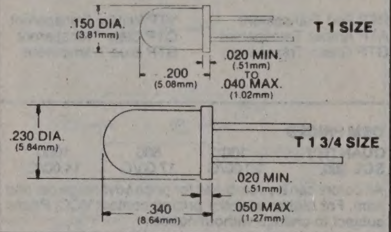


U.S. & For. Pat. Issued & Pend.

OUTLINE DRAWINGS



RECOMMENDED LEDs

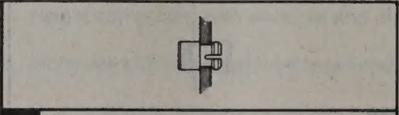


CLIPLITE® LENS/MOUNTS FOR T1 & T1 3/4 LEDs

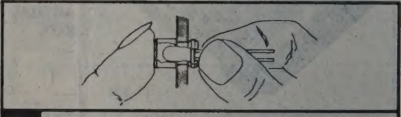
FEATURES

- Installs with finger pressure — no tools required —takes only six seconds
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Protects LED against being pushed back through panel — LED backout
- Moisture seals easily to panel with the application of common sealants
- Intensifies apparent brightness up to 125% by the use of striated lines and fresnel rings
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

SIMPLE TWO-STEP INSTALLATION



1 Snap the CLIPLITE into panel hole.



2 While holding the CLIPLITE tight to the panel with your finger, insert the LED into the CLIPLITE from the back.

SPECIFICATIONS

MATERIAL — Cellulose acetate butyrate

LENS — Flat top design using fresnel rings and striated lines

MOUNTING — Both size CLIPLITEs mount from the front of the panel. Holes should be deburred but not chamfered. The T1 3/4 mounts in a .250 ± .002 (6.35mm) hole on 3/8" centers. Panel thickness from 1/16" to 1/8". The T1 mounts in a .172± .002 (4.4mm) hole on 1/4" centers. Panel thickness from 1/32" to 1/16". P C BOARD attached T 1 LED, major dia. .125, slips into the SML 190 CLIPLITE mounted in a 1/16" thick panel.

NOTE: For panels less than prescribed, standard metal or plastic washers can be used to increase panel thickness.

ORDERING CODES

CLF 280 RTP

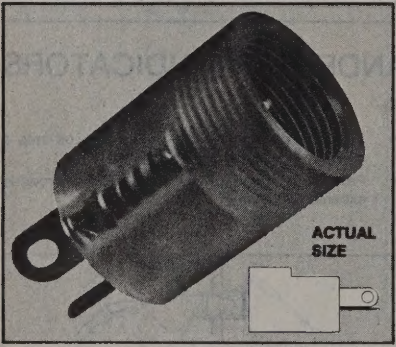
MODEL
SML 190 (T 1 SIZE)
CLF 280 (T 1 3/4 SIZE)
COLOR

RTP Red Transparent	YTP Yellow Transparent
ATP Amber Transparent	CTP Clear Transparent
GTP Green Transparent	BTP Blue Transparent

OEM PRICES

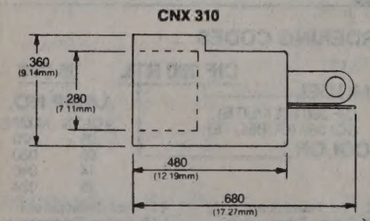
QUANTITY	100	500	1000
SML 190	17.00/C	14.00/C	11.00/C
CLF 280	18.00/C	15.00/C	12.00/C

All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.

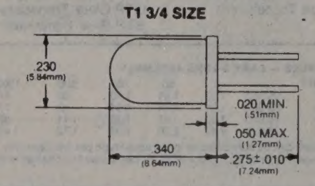


U.S. & For. Pat. Issued & Pend.

OUTLINE DRAWINGS



RECOMMENDED LEDs

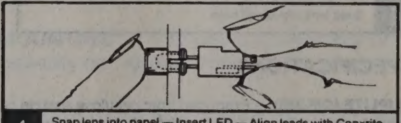


CONXRITE™ SOLDERLESS LED CONNECTOR

FEATURES

- Incorporates a ballast resistor for use on circuits from 3 to 28 volts.
- Requires no tools — provides a simple fast press-fit connection to either Cliplite or clip mount
- Stress relieved connection controls the problem of broken LED leads
- Various colored lenses are available for use with the Cliplite Lens/Mount
- When preassembled to the wiring harness final assembly of the panel mounted LED is greatly simplified
- Makes field replacement of defective LEDs practical and cost-effective

EASY INSTALLATION



1 Snap lens into panel — Insert LED — Align leads with Conxrite spring contacts — Press fit to back of lens/mount.

SPECIFICATIONS:

MATERIAL:
Housing — Polypropylene (Natural)

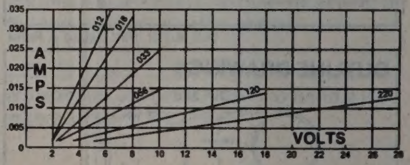
Terminals — Phosphor bronze/tin plated

Resistor — Melf 1/4 watt resistor provides current limiting to 28 volts

Panel Mounts — Cliplite CLF 280 series cellulose acetate butyrate (see specs above). Clip mount polypropylene (Hewlett Packard P/N 5082-4707 or equal)

Note: Trim LED lead length to .275± .010 (7.24 .254mm)

RESISTOR SELECTION GUIDE



ORDERING CODES

CNX 310 012

MODEL
RESISTOR

000 OHMS — 000	560 OHMS — 056
120 OHMS — 012	1200 OHMS — 120
180 OHMS — 018	2200 OHMS — 220
330 OHMS — 033	

OEM PRICES

QUANTITY	100	500	1000
CNX 310	.64	.55	.46

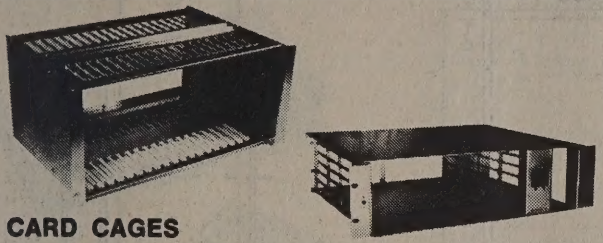
All units and values can be combined for price advantage. For higher quantity pricing contact VCC. Prices subject to change without notice.

For More Information. Circle No. 182

CALMARK CORPORATION

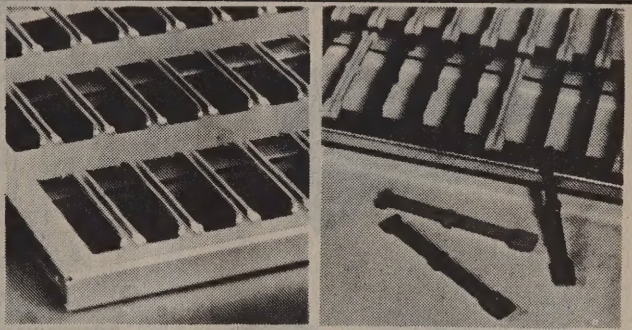
Electronic Packaging, PCB Handling & Cooling Products

4915 Walnut Grove Ave. San Gabriel, CA 91776 / (818) 287-0451 / (818) 287-9942 / TWX (910) 589-1540 / TLX #287292



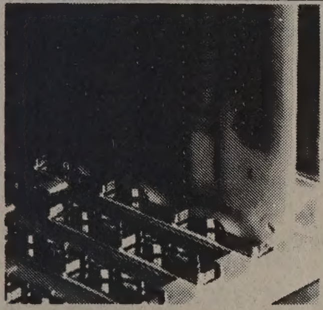
CARD CAGES

Custom designed and fabricated to meet customer requirements.

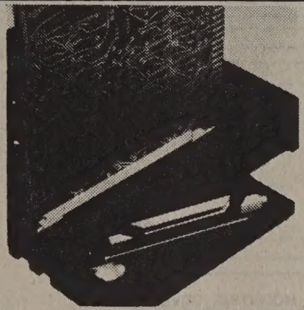


CARD GUIDES

Metal louver and nylon snap-in.



CARD RETAINERS



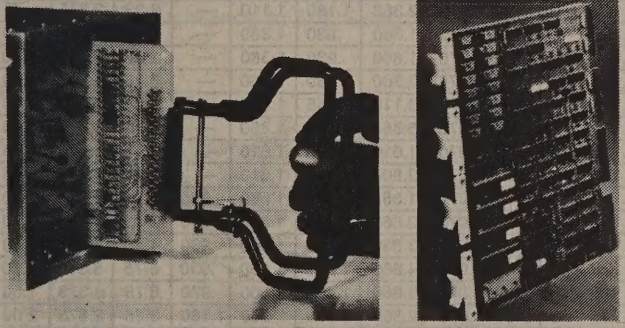
CARD-LOKS

Excellent thermal and electrical conductivity, plus protection against shock and vibration.

CARD INSERTERS & EXTRACTORS

For easy insertion and extraction of PC cards.

- Available in colors for coding.
- Generous area for hot stamp making.
- U.L. Approved
- Available with pre-started assembly pins.



CARD PULLERS

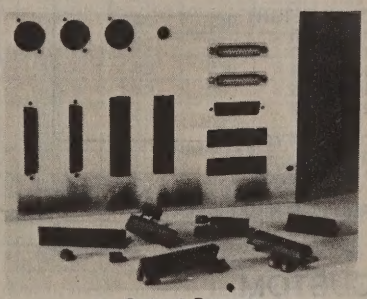
For easy PC card extraction.

CONNECTOR ACCESSORIES

For "D"-subminiature rectangular connectors.

Backshells

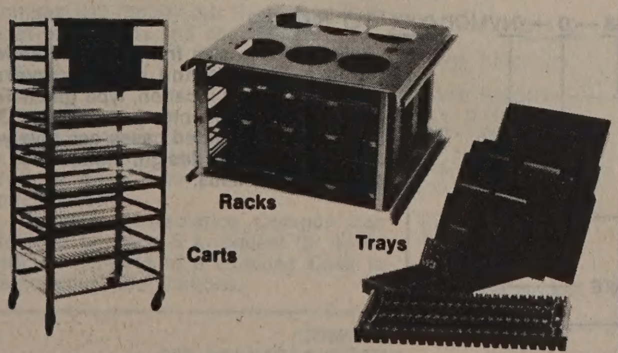
Available with EMI/RFI shielding.



Cutout Covers

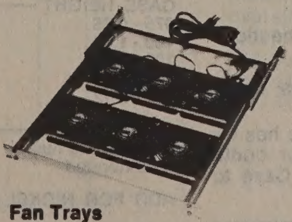
PCB HANDLING PRODUCTS

Trays, Racks, and Carts for safe and efficient handling, transport, and storage of PC boards during all stages of production. Available with static resistant material.

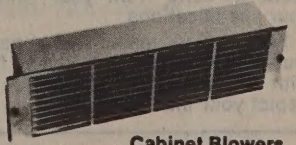


ELECTRONIC COOLING PRODUCTS

Fan Tray Assemblies offer standard mounting with multiple and adjustable fan locations. Cabinet Blowers for cooling of electronic rack equipment. For Special Applications Calmark will design an airmover to meet specific requirements.



Fan Trays



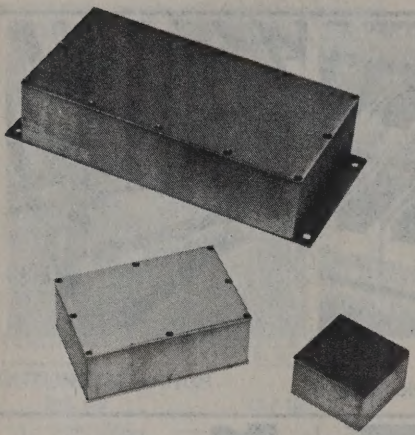
Cabinet Blowers

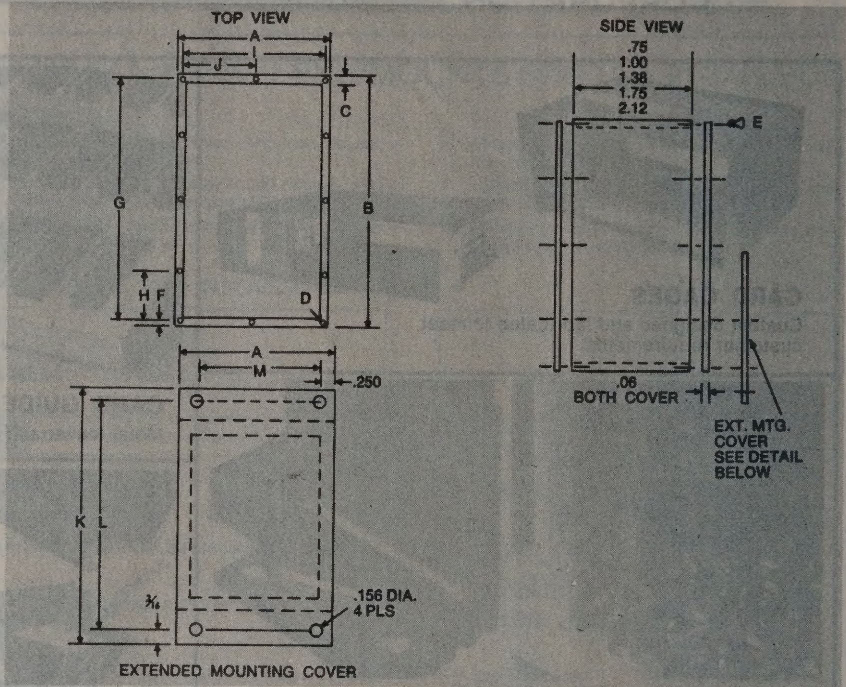
FOR COMPLETE CUSTOM CAPABILITY, CONTACT FACTORY DIRECT

See Our Immediate Action Card Vol. 4

COMPAC™

RFT SERIES





EXTENDED MOUNTING COVER

- ☐ Compac's RFT Series Enclosures have shielding capabilities to 60 dB at 3 GHz
- ☐ Independent access from either side
- ☐ Greater Interior Acreage
  Construction Specs: Case — AL 6063T3 Covers — AL 5052-H32 finish chemical film per MIL C 5541 Class 1 A
  Conformance to MIL 45208A

HOW TO ORDER:

R-51110 — 138 — 0 (N)

CASE PART NO.

CASE HEIGHT
075 - 0.75
100 - 1.00
138 - 1.38
175 - 1.75
212 - 2.12

COVER TYPE
0 - Standard flush
1 - Extended

ADD FOR NICKEL PLATE

	A	B	C	D*	E	F	G	H	I	J	K	L	M
R51080	1.00	1.00	.125	4	0-80	.070	.860	—	.860	—	1.75	1.375	.50
R51090	1.25	1.25	.125	4	0-80	.070	1.110	—	1.110	—	2.00	1.625	.75
R51095	1.25	2.50	.125	6	0-80	.070	2.360	1.180	1.110	—	3.25	2.875	.75
R51100	1.50	1.50	.125	6	0-80	.070	1.360	.680	1.360	—	2.25	1.875	1.00
R51110	1.50	2.00	.125	6	0-80	.070	1.860	.930	1.360	—	2.75	2.375	1.00
R51120	1.50	2.50	.125	6	0-80	.070	2.360	1.180	1.360	—	3.25	2.875	1.00
R31125	1.50	3.25	.125	6	0-80	.070	3.110	1,555	1.360	—	4.00	3.625	1.00
R51130	1.50	6.00	.125	10	0-80	.070	5.860	1.465	1.360	—	6.75	6.375	1.00
R51140	1.75	1.75	.125	6	0-80	.070	1.610	.805	1.610	—	2.50	2.125	1.25
R31150	1.75	3.00	.125	6	0-80	.070	2.860	1.430	1,610	—	3.75	3.375	1.25
R31160	2.00	2.00	.125	8	0-80	.070	1.860	.930	1.860	.930	2.75	2.375	1.50
R51170	2.00	3.00	.125	8	0-80	.070	2.860	1.430	1.860	.930	3.75	3.375	1.50
R51180	2.00	4.00	.125	10	0-80	.070	3.860	1.286	1.860	.930	4.75	4.375	1.50
R51190	2.00	5.00	.125	12	0-80	.070	4.860	1.215	1.860	.930	5.75	5.375	1.50
R51200	2.00	6.00	.125	12	0-80	.070	5.860	1.465	1.860	.930	6.75	6.375	1.50
R51205	2.50	2.50	.125	8	0-80	.070	2.360	1.180	2.360	1.180	3.25	2.875	2.00
R51210	3.00	3.00	.125	8	0-80	.070	2.860	1.430	2.860	1.430	3.75	3.375	2.50
R51220	3.00	5.00	.125	12	0-80	.070	4.860	1.215	2.860	1.430	5.75	5.375	2.50
R51225	3.00	5.00	.188	12	2-56	.094	4.812	1.203	2.812	1.406	5.75	5.375	2.50
R51230	3.00	6.00	.188	12	2-56	.094	5.812	1.453	2.812	1.406	6.75	6.375	2.50
R51250	5.00	6.00	.188	14	2-56	.094	5.812	1.453	4.812	1.604	6.75	6.375	4.50

* D = Number of cover screws

Specifications subject to change without notice

CUSTOM
FROM COMPAC'S RFT SERIES

Compac will modify our RFT Series Enclosures to meet your needs.

- Drilling
- Tapping
- Milling
- "D" Punching
- Cut Outs for Subminiature Connections
- Silk Screening, Painting

Work is done from your prints or to your specifications.

For your convenience Compac has included on page 5 a request for quote with a rendering of a Compac Case to depict your modifications.

R51110 — 138 — 0 — (N)/MOD/XXX

CASE PART NO.

CASE HEIGHT
075 - 0.75
100 - 1.00
138 - 1.38
175 - 1.75
212 - 2.12

COVER TYPE
0 - Standard flush
1 - Extended

ADD FOR NICKEL PLATE

YOUR PRINT #

TO ORDER

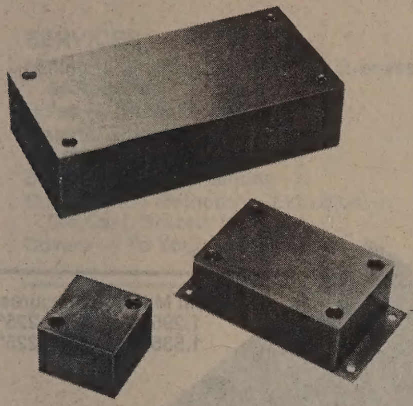
Select a case size from the RFT series, send a drawing and include: overall height, feedthru location, type (plain Teflon or filter) connector location etc. Our expertise in shielded cases can give you a truly CUSTOM design, limited only by your requirements.

COMPAC
279 SKIDMORE ROAD
DEER PARK, NEW YORK 11729
TELEPHONE 516/667-3933
TWX 510-227-1064

For More Information. Circle No. 184

COMPAC™

BLANK SERIES



- ☐ Compac Blank Series Enclosures provide up to 100 dB shielding effectiveness at 100 MHz
- ☐ Easy access and assembly
- ☐ Off-the-shelf availability

CONSTRUCTION SPECS
Frames: 6063-T5QQA200 Extruded Aluminum
Covers: 5052-H32-Aluminum
Standard Finishes
Irridite Chemifilm per MIL C 5541 CL 1 A Conformance to MIL Spec 45208A

HOW TO ORDER:

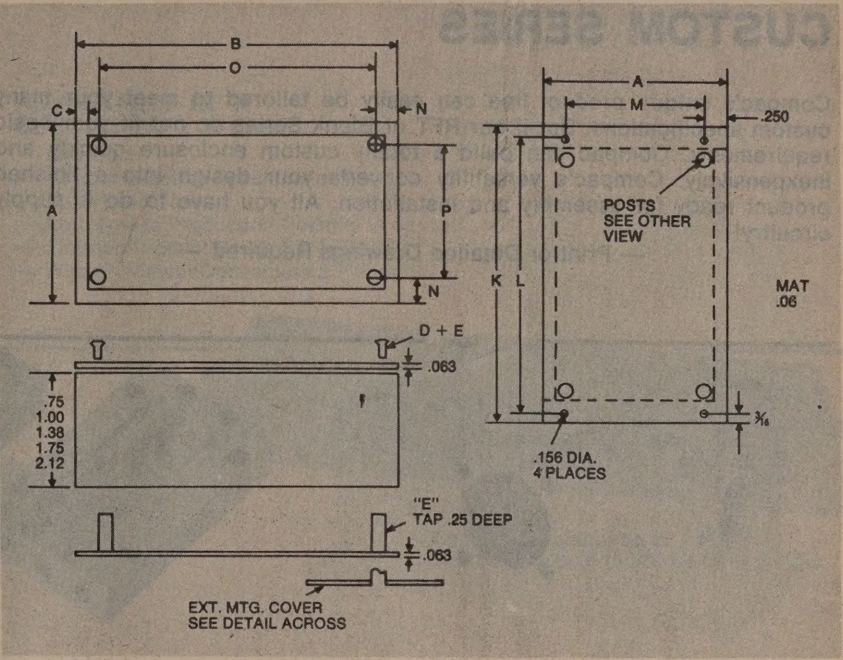
51110 — 138 — 0 — (N)

CASE PART NO.

CASE HEIGHT
075 - 0.75
100 - 1.00
138 - 1.38
175 - 1.75
212 - 2.12

COVER TYPE
0 - Standard flush
1 - Extended

ADD FOR NICKEL PLATE



	A	B	C	D	E	K	L	M	N	O	P
51080	1.00	1.00	.125	2	4-40	1.75	1.375	.50	.250	.50	.50
51090	1.25	1.25	.125	2	4-40	2.00	1.625	.75	.250	.75	.75
51095	1.25	2.50	.125	4	4-40	3.25	2.875	.75	.250	2.00	.75
51100	1.50	1.50	.125	2	4-40	2.25	1.875	1.00	.250	1.00	1.00
51110	1.50	2.00	.125	4	4-40	2.75	2.375	1.00	.250	1.50	1.00
51120	1.50	2.50	.125	4	6-32	3.25	2.875	1.00	.250	2.00	1.00
51125	1.50	3.25	.125	4	6-32	4.00	3.625	1.00	.250	2.75	1.00
51130	1.50	6.00	.125	4	6-32	6.75	6.375	1.00	.250	5.50	1.00
51140	1.75	1.75	.125	4	6-32	2.50	2.125	1.25	.250	1.25	1.25
51150	1.75	3.00	.125	4	6-32	3.75	3.375	1.25	.250	2.50	1.25
51160	2.00	2.00	.125	4	6-32	2.75	2.375	1.50	.250	1.50	1.50
51170	2.00	3.00	.125	4	6-32	3.75	3.375	1.50	.250	2.50	1.50
51180	2.00	4.00	.125	4	6-32	4.75	4.375	1.50	.250	3.50	1.50
51190	2.00	5.00	.125	4	6-32	5.75	5.375	1.50	.250	4.50	1.50
51200	2.00	6.00	.125	4	6-32	6.75	6.375	1.50	.250	5.50	1.50
51205	2.50	2.50	.125	4	6-32	3.25	2.875	2.00	.250	2.00	2.00
51210	3.00	3.00	.125	4	6-32	3.75	3.375	2.50	.250	2.50	2.50
51220	3.00	5.00	.125	4	6-32	5.75	5.375	2.50	.250	4.50	2.50
51225	3.00	5.00	.188	4	6-32	5.75	5.375	2.50	.310	4.38	2.38
51230	3.00	6.00	.188	4	6-32	6.75	6.375	2.50	.310	5.38	2.38
51250	5.00	6.00	.188	4	6-32	6.75	6.375	4.50	.310	5.38	4.38

Specifications subject to change without notice

CUSTOM
FROM COMPAC'S BLANK SERIES

Compac will modify our Blank Series to meet your needs and specifications.

- Drilling
- Tapping
- Milling
- Punching
- Traps for Subminiature Connections
- Silk Screening/Painting

Work is done from your print to your specifications.

For your convenience Compac has included on page 5 a request for quote with a rendering of a Compac Case to depict your modifications.

51110 — 138 — 0 (N)/MOD/XXX

CASE PART NO.

CASE HEIGHT
075 - 0.75
100 - 1.00
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Select a case size from the BLANK Series, send a drawing and include: overall height, feedthru location, type (plain Teflon or filter) connector location; etc. Our expertise in shielded cases can give you a truly CUSTOM design, limited only by your requirements.

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DEER PARK, NEW YORK 11729
TELEPHONE 516/667-3933
TWX 510-227-1064

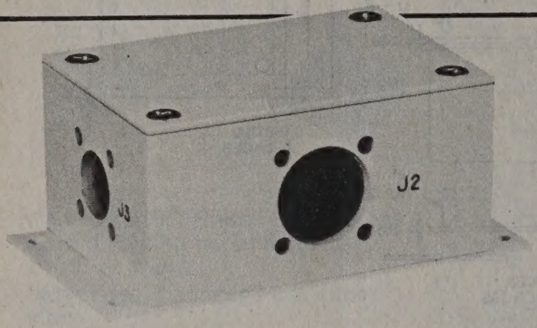
For More Information. Circle No. 184

COMPAC™

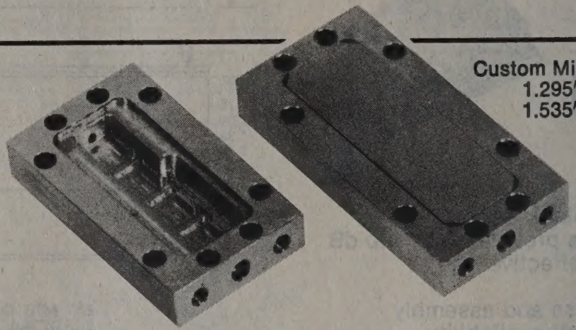
CUSTOM SERIES

Compac's unique product line can easily be tailored to meet your many custom specifications. But if our RFT or Blank Series do not fit your basic requirements, Compac can build a totally custom enclosure quickly and inexpensively. Compac's versatility converts your design into a finished product ready for assembly and installation. All you have to do is supply circuitry!

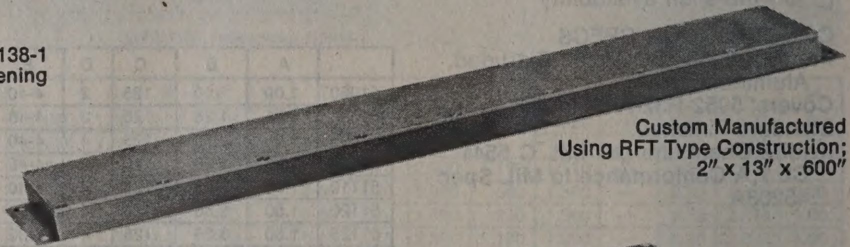
— Print or Detailed Drawings Required —



Manufactured from 51170-138-1
with Custom Drilling, Painting, and Silk Screening



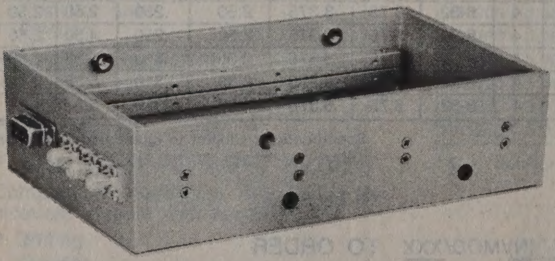
Custom Milled Enclosures,
1.295″ x .765″ x .225″
1.535″ x .765″ x .225″



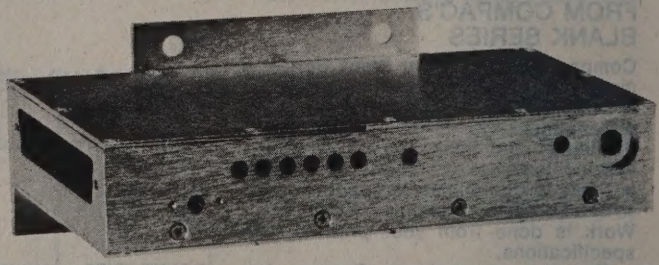
Custom Manufactured
Using RFT Type Construction;
2″ x 13″ x .600″

IF MONITOR
REF IN
VAR OUT
IF IN

Manufactured from R51210-075-1 with
Custom Drilling, Tapping, and
Silk Screening



Custom Manufactured
Using RFT Type Construction, 4.00″ x 7.00″ x 2.00″
Showing Mounting Bars, Custom Drilling for
Hardware and Connectors



Manufactured from R51230-100-0(N)
Showing Custom Mounting Plate
Drilling, Milling and "D" Punching

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Not Limited To
Examples Shown; COMPAC
Can Build To Your Specifications

For More Information. Circle No. 184

COMPAC™

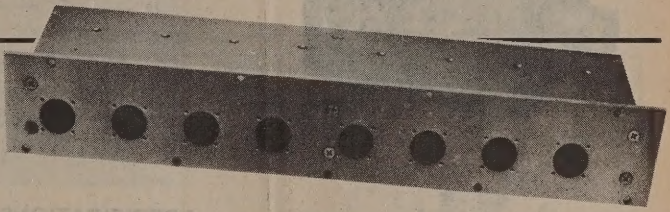
CUSTOM SERIES

SERVICES

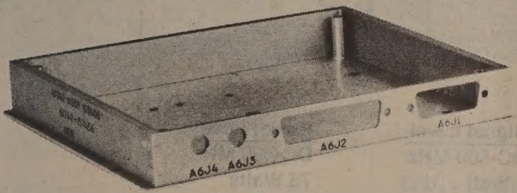
Milling — Enclosures, Channel, Grooves, as Required
Holes — Drilled or Punched
Material Thickness — To Your Specifications
Silk Screening or Painting
Construction Methods — Extrusion, Die Cast, Brazed, or Milled
Covers — To Your Specifications

ADVANTAGES OF A CUSTOM ENCLOSURE

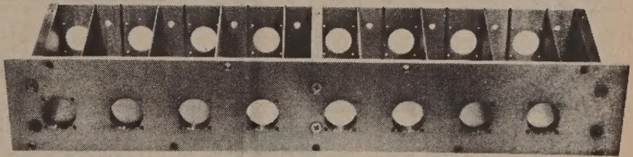
— Low Cost
— To your Exacting Specifications
— Short Lead Times
— Prototype to Production Quantity
— Finished Product Ready for Assembly
— With or Without Connectors & Filters



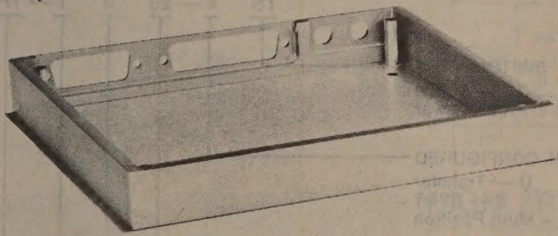
Custom Manufactured to Customer Spec's 19.00″ x 4.00″ x 6.00″



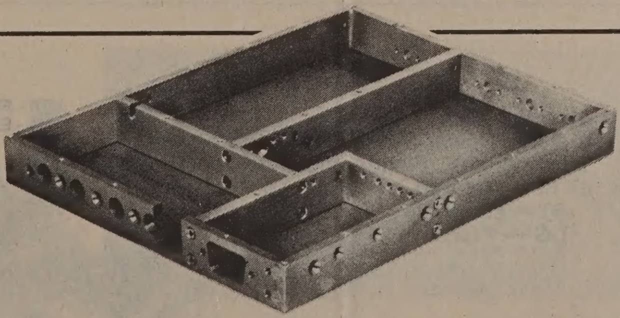
Custom Manufactured Blank Series Construction, 5.00″ x 6.00″ x .75″ Flat and Parallel to .001″ with Custom Milling, Drilling, "D" Punching and Silk Screening



View of above Enclosure Showing Interior and Partitions



View of Above Enclosure Showing Interior Milling



Custom Manufactured using RFT Construction 6.00″ x 8.00,″ x .75″, Show Custom Drilling, Milling, Counter Sinking, and Custom Partitions

Quantities from 1 pc thru production

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DEER PARK, NEW YORK 11729
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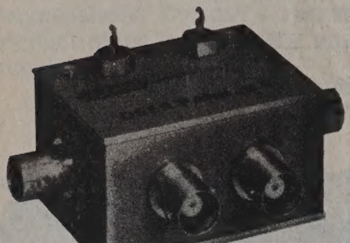
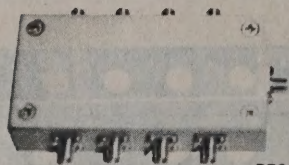
COMPAC™

RF RELAYS & TRANSFER SWITCHES



TSD 2800-PD
1.5 x 2.0 x 1.2

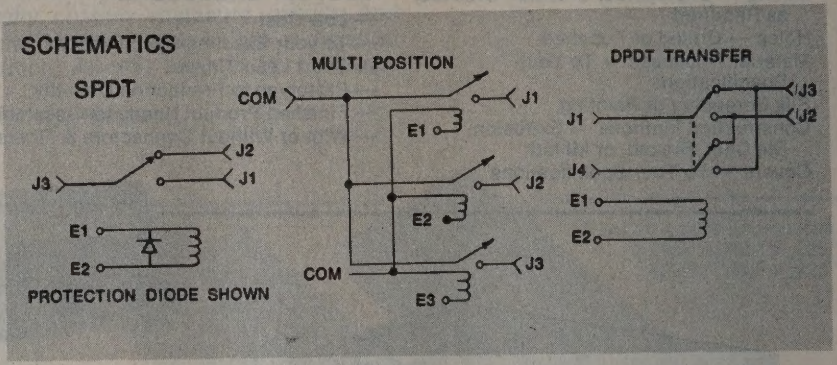
TSS 1201-TPD
1.5 x 1.5 x 1.2
ext. cover 1.5 x 2.25



PR8-2831-TTLF
3.0 x 5.0 x 1.5
ext. cover 3 x 5.75

Single Pole 2 to 16 Position
Double Pole Double Throw Transfer
Signal and Power Lever Units

- ☐ Lightweight
- ☐ Low Cost
- ☐ Small Size



SPECIFICATIONS:

	Signal Level	Power Level
Frequency Range	DC-500 MHz	DC-400 MHz
Power Level	1 Watt	75 Watts
VSWR	1.2 Typ.	1.3 Typ.
Isolation	40 dB	35 dB
Insertion Loss	0.3 dB	0.2 dB
Switching Speed	10 m Sec	15 m Sec

DETAILED SPECIFICATIONS UPON REQUEST

HOW TO ORDER

TS 4—28 0 1—TPD

SWITCH TYPE
TS — Signal
PR — Power

SWITCH CONFIGURED
D — Transfer
S — SPDT
3-16 — Multi Position

COIL VOLTAGE
05, 06, 12, 18, 24, 28

CONNECTOR TYPE
0 - BNC
1 - SMA
2 - TNC
3 - N

MOUNTING
0 - Flush
1 - Extended Flange

OPTIONS
T — Termination 50 ohm ⅛W STD
PD — Protection Diode POS COM STD
TTL — TTL Interface Active High STD
C — DC Connector D Submin Type STD
L — Latching
F — Failsafe
SPECIAL CONFIGURATIONS
Other Options Available

Also Available:
Custom Power Attenuators, Power Terminations, Flange mounted, no air flow required
50 — 800 watts
DC — 1 GHz

* OTHER OPTIONS AVAILABLE. CONSULT FACTORY *

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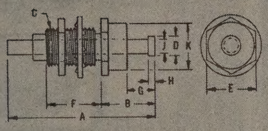
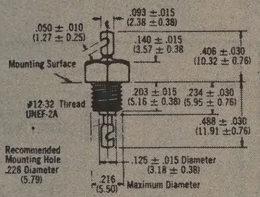
FILTERS & FEED-THRUS


C
J
D
K
H
G
E
F
B
A

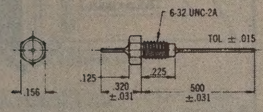
PLAIN TEFLON FEED-THRU

	DIMENSIONS									
PART NO.	A	B	C	D	E	F	G	H	J	K
100-1001	0.690	0.287	12-28 UNF-2A	0.082	0.250	0.225	0.163	0.031	0.062	0.188


.093 ± .015
(2.38 ± 0.38)
.050 ± .010
(1.27 ± 0.25)
.140 ± .015
(3.57 ± 0.38
.406 ± .030
(10.32 ± 0.76)
Mounting Surface
.203 ± .015
(5.16 ± 0.38)
.234 ± .030
(5.95 ± 0.76)
#12-32 Thread
UNEF-2A
.488 ± .030
(11.91 ± 0.76)
Recommended
Mounting Hole
.228 Diameter
(5.79)
.125 ± .015 Diameter
(3.18 ± 0.38)
.216
(5.50)
Maximum Diameter

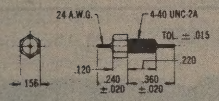
	DIMENSIONS									
PART NO.	A	B	C	D	E	F	G	H	J	K
100-1002	.874	0.406	12-32 UNF-2A	0.093	0.312	0.234	—	0.031	—	—

Capacitance 1000 pF

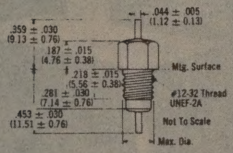

6-32 UNC-2A
TOL ± .015
.125
.225
.156
.320
±.031
500
±.031

RFI/EMI SUPPRESSION FILTERS

PART NO.	RATED I_{DC}	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1003	3 Amps	200 VDC	100 VDC	.01	.001 MFD	—	3	40	50	70	70
100-1004	10 Amps	200 VDC	100 VDC	.01	.022 MFD	10	28	50	60	60	60


24 A.W.G.
4-40 UNC-2A
TOL. ± .015
.220
.120
156
.240
±.020
.360
±.020

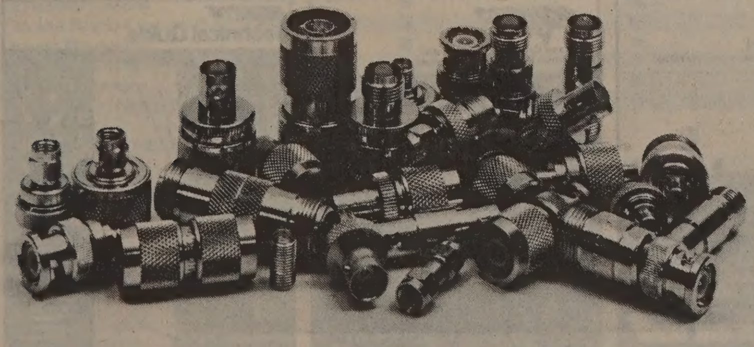
PART NO.	RATED I_{DC}	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1005	10 Amps	200 VDC	100 VDC	.01	.0015 MFD	—	5	42	60	65	65
100-1006	10 Amps	200 VDC	100 VDC	.01	.022 MFD	20	30	50	55	65	65


.044 ± .005
(1.12 ± 0.13)
.359 ± .030
(9.13 ± 0.76)
.187 ± .015
(4.76 ± 0.38)
Mtg. Surface
.218 ± .015
(5.56 ± 0.38)
.281 ± .030
(7.14 ± 0.76)
#12-32 Thread
UNEF-2A
.453 ± .030
(11.51 ± 0.76)
Not To Scale
Max. Dia.

HIGH FREQUENCY LOWPASS FEED-THRU FILTERS

PART NO.	RATED I_{DC}	WORKING VOLTS		DCR MAX.	REFER CAP - - - -	INSERTION LOSS					
		+85°C	+125°C			1 MHz	10 MHz	100 MHz	200 MHz	1 GHz	10 GHz
100-1007	10 Amps	200 VDC	100 VDC	—	5500 pf	—	10	50	70	70	70

ADAPTERS



SIMPLIFIED ADAPTER PART NUMBERS SELECT CONNECTOR TYPE

N = N	SMA = S	FEMALE = F
TNC = T	SMB = SMB	MALE = M
BNC = B	SMC = SMC	

BULKHEAD = Prefix with B
RIGHT ANGLE = Prefix with R
PANEL = Prefix with P

EXAMPLES:	PART NO.
N (male) to SMA (female)	NM-SF
TNC (female) to SMA (female)	TF-SM
BNC (male) to BNC (female)	BM-BF
SMB (male) to SMC (female)	SMBM-SMCF

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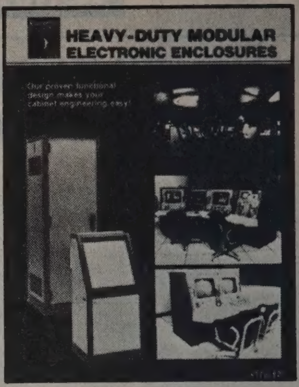
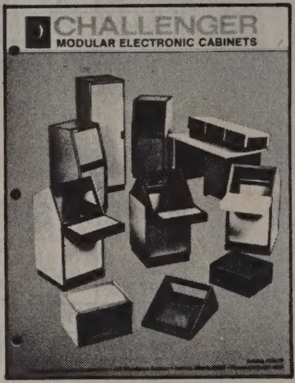
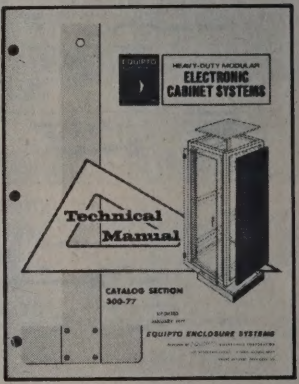

HEAVY-DUTY MODULAR ELECTRONIC ENCLOSURES
Our proven functional design makes your cabinet engineering easy!

Heavy Duty Enclosures


CHALLENGER
MODULAR ELECTRONIC CABINETS

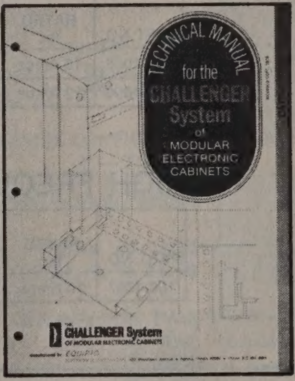
Challenger System Modular Enclosures, Fans & Blowers


HEAVY-DUTY MODULAR ELECTRONIC CABINET SYSTEMS
Technical Manual
CATALOG SECTION 300-77
EQUIPTO ENCLOSURE SYSTEMS

Heavy Duty Technical Manual

SOLID SYSTEM
MODULAR ELECTRONIC CABINETS
144 STANDARD SIZES
NEW
SOLID SYSTEM FOR SOLID SAVINGS

Economical Solid Systems


TECHNICAL MANUAL
for the
CHALLENGER
System
of
MODULAR
ELECTRONIC
CABINETS
CHALLENGER System

Challenger Technical Manual

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MODULAR ELECTRONIC DESK SYSTEMS
The most experienced manufacturer in the electronics enclosure field introduces a totally new desk system dedicated to establishing tomorrow's standards of quality and excellence.

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Instrument Cabinets

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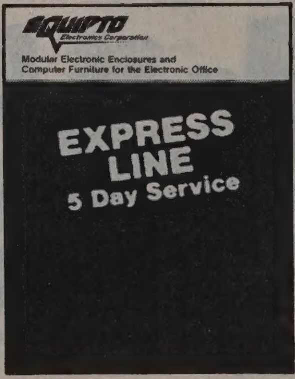
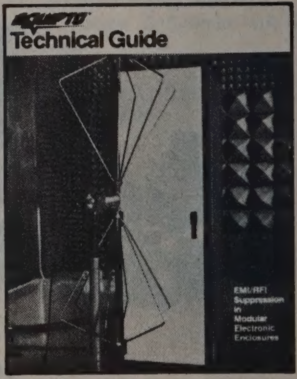
MODULAR ELECTRONIC WORK STATIONS
. . . Featuring New Static Control Systems

Quiptron Modular Work Stations


EQUIPTO
Electronics Corporation
Modular Electronic Enclosures and Computer Furniture for the Electronic Office
EXPRESS LINE
5 Day Service

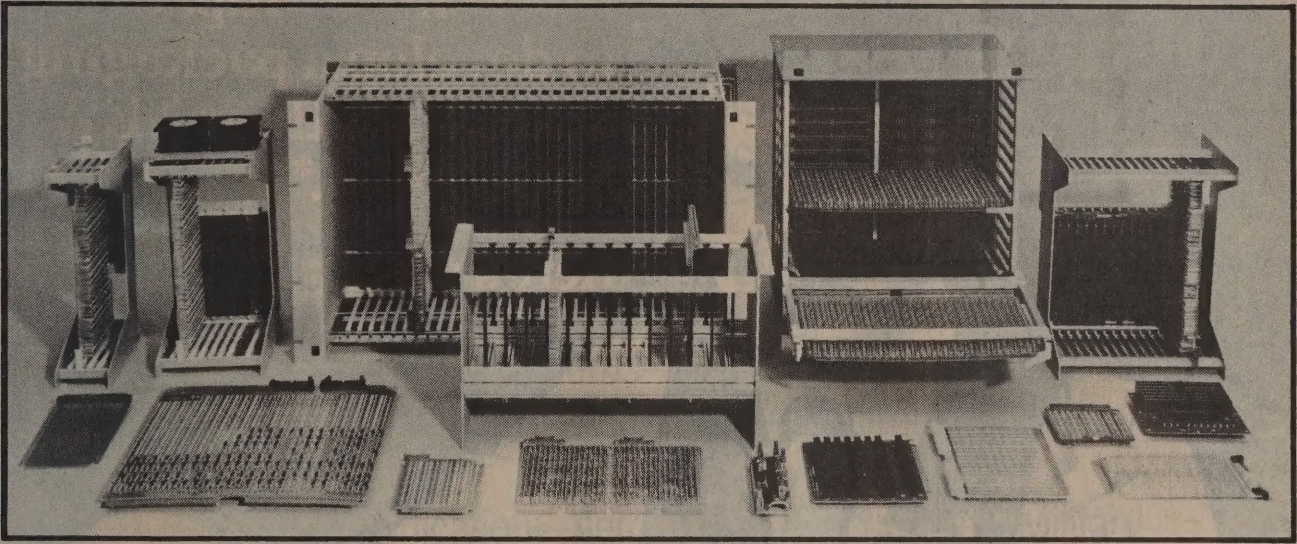
Express Line


EQUIPTO
Technical Guide
EMI/RFI Suppression in Modular Electronic Enclosures

EMI-RFI Technical Guide

For More Information. Circle No. 185

Hybricon Corporation



Business Reply Card located in Gold Book, Volume 1

DESCRIPTION	MULTIBUS[1]	VERSABUS[2]	VME	DEC[3]
WIRE WRAPPABLE BOARDS				
Plated through holes	●	▲	▲	●
Socket Pinned	●	●	●	●
High Density Version	●	●	●	▲
★ *VHF Series (up to 500 Mhz)*	★	★	★	★
Double Height (Extended)	●	●	●	●
Eurocard, Double, Triple	■	■	●	■
★ *Multilayer Double Height*	★	▲	●	▲
★ *Custom Pinning, Socket-Sert®*	★	★	★	★
Flat Cable I/O	●	●	●	●
Edge Connector I/O	●	▲	▲	▲
CUSTOM CONFIGURATIONS	▲	▲	▲	▲
EXTENDER BOARDS				
Double Sided	●	▲	▲	●
Multilayer	●	●	●	●
★ *Double Loop Test Points*	★	★	★	★
Side Braces	●	●	▲	▲
CUSTOM CONFIGURATIONS	▲	▲	▲	▲
BACKPLANE & CARD FRAME ASSEMBLIES				
Press-fit/Solder Tail	●	●	●	●
Double Sided	●	●	■	●
Multilayer	●	●	●	▲
3 to 31 slots	●	●	●	●
★ *Parallel Priority Resolution*	★	■	■	■
★ *P2 Auxiliary Board*	★	■	■	■
Fan and Bracket Assemblies	●	●	●	●
Drawer Mountable	●	●	●	●
19.0" Rack Mountable	●	●	●	●
Long Side Plates	●	●	●	●
CUSTOM CONFIGURATIONS	▲	▲	▲	▲
AUTOMATED SERVICES				
CAD Based Engineering Design	●	●	●	●
Documentation Systems	●	●	●	●
★ *Custom pinning wire wrap boards*	★	★	★	★
Wire Wrap Programming	●	●	●	●
Wire Wrapping Service	●	●	●	●
Assembly Service	●	●	●	●
Automatic Testing	▲	▲	▲	▲

Registered trademarks
1 - Intel Corporation
2 - Motorola Inc.
3 - Digital Equipment Corporation

● Standard, "Off-the-Shelf"
▲ Custom
★ Unique to HYBRICON
■ Not Applicable

Call for information today

Hybricon Corporation 410 Great Road Littleton, Massachusetts 01460 (617) 486-3174 TWX 710-347-0654

Intel chose Mupac to develop a packaging system for their NEW Multibus II.*

Here's why:

Shaun Silverio,
Director of Engineering.

Intel liked the systems approach of our standard packaging hardware. It's modular, it's flexible and it's designed to work together as one integrated system to solve your special packaging problem.

These same features are offered in Multibus Compatible Packaging, making Mupac the ideal choice for your Multibus packaging needs.

Our family of racks can handle from 2 to 26 panels in easy to use modular increments. We provide panel guides on .600 and .750 inch centers, open rack design for ease of access to installed panels and hold-down bars to facilitate shipping.

With Mupac's GND/SIG-GND/GND backplane design, you'll eliminate or drastically reduce crosstalk and noise. You'll get standard features such as terminated bus lines, provisions for parallel priority, and gold plated expansion connector fingers.

Multiple solutions to Multibus packaging is just one example of Mupac's versatile approach to packaging systems. We also furnish Wire Wrappable Panels, Leadless Chip Carrier Adapters, Pin Grid Array and High Rel IC Sockets.

If you're a Multibus user, you should make Mupac Your First Choice in Multibus Compatible Packaging for the same reasons Intel chose us to help develop Multibus II.

Call today for prices and details on the complete line.

*Registered trademark of Intel Corporation

Yes! ☑ Mupac has everything you need for Multibus*Compatible Packaging...

....Including this NEW 5 position .75 pitch Multibus rack.

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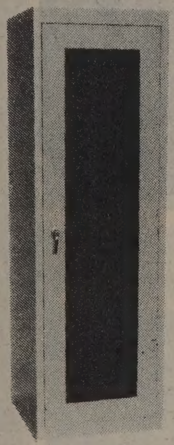
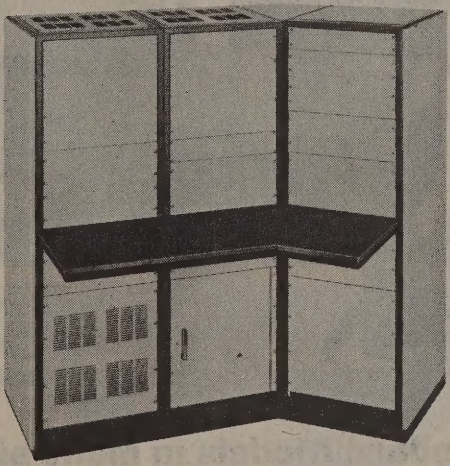
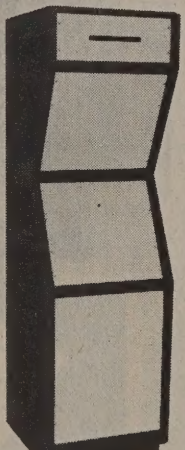
RFI & EMI SHIELDED ENCLOSURE
WITH SHIELDED WINDOW



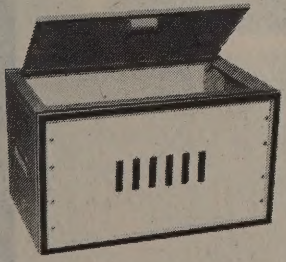
CONTEMPO VERTICAL UNIT
WELDED RACKS



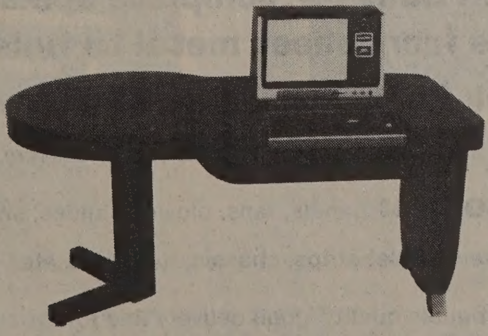
REVERSE SLOPE
CONSOLE



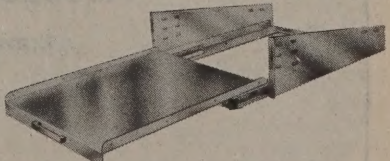
SHIELDED LIFT TOP
DESK CABINET



ERGONOMIC—WORKSTATION
WITH ANTI-STATIC LAMINATE



BASIC SLIDE
ASSEMBLIES



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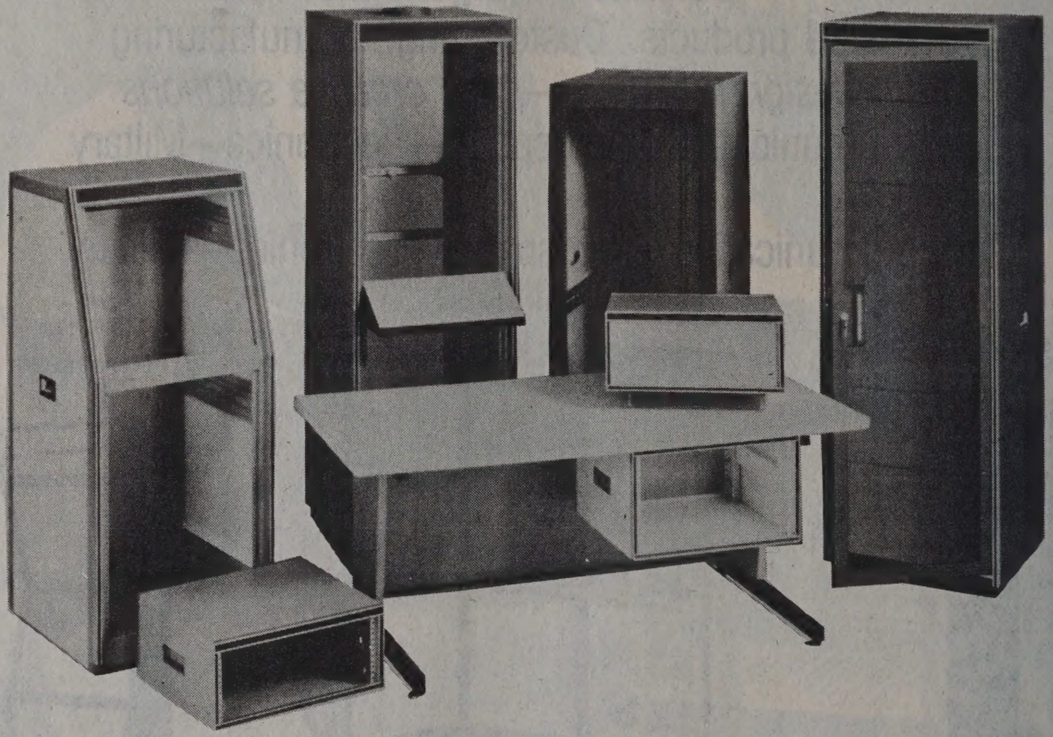
See action card Vol. #4

For More Information. Circle No. 188

CABINETS
CONSOLES
CASES



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Quick Series: Various sizes and models of racks and cases stocked for immediate delivery.

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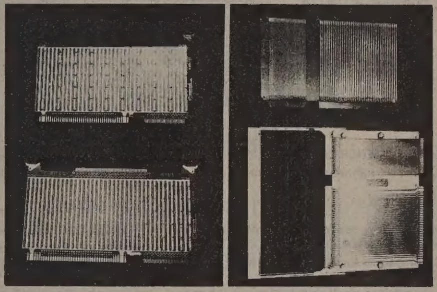
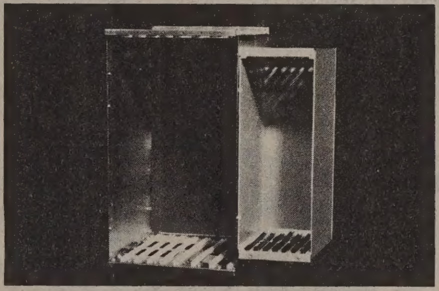
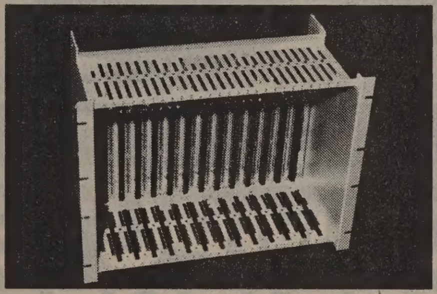


Wire Wrap Cards/Extender Cards - MBI

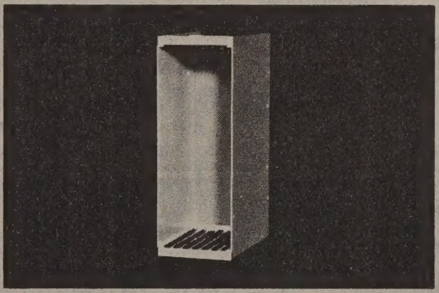


Multibus II Products

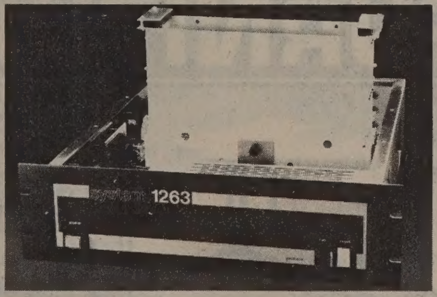


26 Slot Card Cage - MBI

- Also Available in 5, 7, 9, 11, 14, and 18, Slot



VME Products



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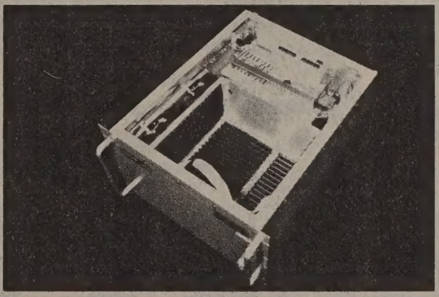
- Meets FCC Class A EMI Requirements
- Available in 4, 11, and 18 Slot



Military EMI/RFI
Power Ready Chassis - MBI

- Meets MIL STD 461 EMI Requirements

Call and discuss your requirements with us

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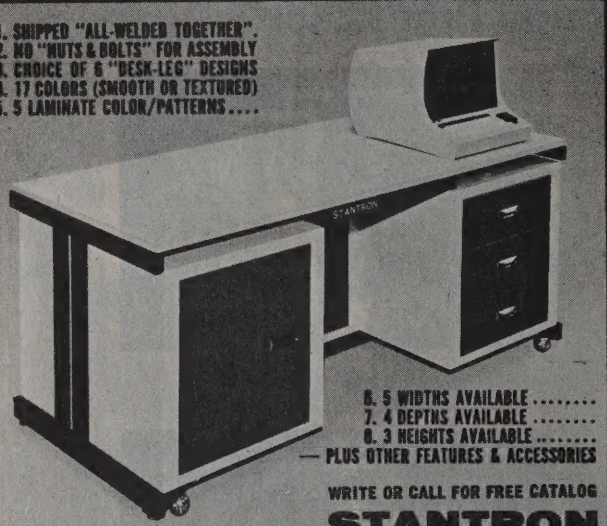
COMPUTER PERIPHERAL FURNITURE



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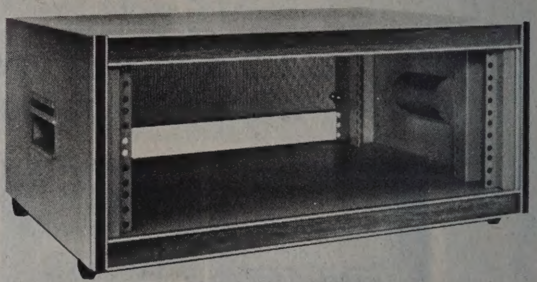
• INCLUDES REAR PERFORATED PANEL • LIGHT WEIGHT •



STANTRON BENCH CABINETS are designed to meet most electronic industry standards, featuring lightweight, rugged construction, distinctive styling and economy pricing.

●

CONSTRUCTION DETAILS

- CASE BODY: One piece welded 20 GA steel with four (4) fixed 16 GA steel mounting angles.
- Mounting angles have $\frac{9}{32}$" clearance holes; 8 (10-32) clip nuts supplied.
- Rear perforated panel included. (1¾" open @ bott.)
- FINISH: STANTRON #21-T Textured Royal Blue.
- TRIM: Extruded, anodized aluminum with pecan vinyl inlay top and bottom and black vinyl inlay in vertical extrusion and handle.
- Four (4) rubber feet.

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5. 5 LAMINATE COLOR/PATTERNS....
6. 5 WIDTHS AVAILABLE............
7. 4 DEPTHS AVAILABLE............
8. 3 HEIGHTS AVAILABLE............

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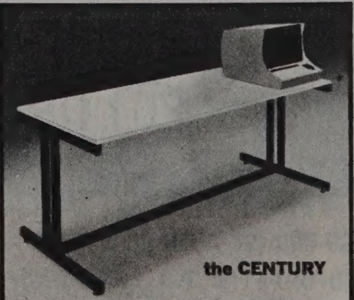

the CENTURY

the EXECUTIVE

For More Information. Circle No. 191

Rack Mount and Stand Alone Enclosures

Aluminum die castings and fabrications provide mechanical ruggedness. Features such as mounting rails, die cast handles, popular sizes, and attractive color choices and finishes give you design flexibility. Call now for detailed catalogs or to discuss your application requirements.

Rack Mount

- **CH Series.** Heavy duty rack mount units in four EIA panel heights (3½", 5¼", 7", and 8¾"). Die cast handles. Easy access from top, bottom, or rear.

Rack Mount or Stand Alone

- **R Series.** Precision die cast aluminum R series enclosures are available in two EIA heights: 3½" and 5¼". Rack and half rack sizes.

- **SR Series.** Features side bumpers and flush-mounted retractable carrying handles. Vacuum-formed protective front panel cover.

Stand Alone

- **L Series.** Aluminum L series cases feature interior mounting rails for PC boards. Two standard sizes: 12"W x 5"H x 10"D and 8½"W x 4"H x 10"D. Optional lock-position carrying handles for tilt-up use.

All available in a wide range of finishes and colors.

Other enclosure models feature pistol grips, panel mounts, belt clips, and underdash mobile mounts.

Custom printed and CNC turret punched panels.

Tracewell Enclosures, Inc.
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Telephone: (614) 846-6175

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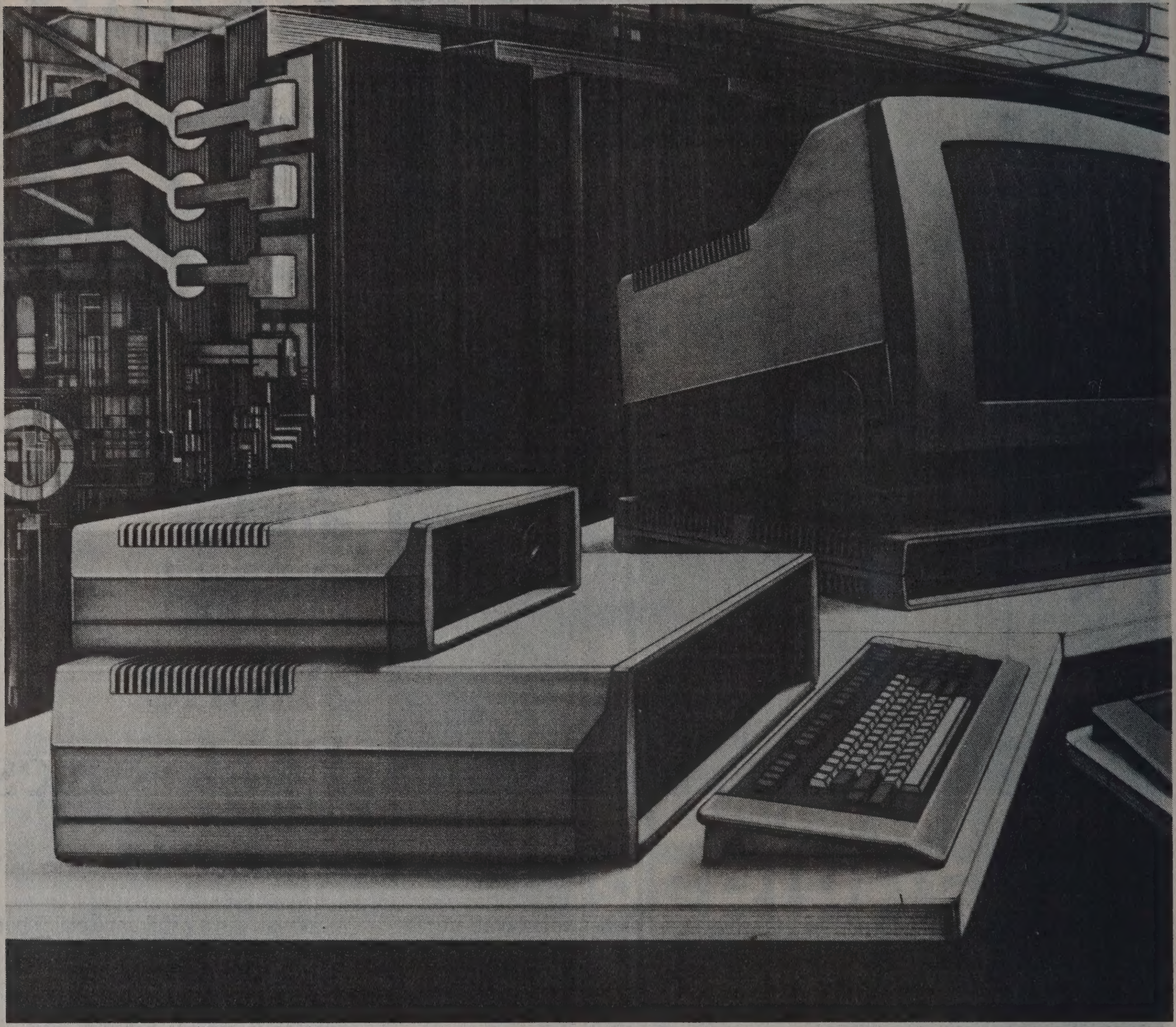
Tracewell Enclosures



REAL RFI/EMI Shielding in new Tracewell Enclosures

New OEM computer enclosures injection molded of Mobay's* 40% aluminum flake-filled resin, Bayblend ME-6540, provide RFI/EMI shielding and maximum design freedom.

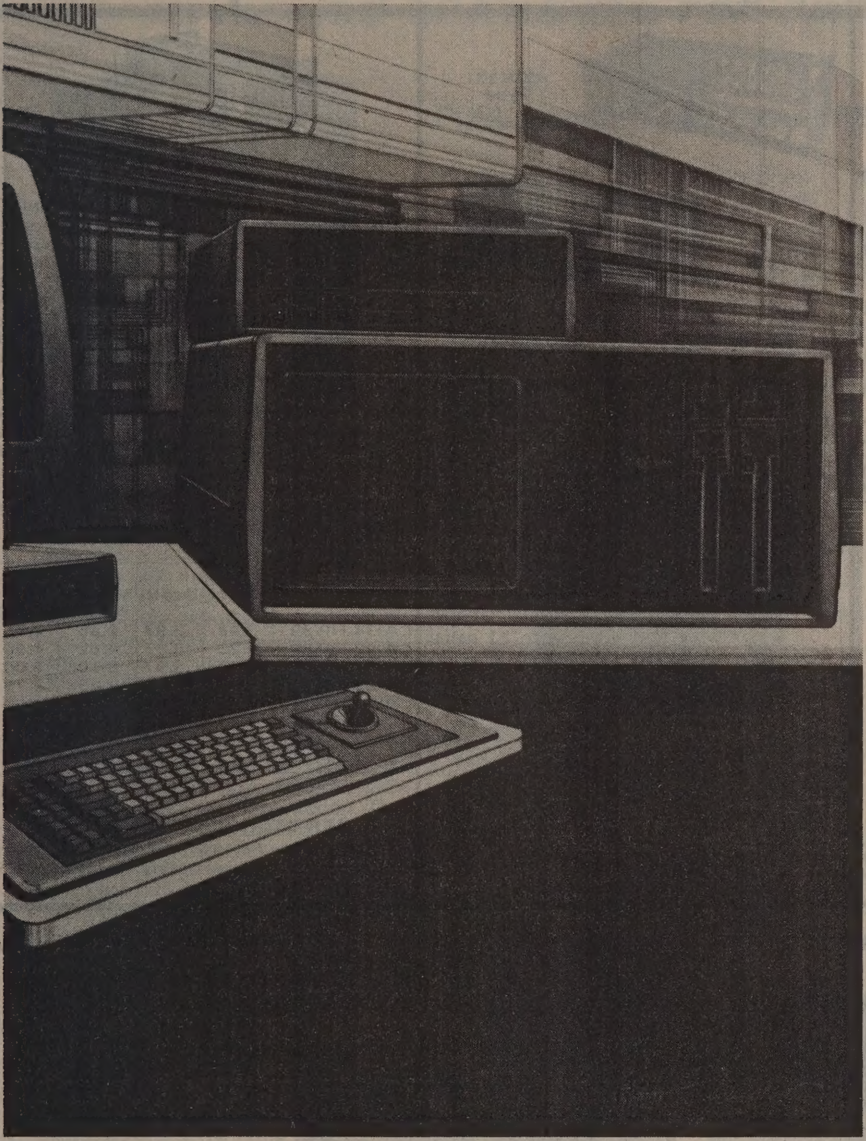
The material is flame retardant and provides 99.99% EMI shielding effectiveness. Its 50-45 dB attenuation over a 0.5-1000 mHz frequency range eliminates the need for further EMI processing.

System 15 enclosures are designed with overlapping joints, proper slot geometry, and positive electrical continuity throughout. Brass inserts join tops, bottoms, and panels for positive grounding. The aluminum flake is from Transmet

Tracewell Enclosures

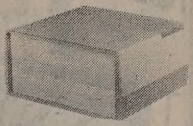
*Mobay Chemical Corporation, Plastics and Coatings Division/Pittsburgh, PA 15205/412-777-2000.

For More Information. Circle No. 192



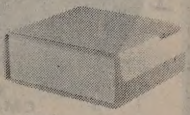
System Enclosures

- Removable top vent for plug-in PC cards. Accepts 19″ EIA front panel.



917

- 10″H x 20″W x 20″D.
- Sized for 12″ CRT, two 8″ floppy disks, card cage and power supply.



717

- 8″H x 20″W x 20″D.
- Sized for 9″ CRT, 5¼″ disk, card cage, and power supply.

Keyboard Enclosures

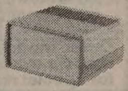
116

- 1.5″H x 20″W x 7″D with a 9° angle.
- Sized for 5 row low profile keyboard.

316

- 2″H x 20″W x 9″D with a 9½° angle.
- Sized for 7 row keyboard with palm rest and joystick or track ball.

Extension Enclosures



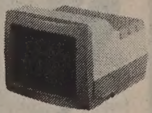
681

- 7″H x 13″W x 13″D.
- Sized for 7″ CRT, and 5¼″ disk or bus system with power supply.

381

- 4″H x 13″W x 13″D.
- Sized for 5″ CRT, and mini or micro floppy disk.

CRT Enclosures

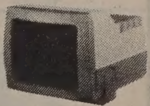


151

CRT Enclosures

- Sized for 14″ color or 15″ black and white CRT.

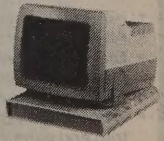
Kit or chassis mount.



152

Enclosure and yoke

- Tilts and swivels.
- Mounts on 917, 717, and 153 base.



153

Enclosure, yoke, and base

- Base sized for two half high 5¼″ floppy disk and large PC board.

Corporation and incorporated in the resin to provide EMI shielding and excellent heat dissipation. System 15 houses most current designs for CRTs, disk drives, keyboards, and all popular busses including VME.

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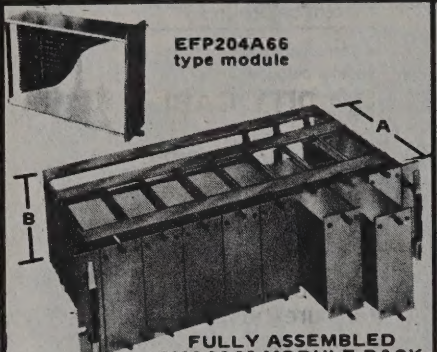
RACK MOUNTING CARD & MODULE CAGES
DESK TOP INSTRUMENT CASES

Vector



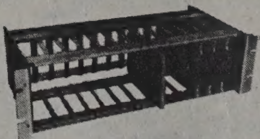
FULLY ASSEMBLED CMA3A20 MODULE RACK

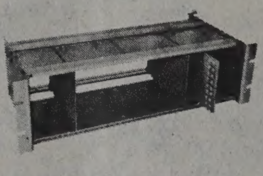
with added handles, filler panels, EFP204A66 modules

Vector-Pak Module Racks are supplied completely assembled, ready for EFP modules. Connectors mount anywhere along bracket-mounted struts which are pre-loaded with 4-40 nuts. All aluminum, natural anodized finished racks provide sturdy custom-looking housing. Fit standard 19" racks.

Part No.	Description	"A" Dim.	"B" Dim.
CMA3A16	Assembled module rack for ten 1.6"w. x 6.6"lg. modules (EFP164A66)	9"	5¼"
CMA3A20	Assembled module rack for eight 2"w. x 6.6"lg. modules (EFP204A66)	9"	5¼"
CMA4A20	Assembled module rack for eight 2"w. x 9.6"lg. modules (EFP204A97)	12"	5¼"
CMA4A30	Assembled module rack for five 3" w. x 9.7" lg. modules. (EFP304A97)	12"	8¾"

Order modules separately • 66 module, 6 rack models available off the shelf • Contact Vector for special requirements



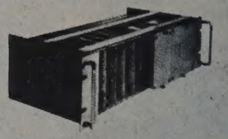


CARD RACKS FULLY ASSEMBLED

Vector Card Racks fit 19-inch racks and are supplied completely assembled ready for cards. Connectors mount without hole drilling to bracket mounted aluminum struts which have captive 4-40 nuts. 5¼" high unit holds cards 3" to 4½" wide by 6.5" or 9.6" long. 8¾" high unit holds cards 6½" to 7.98" wide by 9.6" long. Sturdy aluminum construction used throughout except on CCK13P which has nylon guides.

Part No.	Description
CCK13	Assembled rack 5¼"h. x 19" w. x 8.9" deep with 21 pairs of guides installed on ¾" centers. Also available – CCK13P w/plastic guides
CCK17	Assembled rack 8¾"h. x 19" w. x 12" deep with 21 pairs of guides installed on ¾" centers
CCK3	Assembled rack 5¼"h. x 19" w. x 8.9" deep with continuous card guides top & bottom

Table top cases, doors, & accessories available • 20 models available off the shelf • Fast production on custom models



MULTI-PURPOSE CAGE KITS

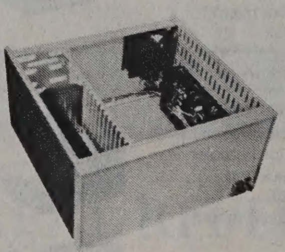
For those applications where pre-assembled units lack the versatility needed due to special size requirements, etc., multi-purpose kits are available. These adjust to all card, module or receptacle size within range. Kits are supplied unassembled and have all required hardware. Major parts include 2 aluminum flanged side walls formed and slotted for standard rack mounting 6 extruded aluminum T-struts (cross members) with mounting brackets and printed scale marking plus large assortment of required and extra screws, nuts, and lock washers. Card guides must be ordered separately. Special features of these kits are: slotted side walls for maximum mounting versatility — bracket mounting for all cross members (T-struts) for forward-backward positioning.

Kit Part No.	Height	Depth	Max. Module Height	Max. Card Height
CA-34-HP-89	3.48	8.97	2.85	2.75
CA-52-HP-89	5.23	8.97	4.62	4.50
CA-87-HP-89	8.73	8.97	8.10	8.00
CA-34-HP-119	3.48	11.97	2.85	2.75
CA-52-HP-119	5.23	11.97	4.62	4.50
CA-87-HP-119	8.73	11.97	8.10	8.00
CA-52-HP-156	5.23	15.72	4.62	4.50
CA-87-HP-156	8.73	15.72	8.10	8.00

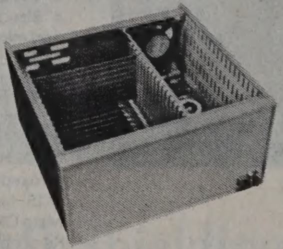
USER DESIGNED PACKAGING

All parts of the extensive Vector-Pak system may be purchased separately to speed packaging prototypes.

STD-BUS & S100-BUS COMPUTER MAINFRAMES

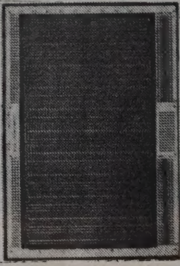


VP200
STD BUS MAINFRAME



VP100
S100 BUS MAINFRAME

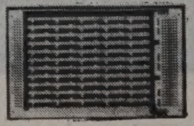
- Heavy duty power supplies
- All-metal construction for shielding; 9" x 17" x 17"
- EMI line filter and spike limiter
- Cooling fan with EMI filter and finger guard
- Easy access by sliding out top cover
- Beige vinyl clad aluminum covers, brushed clear anodized aluminum trim and panels
- Rack-mountable on customer-supplied slides
- STD-Bus 16-slot motherboard, S100-Bus 12-slot motherboard with faraday shield lines, superior power and ground busing and decoupling capacitors
- Mainframe includes key-operated power switch; lighted reset button; one unswitched and two switched 110 V AC convenience outlets; covered holes on rear for DB25 connectors for terminal, printer, modem and networking, two DB50 connectors for disk drives; two centronics connectors for printers and BNC connector for video out



EUROCARDS FOR GENERAL USE PLUS VME BUS, RM65 AND CIMBUS

Sizes per DIN 41494.
Accept 96-position type C connector per DIN 4161Z

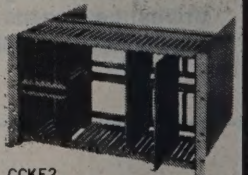
- Holes drilled & plated-thru, .043" dia. on 0.1" grid.
- Accept any width DIP ICs.



Single size: 3.94" x 6.3" x .062"
4614: 3-hole-pad and bus board
4614-2: Wire wrapping bus board
4614-3: Pad-per-hole board (.080" dia. solder pads around each hole).
Double size: 9.19" x 6.3" x .062"
4615: 3-hole-pad & bus board
4615-2: Wire wrapping bus board
4615-3: Pad-per-hold board (.080" dia. solder pad around each hole).

EUROCARD RACKS

CATALOG NUMBER		DESCRIPTION	CAGE SIZE HIGH	WIDE	DEEP
CCKE1	†	Assembled	5¼"	19"	14¼"
CCKE1U	†	Unassembled			
CCKE2	†	Assembled	10½"	19"	14¼"
CCKE2U	†	Unassembled			
DK1	★	25% divider kit for CCKE2	CARD HEIGHT IN MILLI-METERS	100 mm 233.4 mm	
DK2	★	50% divider kit for CCKE2		100 mm 233.4 mm	
DK3	★	75% divider kit for CCKE2		100 mm 233.4 mm	
DK4	★	100% divider kit for CCKE2		100 mm 233.4 mm	



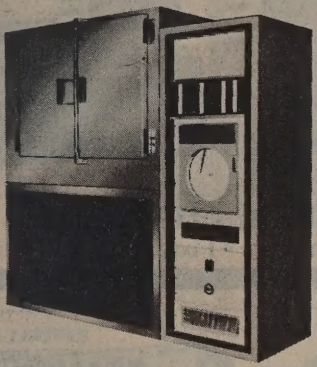
CCKE2
EUROCARD RACK
WITH DK1 DIVIDER KIT
INSTALLED
(10 pairs of card guides supplied.)

FAST PRODUCTION ON CUSTOM MODELS

VECTOR ELECTRONIC COMPANY, 12460 Gladstone Avenue, P.O. Box 4336, Sylmar, CA 91342-0336 Phone (818) 365-9661

BLUE M

ADVANCED CHAMBERS FOR CRITICAL WORK



FULL RANGE TEMPERATURE/HUMIDITY CABINETS

Feature PRO-CON Microprocessor-Based Programmer-Controller providing: dry bulb entry and digital display in °F. or °C. with 0.1° accuracy; direct R.H. input; zero crossover firing; split range control with dual P.I.D.; 98% R.H. truly obtainable; automatic refrigeration function; energy-efficient design. RS-232C computer interface, printer and wattage dissipation capability optional. Range: −18°C. to +93°C. (+200°F.) Popular sizes. Representative of a complete line of temperature/humidity chambers including exclusive air-cooled models.

MICROPROCESSOR CONTROLLED CHAMBERS

State-of-the-art instrumentation makes fully automated programmed operation a matter of pushing buttons. The only limitations in programming flexibility are the inherent capabilities of the chambers, and they, in turn, have been engineered to be completely compatible with the instrumentation. These facilities thus represent perfectly matched systems providing the finest, most reliable performance available today.

The list below shows the variety of Blue M chambers now available with this remarkable instrumentation. The Full Range Temperature/Humidity, described in detail above, is another, and typifies the quality of them all. Full information on them is available from your local Blue M Branch Office or from our headquarters.

VERSA-RANGE® TEST CHAMBERS — Standard and High-Powered high-low cabinets.

DUAL THERMAL SHOCK TEST CABINETS

INERT GAS OVENS — Standard (to +316°C.) and Ultra-Temp® (to +593°C.)

ULTRA-TEMP OVENS — to +704°C.

MECHANICAL CONVECTION HIGH-POWERED OVENS — to +343°C.

HIGH-POWERED INDUSTRIAL BATCH OVENS — to +316°C.

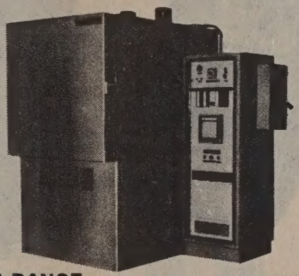
PHOTOELASTICITY OVENS

STABIL-GLOW® INDUSTRIAL BOX TYPE FURNACES — to +1177°C.

RAD-O-GLOW® GLOBAR® FURNACES — to +1450°C.

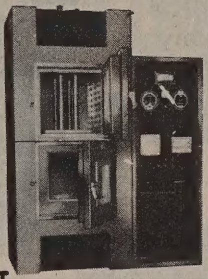
TEMP-O-LOY ANNEALING OVENS — to +704°C.

STABIL-THERM® LN$_2$ CONSTANT TEMPERATURE ENVIRONMENTAL CABINETS — from −120°C. to +300°C.



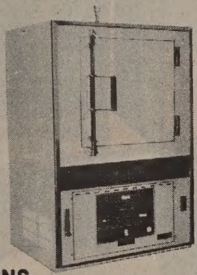
VERSA-RANGE REFRIGERATED TEST CHAMBERS

Two versatile ranges: −73°C. to +204°C. and −40°C. to +121°C. Sizes from 3 to 64 cu. ft. Also high powered microprocessor models, chest type chambers, and LN$_2$ units.



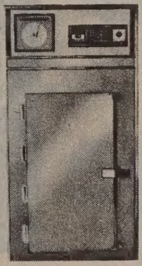
THERMAL SHOCK TEST CHAMBERS

Dual cabinets for Mil 202 and 883. Work chamber moves automatically between hot and cold chambers for in-spec performance. Also baths for liquid-to-liquid shock tests.



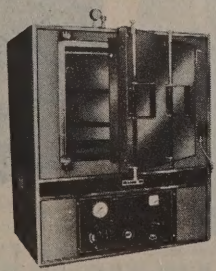
CLEAN ROOM OVENS

Provide Class 100 — or better — first air; 99.97% filtering of particles to 0.3 microns. Push-button operation. Also new Step Curing Epoxy Ovens for semiconductor industry processing.



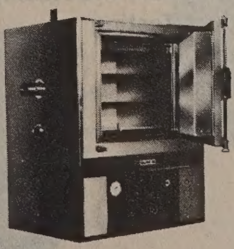
REDESIGNED BURN-IN OVENS

Ready for fixturing with all needed engineering, operational, and safety features built-in. Exclusive Digital Setpoint SCR Control has zero crossover SCR firing, balanced 3-phase operation.



INERT GAS OVENS

Complete line — from manual to fully automated control. To +593°C., sizes to 24 cu. ft. Also Life Test Ovens — manual or programmed, and Class A Batch Ovens.



FRICTION-AIRE, OVENS WITHOUT HEATERS

Air turbulence heats to +260°C. Three models U.L. Listed for Class 1, Group D service have +150°C. range. Others built to N.E. Code for Class 1, Group D locations.

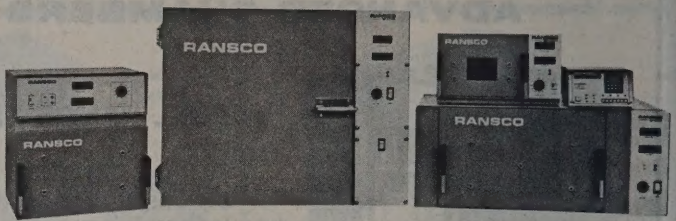
BLUE M

A UNIT OF GENERAL SIGNAL

138TH & CHATHAM STREETS, BLUE ISLAND, ILLINOIS 60406
(312) 468-7755 • 385-9000 • TWX 910-689-3398

ENVIRONMENTAL SIMULATION EQUIPMENT

- Temperature: -300° to + 1000°F
- Humidity: 5% RH to 95% RH
- Altitude: Ambient to 300,000 Ft.
- Sizes: 0.4 Cu. Ft. to 5000 Cu. Ft.

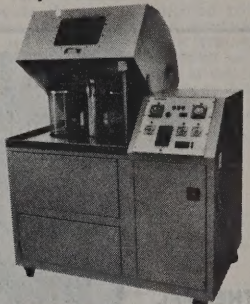


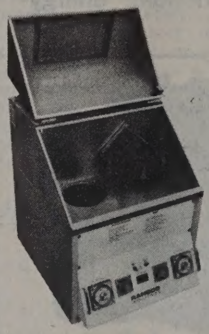
BENCH TEMPERATURE CHAMBERS

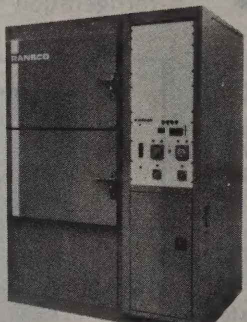
8 Models • Programmers • Fixtures

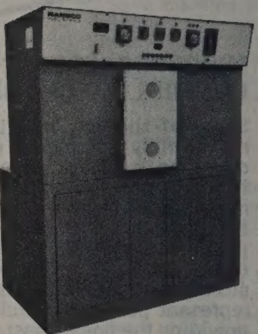
THERMAL SHOCK - TEMPERATURE CYCLING

Liquid to Liquid
Air to Air
Vertical
Rotary



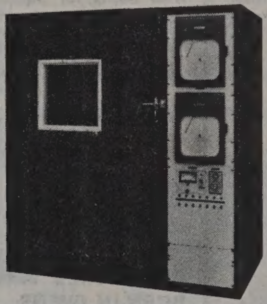


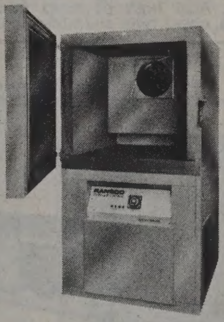


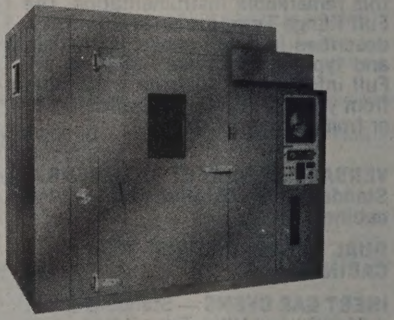


ENVIRONMENTAL SIMULATION CHAMBERS AND ROOMS

Temperature-Humidity
Temperature

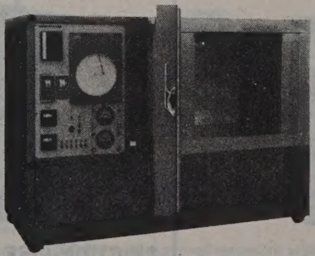


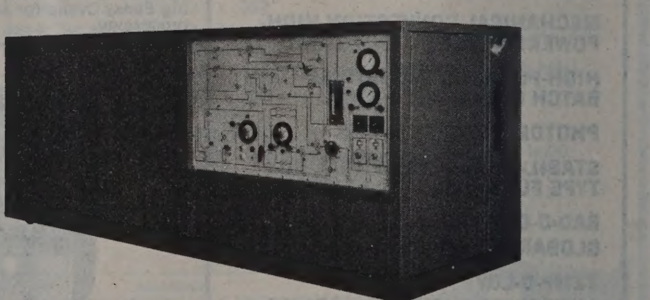




CUSTOM DESIGN

Air or Fluid Conditioners
Temperature Processing
Product Testing
Vibration
Altitude





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A Subsidiary of **DESPATCH** INDUSTRIES, INC.
2201 Statham Blvd., Oxnard, CA 93033 • Telex 6-59235
(805) 487-7777
Sales and Service Offices in Principal Cities

Tenney ENGINEERING, INC.

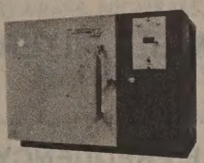
ENVIRONMENTAL TEST EQUIPMENT

The Largest and Most Experienced Manufacturer of High Technology Environmental Test Equipment

144 Springfield Rd., Union, New Jersey 07083 • (201) 686-7870

BENCHTOP TEMPERATURE CHAMBERS

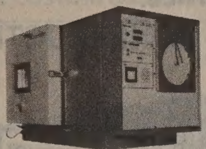
Work space:
1¼ and 5 cubic feet.
Temperature range:
−80°C to +200°C



Bulletins 108 and 123

BENCHTOP TEMPERATURE-HUMIDITY CHAMBERS

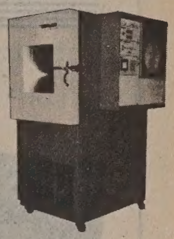
Workspace:
3 and 5 cubic feet
Temperature range:
−73°C to +200°C
Humidity capabilities:
20% RH to 98% RH



Bulletins 101 and 123

TENNEY SERIES HIGH-LOW TEMPERATURE AND TEMPERATURE HUMIDITY TEST CHAMBERS

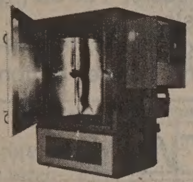
Workspace:
6 cubic feet
64 cubic feet
Temperature range:
−80°C to +200°C
Humidity: Optional



Bulletins 104 and 144

TH & T SERIES MODERATE RANGE TEMPERATURE-HUMIDITY CHAMBERS

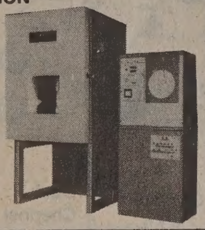
Workspace:
27 cubic feet and
65 cubic feet
Temperature range:
Low to −18°C
High to +93°C
Humidity: Optional



Bulletin 139

MIL-STD 781 AGREE TEMPERATURE- VIBRATION CHAMBERS

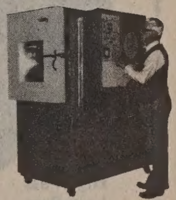
Size:
Available in sizes for mating with vibrator units having table tops from 4 square feet to 40 square feet
MicroTenn Standard



Bulletin 105

TENNEYSTRAT ALTITUDE- TEMPERATURE CHAMBERS

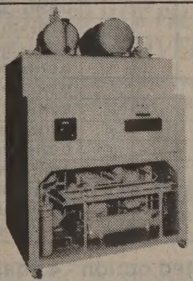
Workspace:
3.2 cubic feet thru 64 cubic feet
Temperature range:
−73°C to +177°C
Altitude: to 200.000 feet
Humidity: Optional



Bulletin 141

LOW TEMPERATURE PROCESS EQUIPMENT

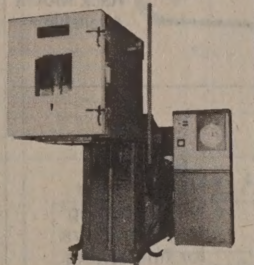
Packaged Refrigeration Systems
Temperature range:
Low to −73°C
High to +121°C



Bulletin 114

VIBRATION/ TEMPERATURE CHAMBERS

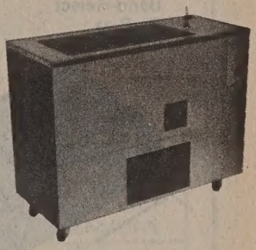
Workspace:
Standard from 5 cubic feet to 64 cubic feet
Temperature range:
−73°C to +200°C
Humidity: Optional



Bulletin 102

MULTI-RANGE PRECISION TEMPERATURE BATHS

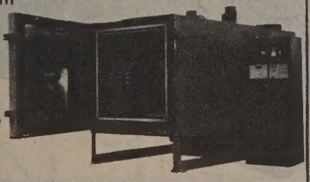
Workspace:
One gallon and nine gallon
Temperature range:
−73°C to +120°C



Bulletins 107 and 125

CERT SYSTEMS

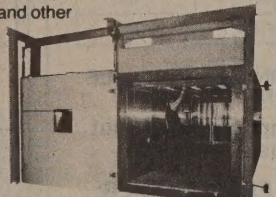
Combined Environment Reliability Testing Systems provide temperature, humidity, altitude, random vibration and cooling air simulation. Permits simulation of mission profile environments.



Bulletin 134

WALK-IN ROOMS

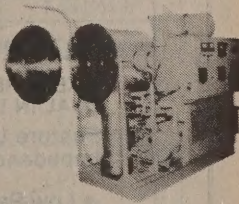
For burn-in, temperature, humidity, altitude and other controlled environment testing. Custom-engineered in unitized or semi-unitized packages as well as modular panels.



Bulletin 113

THERMAL VACUUM SPACE SIMULATORS

Workspace:
Standard 1½ feet to 6 feet diameters
Vacuum capability:
to 2×10^{-8} Torr.
Temperature range: From −196°C to +177°C



Bulletin 120

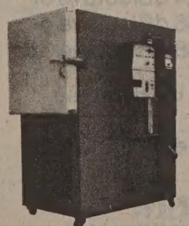
THERMAL SHOCK CHAMBERS

Two zone, three zone and dual loading capabilities. Vertical or horizontal configurations. Designed for MIL-STD 883/202 shock testing.
Workspace:
2, 8 and 10 cubic feet. Microprocessor controls standard.

Bulletin 121

VACUUM CHAMBERS AND VACUUM OVENS

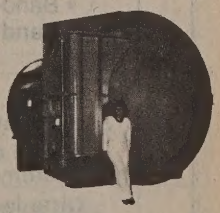
Workspace:
4 cubic feet thru 27 cubic feet
Temperature range:
to +150°C
Vacuum capability:
to 169 microns
(200,000 feet)



Bulletin 110

AUTOCLAVE SYSTEMS

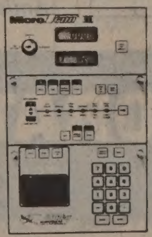
Sizes:
Small laboratory models to large production units
Temperature range:
+400°C
Pressure to 800 psig.
Vacuum: Optional



Bulletin 122

MICROTENN®II

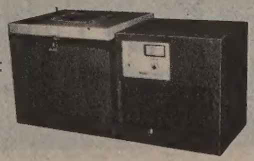
Microprocessor Programmer-Controller automatically signals chamber to perform programs entered via the keyboard or by the Command Cartridge. Computer interfaces are available.



Bulletin 137

TENNEY SUB-ARCTIC INDUSTRIAL CABINETS AND COLD STORAGE CHESTS

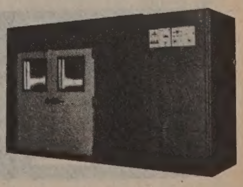
Workspace:
6 cubic feet thru 12 cubic feet
Temperature range:
Low to −80°C
High to +177°C



Bulletin 115

BURN-IN CHAMBERS

Size and number of doors may be specified to meet any burn-in requirement
Typical temperature range:
0°C to +60°C



Bulletin 133

For More Information. Circle No. 196

Active Electronic Filters

Instruments and custom-built modules. Expert assistance in filter selection. Fast prototype service.

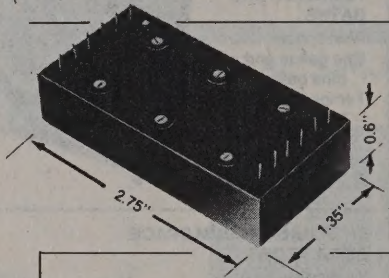
NEW! HYBRID CONSTRUCTION PROGRAMMABLE FILTERS

VARIABLE FREQUENCY FILTER
A.P.CIRCUIT CORP
HIGH PASS
LOW PASS
BAND PASS
BAND REJECT
BY PASS
HP DC
LP DC
GAIN
DAMPED
NORMAL
FREQ. Hz
POWER
ON
OFF
IN
OUT

High-Pass
Low-Pass
Band-Pass
Band-Reject
By-Pass

AP 200L SERIES
5.5 lbs. 3 kg.

Dual
Channel
Rack Mount
Available



6 pole
Band Pass
Band Reject
with trimming
potentiometers
for fine tuning

VARIABLE FREQUENCY INSTRUMENTS FEATURE:

- Low Noise (50 micro Volt RMS)
- High Input, Low Output impedance
- 0 dB insertion loss or +20 dB Preamplifier
- 24 dB / octave slope
- Frequency range 0.01 Hz to 5 MHz
- Portable battery operated option

Partial List of Models	FUNCTION Low Pass	High Pass	Band Pass	Band Reject	Tuning Range	
APVL-43-5	✓				0.02Hz–2KHz	A
APVL-44-5	✓				0.2Hz–20KHz	A
APVL-45-5	✓				2.0Hz–200KHz	A
APVH-43-5		✓			0.02Hz–2KHz	A
APVH-44-5		✓			0.2Hz–20KHz	A
AP255-5	✓	✓	✓	✓	0.2Hz–20KHz	B
AP260-5	✓	✓	✓	✓	0.1Hz–10KHz	B
AP265-5	✓	✓	✓	✓	0.02Hz–2KHz	B
AP280-5	✓	✓	✓	✓	2.0Hz–200KHz	B
AP220-5	✓	✓	✓	✓	20Hz–2MHz	B
AP 301			✓		0.1–10KHz	B
AP 401			✓	✓	0.1–10KHz	B

A: Rack mounted option - 4 channel std.
B: Rack mounted option - 2 channel std.

FILTER MODULES

FIXED FREQUENCIES • EXTERNALLY TUNEABLE
DUAL IN LINE CONSTRUCTION

Feature Low Noise, High Input, Low Output Impedance. O insertion Loss.

- Low-Pass
- High-Pass
- Band-Pass
- Band Reject

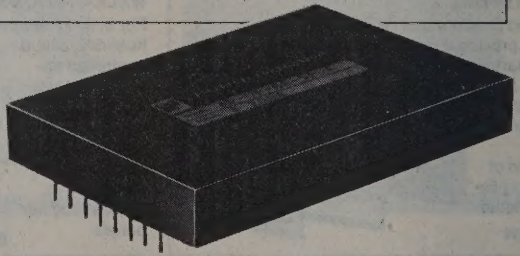
STD. FREQUENCIES:
0.01 Hz—500 KHz
4 pole 24 dB/octave or
6 pole 36 dB/octave or
8 pole 48 dB/octave

High Q Band reject including 60 Hz noise elimination filter.

Signal conditioning units assembled to customer specifications.

Ultra low power options available

For a complete catalog and additional information write to Dept. P.



Programmable Filters

Model AP-DP-8S-5P

Cut off Frequency	Bit 3	Bit 2	Bit 1
f_0	0	0	0
$2f_0$	0	0	1
$4f_0$	0	1	0
$8f_0$	0	1	1
$16f_0$	1	0	0
$32f_0$	1	0	1
$64f_0$	1	1	0
$128f_0$	1	1	1

Voltage Tunable Filters*

MODEL AP-6VC

6 Pole Voltage-Controlled
- Low-Pass
- High-Pass
- Band-Pass
- Band-Reject

**Particularly useful as Antialiasing Filters*

A. P. CIRCUIT CORPORATION

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epc
CORPORATION

MANUFACTURERS OF ACTIVE AND PASSIVE FILTERS—DC TO 500MHz.

LOWPASS, HIGHPASS, BANDPASS, BANDREJECT CUSTOM OR STANDARD DESIGNS.

FILTER TYPES

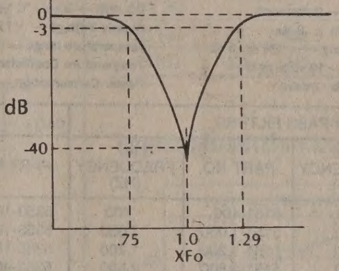
- Elliptic
- Chebychev
- Butterworth
- Bessel
- Gaussian
- Legendre
- Inverted Chebychev
- Audio Frequency
- Equalizers
- Harmonic
- IF
- Video
- Telemetering
- Tone, Telegraph
- Constant group delay
- Wideband Band Pass
- Phase matched
- Attenuation matched

Components manufactured to rigid MIL-STD specifications with operating temperature range from −55°C to + 125°C.

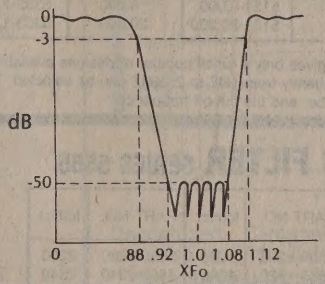
CUSTOM BUILT FILTERS PROMPT DELIVERY

The filters listed here are some of the typical units we build. We can design filters to your exact specifications. Call for more information.

ACTIVE NOTCH FILTER

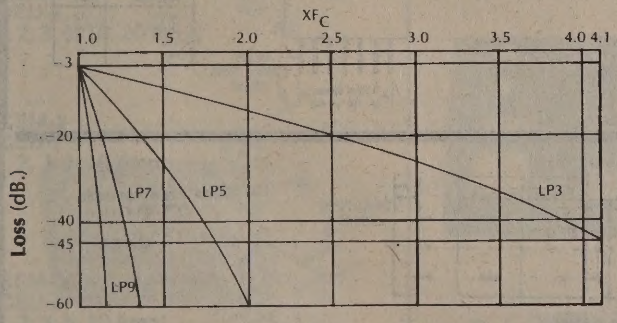


LC BAND REJECT FILTER



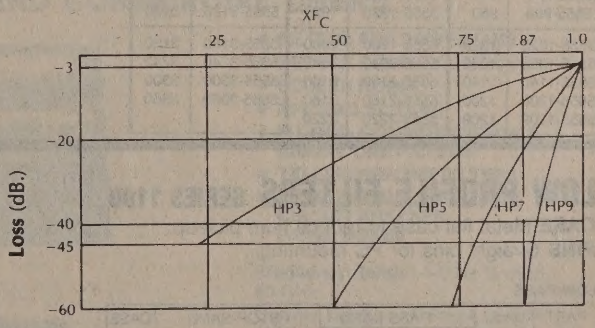
LC LOW PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
LP3	>45dB @ 4.1 Fc & above	1x1x.6″
LP5	>60dB @ 2 Fc & above	1.25x1.25x.6″
LP7	>60dB @ 1.35 Fc & above	1.5x1.5x.6″
LP9	>60dB @ 1.15 Fc & above	2x1.75x.6″



LC HIGH PASS SERIES

SERIES TYPE	STOPBAND	MAX. CASE DIMENSIONS
HP3	>45dB @ .24 Fc & below	1x1x.6″
HP5	>60dB @ .5 FC & below	1.25x1.25x.6″
HP7	>60dB @ .74 Fc & below	1.5x1.5x.6″
HP9	>60dB @ .87 Fc & below	2x1.75x.6″



LC NARROW BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
NB-2	±2	.98 Fo & 1.02 Fo	.85 Fo & below 1.17 Fo & above
NB-3	±3	.97 Fo & 1.03 Fo	.80 Fo & below 1.25 Fo & above
NB-4	±4	.96 Fo & 1.04 Fo	.74 Fo & below 1.35 Fo & above

LC WIDEBAND BANDPASS SERIES

SERIES TYPE	PERCENT BANDWIDTH (3dB)	PASSBAND 3dB. MAX @	STOPBAND >60dB. @
WB-25	25	.87 Fo & 1.14 Fo	.58 Fo & below 1.70 Fo & above
WB-50	50	.78 Fo & 1.28 Fo	.38 Fo & below 2.60 Fo & above
WB-100	100	.62Fo & 1.62 Fo	.21 Fo & below 4.65 Fo & above

CASE DIMENSIONS: 2″x1.75″x.6″ MAX

ELECTRONIC PRECISION COMPONENTS CORPORATION

11 SANDFORD BLVD., MT. VERNON, N.Y. 10550 • TELEPHONE (914) 664-2333

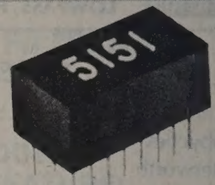
For More Information. Circle No. 198

data delay devices, inc.

385 Lakeview Ave., Clifton, N.J. 07011
Tel: (201) 772-1106

SHORT FORM CATALOG

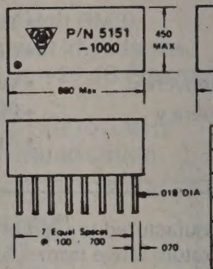
DIP-ACTIVE FILTERS SERIES 5151-5353



SPECIFICATIONS

- **Transfer characteristics** — Butterworth
- **Gain in pass-band** — 0 db ± .2 db.
- **Cut-off frequency accuracy** — ± 2% @ -3 db.
- **Maximum input voltage** — 10 volts peak.
- **Skirt Attenuation** — 24 db / octave.
- **DC drift** — 20uV / °C typical.
- **Supply Voltage** — ±15V typical (±9V to ±18V operational).
- **Temperature range** — 0° to +70°C (standard); -55°C to + 125°C (on request).
- **Temperature Coefficient** — .03% / °C. Better on request.
- **Power Consumption** — 200MW Maximum.

LOW-PASS FILTERS				HIGH-PASS FILTERS			
PART NO.	3 db FREQUENCY (HZ)	PART NO.	3 db FREQUENCY (HZ)	PART NO.	3 db FREQUENCY (HZ)	PART NO.	3 db FREQUENCY (HZ)
5151-1	1	5151-400	400	5353-10	10	5353-2,500	2,500
5151-10	10	5151-1,000	1,000	5353-100	100	5353-3,250	3,250
5151-20	20	5151-1,200	1,200	5353-160	160	5353-4,000	4,000
5151-40	40	5151-2,500	2,500	5353-400	400	5353-13,000	13,000
5151-50	50	5151-4,000	4,000	5353-500	500	5353-16,000	16,000
5151-100	100	5151-5,000	5,000	5353-1,000	1,000	5353-20,000	20,000
5151-200	200	5151-20,000	20,000	5353-1,800	1,800		



FUNCTION	PIN #
INPUT	1
OUTPUT	11
GND	15
V+	12
V−	8

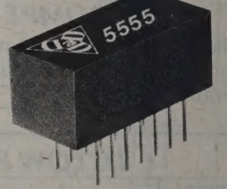
NOTE: The above table gives only a small number of designs available. Many other designs are availabe on request. Any frequency from 1HZ to 25KHZ can be selected. To make a part number, simply use the basic series number and the cut-off frequency.

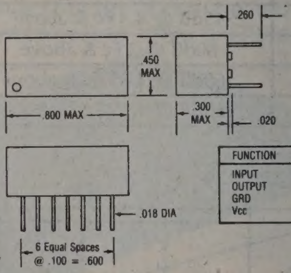
BAND-PASS FILTER SERIES 5555

PART NO.	fc(Hz)	PART NO.	fc(Hz)	PART NO.	fc(Hz)
5555-360	360	5555-1260	1260	5555-2280	2280
5555-420	420	5555-1320	1320	5555-2340	2340
5555-480	480	5555-1336	1336	5555-2400	2400
5555-540	540	5555-1380	1380	5555-2460	2460
5555-600	600	5555-1440	1440	5555-2520	2520
5555-560	660	5555-1477	1477	5555-2580	2580
5555-697	697	5555-1500	1500	5555-2640	2640
5555-720	720	5555-1560	1560	5555-2700	2700
5555-770	770	5555-1620	1620	5555-2760	2760
5555-780	780	5555-1633	1633	5555-2820	2820
5555-840	840	5555-1680	1680	5555-2280	2880
5555-852	852	5555-1740	1740	5555-2940	2940
5555-900	900	5555-1800	1800	5555-3000	3000
5555-941	941	5555-1860	1860	5555-3060	3060
5555-960	960	5555-1920	1920	5555-3120	3120
5555-1020	1020	5555-1980	1980	5555-3180	3180
5555-1080	1080	5555-2040	2040	5555-3240	3240
5555-1140	1140	5555-2100	2100	5555-3300	3300
5555-1200	1200	5555-2160	2160	5555-3360	3360
5555-1209	1209	5555-2220	2220		

SPECIFICATIONS

- **Response:** See graph.
- **Gain @ fc:** 10 db typical.
- **Center Frequency Accuracy:** ±1%.
- **Input Voltage:** 1v rms Max.
- **Supply Voltage:** 15Vdc.
- **Temperature Range:** 0° to 70°C.
- **Temperature Coefficient:** .03%/°C.
- **Power Consumption:** 625 MW @ 25°C.
- **Output Load:** 600 Min.

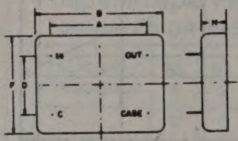


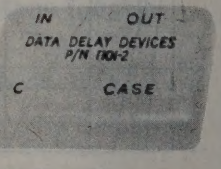


FUNCTION	PIN #
INPUT	12
OUTPUT	10
GRD	7
Vcc	14

LOW PROFILE FILTERS SERIES 1100

CASE Metal flat case to reduce hum pick-up.
PINS Straight pins for PC mounting





LOW-PASS

PART NO.	Imp. IN/OUT	PASS-BAND (1db)	PASS-BAND (3db)	STOP-BAND	CASE NO.
1101-1	10K	DC to 460Hz	600Hz	40db above 750Hz	1
1101-2	600	DC to 3KHz	3.4KHz	40db above 4.2KHz	1
1101-3	10K	DC to 4.4KHz	5KHz	43db above 6.3 KHz	1
1101-4	1K	DC to 9KHz	10KHz	43db above 12.8KHz	1
1101-5	600	DC to 15KHz	18KHz	43 db above 23KHz	1
1101-6	600	DC to 43KHz	50KHz	43db above 64KHz	2

BROAD BAND-PASS

PART NO.	Imp. IN/OUT	PASS-BAND	STOP-BAND (36db) BELOW	STOP-BAND (36db) ABOVE	CASE NO.
1103-1	10K	1KHz to 2KHz	0.5KHz	4KHz	3
1103-2	10K	2KHz to 4KHz	1KHz	8KHz	3
1103-3	10K	4KHz to 8KHz	2KHz	16KHz	3
1103-4	10K	10KHz to 20KHz	5KHz	40KHz	4

HIGH-PASS

PART NO.	Imp. IN/OUT	PASS-BAND (1db)	PASS-BAND (3db)	STOP-BAND	CASE NO.
1102-1	10K	300Hz & above	200Hz	40db below 140Hz	1
1102-2	10K	600Hz & above	400Hz	40db below 280Hz	1
1102-3	10K	1.2KHz & above	800Hz	40db below 560Hz	1
1102-4	10K	3KHz & above	2KHz	40db below 1.4KHz	2
1102-5	10K	6KHz & above	4KHz	40db below 2.8KHz	2

CASE DIMENSIONS

CASE	A		B		D		F		H	
NO.	IN.	M.M.	IN.	M.M.	IN.	M.M.	IN.	M.M.	IN.	M.M.
1	1.4	35.56	1.875	47.63	1.4	35.56	2.0	50.8	0.5	12.70
2	1.4	35.56	2.0	50.8	0.8	20.32	1.5	38.1	0.375	9.53
3	1.4	35.56	2.0	50.8	0.8	20.32	1.5	38.1	0.5	12.70
4	0.8	20.32	1.25	31.75	1.0	25.4	1.75	44.45	0.375	9.53

DATA DELAY DEVICES INC. • 385 Lakeview Avenue, Clifton, N.J. 07011 • (201) 772-1106

LOW PRICE — ON SHELF — STANDARDS CERTIFICATION

FIL-COIL RFI/EMI POWER LINE FILTERS

Electrical Specifications

LEAKAGE CURRENT:
Line to Ground
@ 115 VAC 60 Hz — .65 mA
@ 250 VAC 50 Hz — 1.25 mA

TEST VOLTAGE:
Line to Ground — 2250 VDC
Line to Line — 1450 VDC

OPERATING FREQUENCY: 50-400 Hz

RATED VOLTAGE: 115-250 VAC

Usage

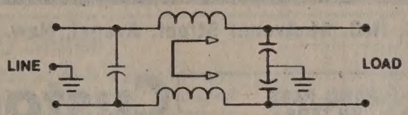
FCEIA SERIES (Econo-Universal)
Line to Ground Protection

FCEIJ Series (Econo-Super)
Line to Line and
Line to Ground Protection

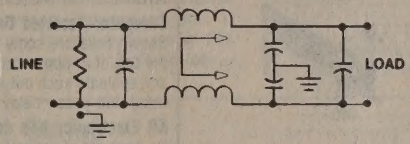
FCEIG SERIES (Econo-Med)
Patient Care Equipment

Customers Inquiry Should Specify: Rated Voltage, Current, Line Freq., Max. Operating Ambient Temp. @ Rated Current, Max. Leakage Current (Line to Ground), Humidity Range, Current Overload, Dimensions, HiPot (Line to Ground and Line to Line), Insulation Resistance, Insertion Loss.

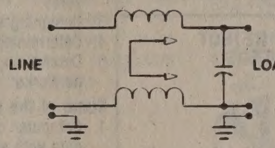
FCEIA SERIES



FCEIJ SERIES



FCEIG SERIES



Fil-Coil Numbering Code

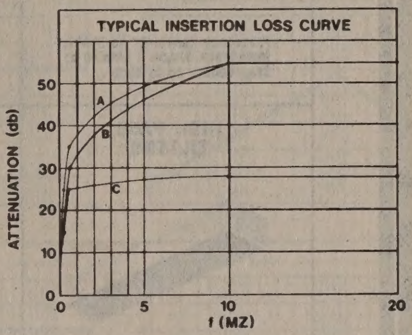
FCEIA - 2 - 5
Amperes
Configuration (Line & Load Termination)
Series

Fil-Coil Series will carry U.L., CSA, VDE, SEV, SEMCO, ASA, CISPR approvals as required and will meet FCC Rules, Part 15, subpart "J".

MIL-STD-220 Insertion Loss (db)

	Frequency			MHz	
Amp	.15	.2	.5	10	20
1, 3 (A)	20	25	35	55	55
2, 5, (B) 10, 20	15	20	30	55	55
30 (B)	15	20	30	55	55
6 (C)	12	15	25	28	28

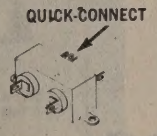
Typical Insertion Loss Curve



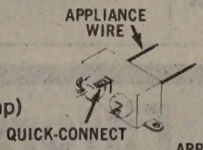
Recognized Components, Electromagnetic Noise Filter (UL 1283), for use in:
Data Processing (UL-478)
Medical & Dental (UL-544)
Office Appliance (UL-114)
Graphic Arts (UL-775)
Teaching & Instruction (UL-960)

Configurations

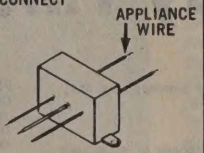
FCEIG-1
(6 Amp only)
FCEIA-1
FCEIJ-1
(1, 2, 3, 5, 10, 20 Amp)



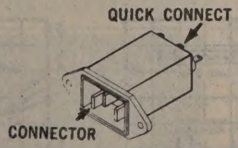
FCEIA-2
FCEIJ-2
(1, 2, 3, 5, 10 Amp)



FCEIA-3
FCEIJ-3
(1, 2, 3, 5, 10 Amp)

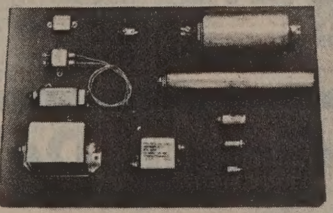


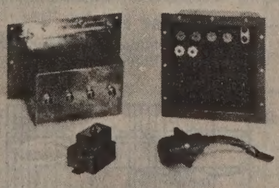
FCEIG-4
(6 Amp only)



RFI/EMC EXCELLENCE

ELECTRONIC FILTERS FOR MILITARY, INDUSTRIAL AND COMMERCIAL USERS





- FILTERS FOR POWER LINE
- SECURE CONMUNICATIONS
- SCREEN ROOM
- RFI/EMC FILTERS
- FIL-COIL COMMUNICATION & SIGNAL LINE FILTERS
- TELEPHONE LINE FILTERS
- RF FILTERED & SHIELDED CIRCUIT BREAKER PANEL BOXES

Frequency Range — 0 Hz to over 50 GHz

Current Range — 0 Amps to over 1500 Amps

Voltage Ratings — Up to 2400 V.A.C.: 10,000 V.D.C.

Quality 1. Complies with MIL-F-15733
2. Where required, manufactured to UL, QPL, CSA, VDE and other international testing standards

UL APPROVED

fil-coil

SEND FOR FREE CATALOG

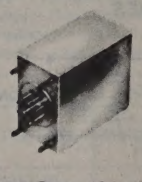
ECONOMY INTERNATIONAL, INC.
800 AXINN AVE., GARDEN CITY, NY 11530 • TELEPHONE (516) 294-5445

KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (201) 636-1900

LOW PASS FILTERS

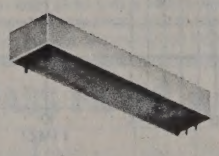
Frequency Range: DC to 50MHz
Impedance Range: 1 ohm to ∞
Stop Bands: 10 to 80db

BAND PASS FILTERS



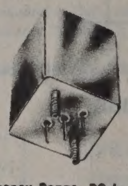
Frequency Range: DC to 50MHz
Band Width: 1% to >100%
Stopband: 10 to 80db
Impedance Range: 1 ohm to ∞

HIGH PASS FILTERS



Frequency Range: DC to 50MHz
Impedance Range: 1 ohm to ∞
Step Bands: 10 to 80db

BAND REJECT FILTERS



Frequency Range: DC to 50MHz
Band Width: 1% to >100%
Stop Band: 10 to 80db
Impedance Range: 1 to ∞

Custom LC Filters

☐ Filters ☐ Attenuation Equalizers ☐ Group Delay Equalizers ☐ Cable Equalizers ☐ Phase Equalizers ☐ Phase and Attenuation Matched ☐ Delay Lines

Computer-Assisted Design

Shown here are some typical examples of our LC filter design capabilities. Through the use of in-house computers, plus computer time-sharing, we can quickly generate and evaluate such output data as frequency vs. impedance, attenuation, phase, group delay and phase delay in order to provide an immediate quotation.

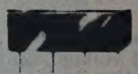
KR Electronics has computer programs for:

1. Analysis of network behavior to determine attenuation, phase, group delay, transient response and response to a step function and a tone burst.
2. Predistortion of a network and synthesis of a network directly from the poles and zeros.
3. Designing equal ripple group delay networks from your error curve.
4. Determining a network's tolerance sensitivity and reliability.
5. Determining degree of success that can be achieved in production of matched networks.

Some of the specialized test equipment used:

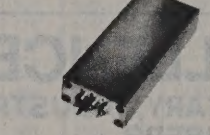
1. Computer controlled HP 3042A automatic test set can supply tabular or graphic data with each unit.
2. Programmable synthesizer, phase, gain test sets.
3. Swept low frequency group delay and attenuation test set.
4. Spectrum analyzer.
5. Swept high frequency test set.

DIP Filters



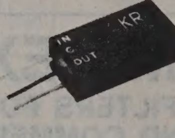
For information on our complete line of DIP filters, send for comprehensive catalog.

MATCHED PHASE & ATTENUATION



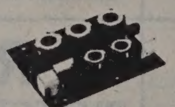
Typical Specifications:
Phase Matched ± 2½° in Pass Band
Attenuation Matched ±.25db in Pass Band for use in Sonar & other multi channel systems.

MAXIMUM FLAT DELAY (BESSEL) FILTER



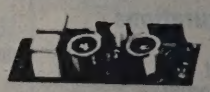
Size (Typical): .75" x .75" x 1.5"
Frequency Range: 1.5KHz to 1MHz
Z Range: 50 to 10 K
Overshoot: <1%
Delay Flat: <2% to Fc

LINEAR GROUP DELAY VIDEO FILTER



Typical Specifications:
L.P. Cutoff: 4.5 MHz
I.L.: <1db
Passband Ripple: <±.1db
Pass Band Delay Distortion: <25 nsec.
Stopband: >25db

GROUP DELAY & ATTENUATION EQUALIZER NETWORK



To correct system introduced delay distortion & attenuation roll off.

Constant Group Delay Filters

Computer-designed and checked to give equal ripple delay over the pass band insuring exact delay and attenuation characteristics.

Frequency Range: DC to 50 MHz
Impedance Range: 1 ohm to ∞
Temperature Range: —55°C to +125°C.
Complete Encapsulation
Hermetic Seal
P.C. Board Construction
Case Configuration:
Stock or Custom Designed
P.C. Card
Dual In-Line
Standard Hardware Program

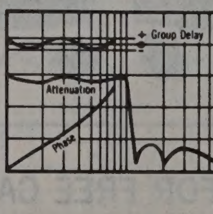
All filters conform to applicable mil specifications.

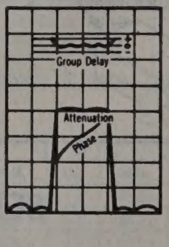
Phase & Attenuation Matching

Differential phase and attenuation matched to eliminate the need for adjustments in multi-channeled systems.

Linear Phase Filters

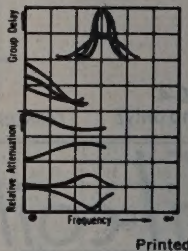
To reduce distortions and lower transient response in modulated systems.





Equalizers

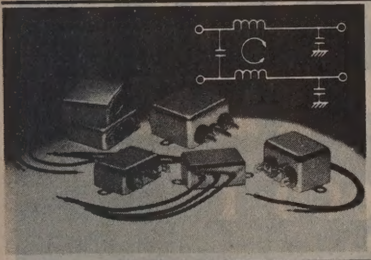
Phase/Delay/Attenuation
Computer-designed correction networks derived from system error curves.



Printed in USA

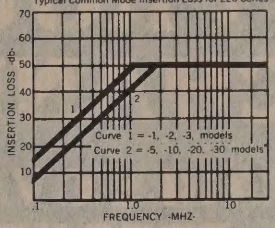
JMK INCORPORATED **filters**

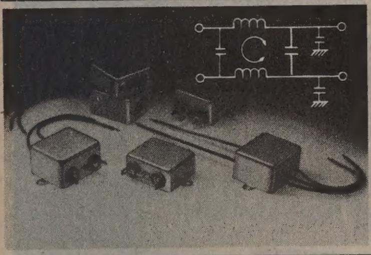
JMK has the filter just right for your power application. Whether it has to do with audio systems, lab test equipment, medical equipment, printers, power converters, video displays, modems, processors, cash registers, pinball machines, televisions, aircraft power supplies, or whatever your specific application may be, we have the filter.



220 Series

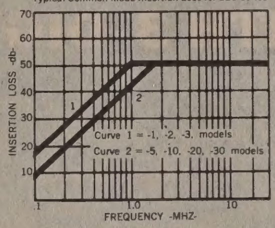
The 220 series is designed to give excellent filtering of "common mode," line-to-ground interference on computer-peripheral and other electronic hardware. Line-to-ground interference is the most common interference experienced and is generally the major source of "interference caused" malfunctions.

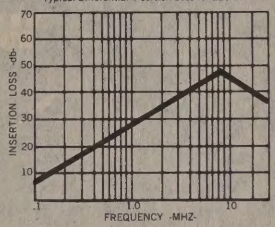

Typical Common Mode Insertion Loss for 220 Series

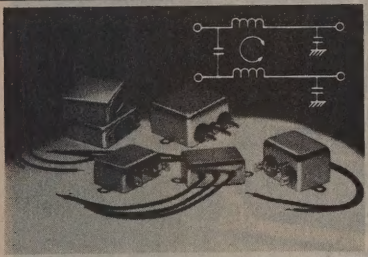


221 Series

The 221 series has the same "common mode" performance as the 220 series but the circuit has been modified to give substantial "differential mode" rejection of noise caused by switching transistors and power supply diodes.

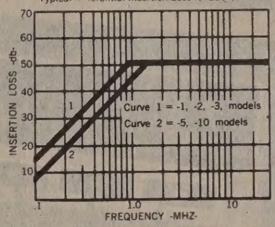

Typical Common Mode Insertion Loss for 221 Series

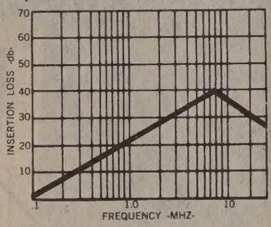

Typical Differential Insertion Loss for 221 Series

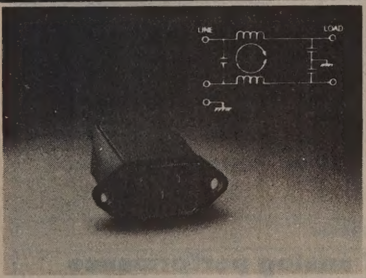


223 Series

The 223 series in intended as an economical compromise between the 220 and 221 series. This filter has the same "common mode" performance as the 220 model with approximately one-half the differential attenuation of the 221 series.

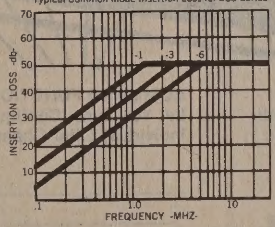

Typical Differential Insertion Loss for 223 Series

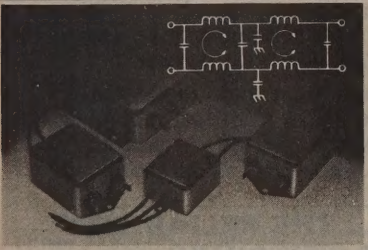

Typical Differential Insertion Loss for 223 Series



233 Series

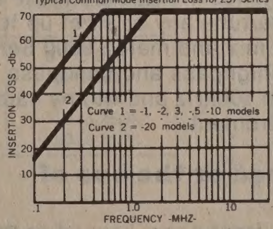
The 233 series filter is a compact filter with an integral IEC connector. This filter gives effective line-to-ground insertion loss and has low leakage current to meet VDE, SEV and other safety organization requirements. If you want an integral filter and connector ask your representative or contact the factory. Many of our other filters can be made available with the IEC connector.

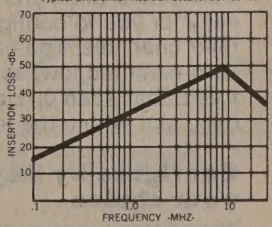

Typical Common Mode Insertion Loss for 233 Series

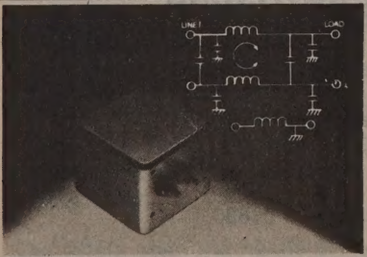


237 Series

This series is a high performance package where filtering requirements are more stringent than those associated with the 220 or 221 series. This package incorporates very high attenuation of both "common mode" and "differential mode" interference yet the cost for such attenuation is moderate.

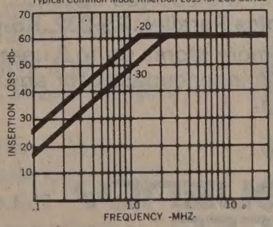

Typical Common Mode Insertion Loss for 237 Series

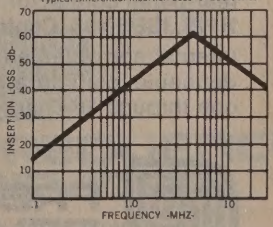

Typical Differential Insertion Loss for 237 Series



283 Series

The 283 series is a compact single phase high current filter. This filter is rated for 20 and 30 amps and has good common mode and differential mode insertion loss. This filter has a ground coil for high frequency ground isolation which may be included or omitted as desired.

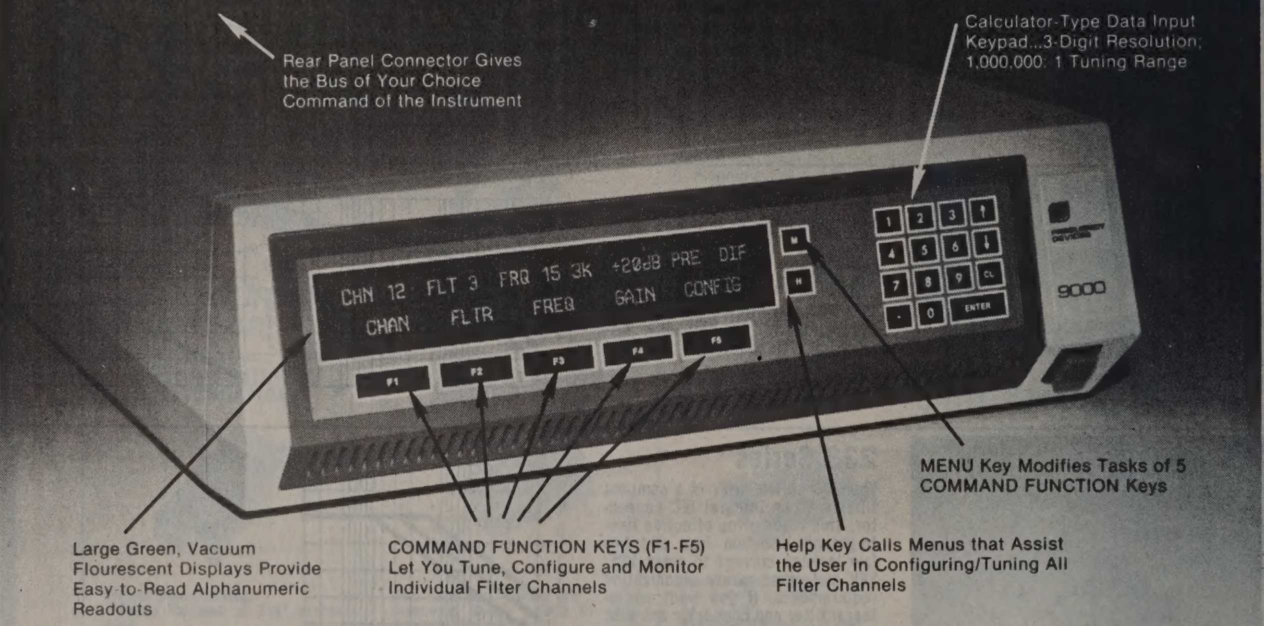

Typical Common Mode Insertion Loss for 283 Series


Typical Differential Insertion Loss for 283 Series

JMK INCORPORATED • 15 CALDWELL DRIVE • AMHERST, NH 03031 • (603) 886-4100

KEYPAD- AND BUS- PROGRAMMABLE 16-CHANNEL FILTER

TUNABLE OVER A 1,000,000:1 FREQUENCY RANGE WITH 3-DIGIT RESOLUTION


CHN 12 FLT 3 FRQ 15.3K +20dB PRE DIF
CHAN FLTR FREQ GAIN CONFIG
F1
F2
F3
F4
F5
ENTER
9000

Rear Panel Connector Gives the Bus of Your Choice Command of the Instrument

Calculator-Type Data Input Keypad...3-Digit Resolution; 1,000,000: 1 Tuning Range

MENU Key Modifies Tasks of 5 COMMAND FUNCTION Keys

Large Green, Vacuum Flourescent Displays Provide Easy-to-Read Alphanumeric Readouts

COMMAND FUNCTION KEYS (F1-F5) Let You Tune, Configure and Monitor Individual Filter Channels

Help Key Calls Menus that Assist the User in Configuring/Tuning All Filter Channels

Makes complex filtering tasks easier

COMMAND and HELP menus in firmware make it easy for you to configure/tune any or all of up to 16 filter channels. You can mix and match **9000 Series** card-mounted lowpass, highpass and bandpass filters that span 0.1Hz to 100kHz and fit any card cage slot within the instrument.

Configure by Keypad or the bus of your choice

The choice is yours: the front-panel keypad or the rear-panel connector over the bus you specify: **HPIB..IEEE-488..Centronics Parallel..RS-232..RS-499.** Internal non-volatile memory stores up to 8 user-definable configurations independently for any of one through 16 channels.

A full spectrum of analog performance

Responses: Include Butterworth, Bessel, and near ideal Elliptic characteristics, with up to 8 poles and 6 zeros per filter. Special needs? No problem.

Configurations: Each channel is logic-or keypad-configurable with single-ended or differential inputs; programmable pre-and post-filter amplification, plus filter bypass...and much, much more.

ALL THIS, PLUS...THE RELIABILITY OF SOLID STATE SWITCHING

Connect a **9000 Series** instrument to your digitally controlled system to perform "intelligent" multi-channel filtering with ease. Call us today and get the best of the analog and digital worlds.

FREQUENCY DEVICES™

25 Locust Street, Haverhill, Massachusetts 01830
(617) 374-0761 TWX 710-347-0314

DIGITALLY PROGRAMMABLE ACTIVE FILTERS

COMPLETE WITH INTERNAL SOLID STATE SWITCHES

A Design and Application Breakthrough

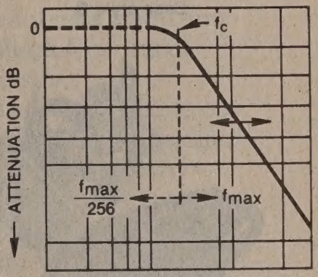
Internal switches eliminate electromechanical relays, along with their problems. Now filtering becomes digitally programmable under a computer or any proper digital data source...Reliability, versatility and compact size made possible by internal solid state switching.

Enhances "Intelligent" and Complex Applications

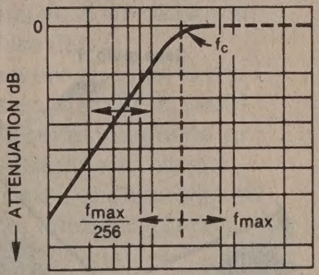
- Anti-Alias Prefiltering
- Data Acquisition Systems
- Programmable Automatic Test (A.T.E) Systems
- Seismic Exploration
- Production Test Systems
- Industrial Process Control
- Real and Compressed Time Data Analysis
- Biomedical Measurements

Fills Long-Felt Need for TUNABLE Classical Filter Responses

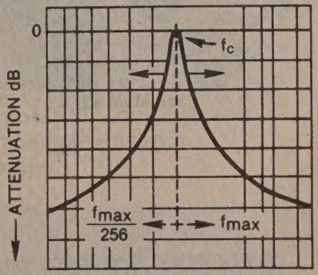
- Digitally-Programmable 4-Pole Lowpass, Highpass and Bandpass Butterworth, Bessel and Chebycheff Models
- Internal 3-Mode CMOS Interface Latches Frequency Selection Bytes
- Plug-in and Ready-to-Use Finished Filter Components
- A 256:1 Tuning Range Over Five Frequency Bands Between 0.1Hz and 51.2 kHz
- Internal Solid State switches Extend Operational Lifetime
- Readily Available
- Sensibly Priced



NORMALIZED FREQUENCY f/fc
844 SERIES LOWPASS



NORMALIZED FREQUENCY f/fc
874 SERIES HIGHPASS



NORMALIZED FREQUENCY f/fc
864 SERIES BANDPASS

844 SERIES 4-POLE LOWPASS FILTERS

BUTTERWORTH RESPONSE	BESSEL RESPONSE	CHEBYCHEFF RESPONSE Passband Ripple 0.2dB	CHEBYCHEFF RESPONSE Passband Ripple 0.5dB	PROGRAMMABLE TUNING RANGE (Hz)
844P8B-1	844P8L-1	844P8YA2W-1	844P8YA5W-1	0.1 to 25.6
844P8B-2	844P8L-2	844P8YA2W-2	844P8YA5W-2	1.0 to 256
844P8B-3	844P8L-3	844P8YA2W-3	844P8YA5W-3	10 to 2560
844P8B-4	844P8L-4	844P8YA2W-4	844P8YA5W-4	100 to 25.6k
844P8B-5	844P8L-5	844P8YA2W-5	844P8YA5W-5	200 to 51.2k

Other Frequency Devices filter products include the following:

- The 900 Series Filter Instrument ...Front-Panel-Switch Tunable
- Resistive Tunable Lowpass, Highpass and Bandpass Filters
- The 9000 Series Digitally Programmable Multi- Channel Filter Instrument
- Fixed Frequency Lowpass, Highpass and Bandpass Filters
- Touch Tone Encoders and Decoders, FSK, PCM and Modem Filters
- Precision Single-Phase and Quadrature Sinewave Oscillators

Our filters span the needs of most technologies, so call Frequency Devices first. Call today with your standard or special, limited-quantity and OEM filter requirements.

FREQUENCY DEVICES™

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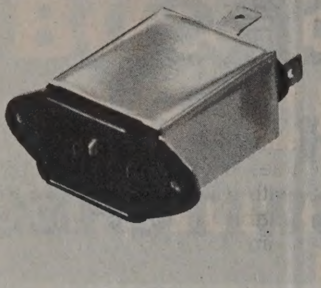
POTTER COMPANY

EMI Power Line Filters

varian



Case style G

608 SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 608 Series features the IEC international power line connector and is designed to provide superior insertion loss down to 10 KHz. This will help switching power supply manufacturers meet the new VDE low frequency conducted EMI requirements. Series 608 is designed to meet the requirements of IEC, CSA, BSI, VDE, SEV and UL. The series is UL recognized. CSA, VDE and SEV approvals are pending.

Ask for Bulletin 8401

Case style G

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE: 115-250VAC
OPERATING FREQUENCY RANGE: 50-60 Hz
MAXIMUM LEAKAGE CURRENT:

Applied Voltage	CURRENT
250 VAC @ 50 Hz	0.5 mA

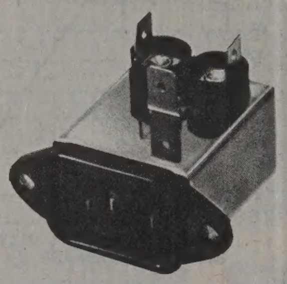
TEST VOLTAGE:

Line-to-ground	2250 VDC
Line-to-line	1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency In MHz						
AMP	.01	.05	.1	.5	1	10	20
1	28	36	45	60	60	60	60
2	18	28	36	54	58	60	60
3	14	25	31	46	52	50	60
4	10	21	27	40	46	60	60
6	8	15	20	31	40	57	60

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.



Case style H

609 SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 609 Series was designed as a companion to our 610 Super Series. It also meets the requirements of VDE and features the IEC international power line connector. The compact construction complies with IEC, CSA, BSI, VDE and SEV. The series is UL recognized. CSA, VDE and SEV approvals are pending.

Ask for Bulletin 8402

Case styles G and H

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE: 115-250 VAC
OPERATING FREQUENCY RANGE: 50-60 Hz
MAXIMUM LEAKAGE CURRENT:

Applied Voltage	CURRENT
250 VAC @ 50 Hz	0.5 mA

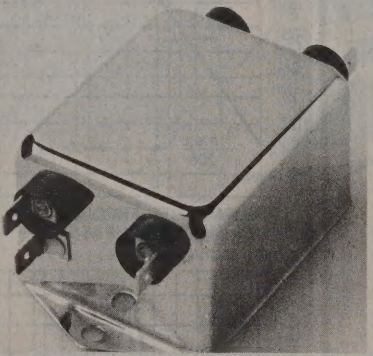
TEST VOLTAGE:

Line-to-ground	2250 VDC
Line-to-line	1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency in MHz					
AMP	.15	.5	1	5	10	20
1	30	45	54	60	60	55
3	24	38	45	60	60	55
6	17	32	40	58	60	55

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.



Case style 625A3

610 SUPER SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 610 Super Series was designed specifically to meet the low frequency requirements of the latest VDE EMI specifications and features the IEC international power line connector. Series 610 is designed to meet the requirements of IEC, BSI, VDE, and SEV. The series is UL recognized, and CSA approval is pending.

Ask for Bulletin 8403

Case styles G and H

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE: 115-250 VAC
OPERATING FREQUENCY RANGE: 50-60 Hz
MAXIMUM LEAKAGE CURRENT:

Applied Voltage	CURRENT
250 VAC @ 50 Hz	0.5 mA

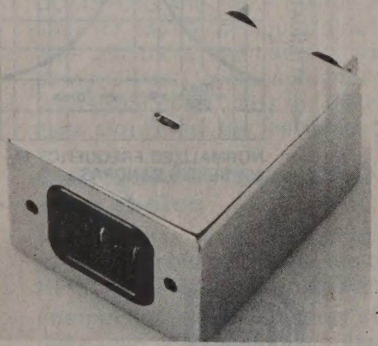
TEST VOLTAGE:

Line-to-ground	2250 VDC
Line-to-line	1500 VDC

TYPICAL INSERTION LOSS (dB):

	Frequency in MHz					
AMP	.15	.5	1	5	10	30
1	24	34	40	47	50	50
3	19	29	35	43	47	50
6	13	22	28	40	42	47

Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.



Case style 625G3

625 SUPER SERIES

HIGH PERFORMANCE INTERNATIONAL FILTERS

The 625 Super Series provides additional insertion loss down to 10 KHz to meet the latest VDE EMI specifications. They are designed primarily for the effective reduction of line-to-ground (common mode) and line-to-line (differential mode) interference in equipment which must meet the requirements of FCC and VDE specifications. All models are UL recognized. Low leakage current models are available in all ratings. To order these, replace the "V" suffix with an "E."

Ask for Bulletin 8404

Case styles 625A3 and 625G3

PERFORMANCE CHARACTERISTICS:

RATED VOLTAGE: 115-250 VAC
OPERATING FREQUENCY RANGE: 50-60 Hz
MAXIMUM LEAKAGE CURRENT:

Applied Voltage	CURRENT "V"	CURRENT "E"
115 VAC @ 60 Hz	0.5 mA	0.25 mA
250 VAC @ 50 Hz	1.0 mA	0.5 mA

TEST VOLTAGE:

Line-to-ground	2250 VDC
Line-to-line	1500 VDC

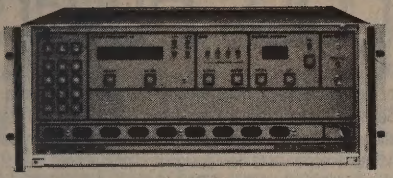
TYPICAL INSERTION LOSS (dB):
FILTER RATED AT 3.0A RMS ONLY

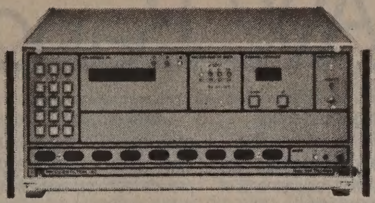
	Frequency In MHz								
	.01	.02	.05	.15	.5	1	5	10	20
625VS	22	27	37	50	55	55	55	55	55
625ES	22	27	36	47	47	45	45	45	45

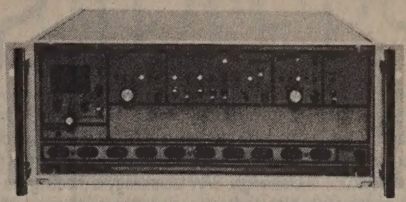
Tested in accordance with MIL-STD-220 with the unused circuit grounded on the load side.

POTTER COMPANY
P.O. BOX 337,
WESSON, MISSISSIPPI 39191
(601) 643-2215

For More Information Circle No. 204





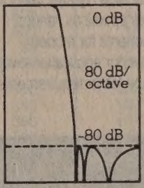


32 and 64 Channel Anti-Alias Filters
For HP, LP, TD, BP, BR, too. Save 25-50% per channel over 16 channel systems. 2½-3 digit resolution. Wide variety of options, including economical fixed frequency filters.

Super BP and More
Industry's first multichannel, programmable frequency-band translator. 80 dB/bandwidth-octave skirts for super BP. Zooms in to extend performance of systems for spectrum analysis, beam forming and modal analysis.

16 Channel Filter-Amp
Save 25-35% by buying one instrument instead of two. 62 programmable cut-off frequencies. DC differential input state with 100 dB CMRR. Programmable prefilter and post-filter gain of 1-1000.

BEGONE CURSED ALIAS



You want data clean and meaningful for digital conversion.

We keep extending our line of Precision Conditioners™ to do it your way.

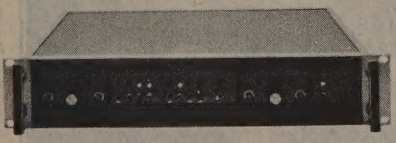
We were first to provide 80 dB/octave attenuation and time delay filters superior to Bessel in multichannel, programmable filter systems. And we did it with 1° phase match.

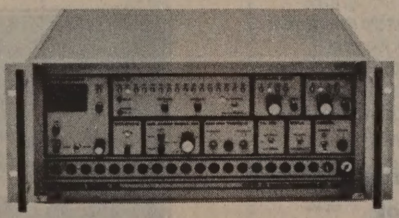
We were also first to provide standard GPIB, parallel and serial interfaces for filter systems and other Precision Conditioners you can put under computer control.

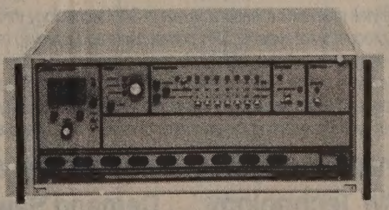
Dual Channel Anti-Alias Filter
For HP, LP, TD, BP, BR, too. 124 programmable cut-off frequencies. Frequency range of .01 Hz to 150 kHz. Gain 1, 2, 5 and 10.

Gain-Ranging Amps
Programmable or automatic. Provide conditioning needed to store signals of wide dynamic range within the limited dynamic range of magnetic tape. No manual logging needed.

Multimode Conditioner
16 channels, each with choice of strain, charge and voltage conditioning. All functions, including calibration, are programmable for computer control. Usually teams with filter-amp.







Call 607-277-3550.
Or write for specs and demonstration. Telex 646846.

PRECISION FILTERS, INC.
240 Cherry Street, Ithaca, New York 14850

SAW Bandpass Filters

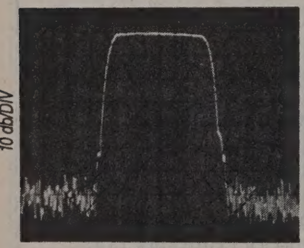
Surface Acoustic Wave Technology provides performance advantages and design flexibility that has proven to be invaluable to engineers in need of reliable, reproducible components featuring linear phase, temperature stability, small size, low shape factor and excellent rejection. Increasingly, SAW technology is meeting the exacting requirements of modern systems with high performance bandpass filters and other state-of-the-art signal processing components such as pulse compressors, delay lines, and resonator products. In addition to this broad product line, Sawtek provides the total engineering support needed to make the proper design trade-offs among key parameters in order to achieve the optimum performance available from SAW technology.

Sawtek produces hundreds of standard SAW products for both low and high volume programs in Cable Television, Satellite Communications, Modems, Radar, EW, and many other signal processing applications. In addition, Sawtek's custom design capability can provide technical assistance and rapid response to new design and production requirements at frequencies from 10 MHz to more than 1 GHz. Sawtek also designs and produces custom subsystems which incorporate SAW components. These include filter banks comprised of cascaded filters packaged in a single assembly, amplifier-filter modules with adjustable gain, and SAW resonator-controlled oscillators. Some of the common SAW bandpass filter products produced by Sawtek and their characteristics are summarized below.

WIDE BANDWIDTH

TVRO and other receiver applications often require wide bandwidth filters designed to provide superior rejection and group delay performance. SAW bidirectional bandpass filters are available with fractional bandwidths as large as 60% at frequencies approaching 1000 MHz. The high coupling materials used to achieve these bandwidths exhibit temperature coefficients of 72 to 94 PPM/°C. Insertion loss from 25 dB to 30 dB is typical of this class of filters in order to optimize group delay and time spurious performance. Shape factors (45 dB:1 dB) normally vary from 1.4:1 to 1.8:1.

Among a family of 70 MHz IF filters that is available off-the-shelf with bandwidths of 10 MHz to more than 36 MHz is the representative filter shown in the photograph below. This device provides a 24 MHz 3-dB bandwidth, 1.35:1 shape factor, and ±10 nsec maximum group delay variation. The packaged filter dimensions are either 0.87″×0.5″×0.2″ or 0.6″ diameter. Similar products are available at many other 1st or 2nd IF frequencies.

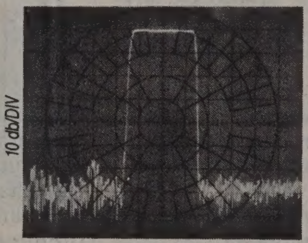


70 MHz
6 MHz/DIV

LOW SHAPE FACTOR

CATV modulator requirements and many similar applications require very low shape factor (45 dB:1 dB) to eliminate adjacent channel interference while preserving linear phase. Sawtek manufactures numerous VSB filters for both U.S. and European CATV requirements. This class of filters exhibits shape factors between 1.15:1 and 1.3:1 with an insertion loss of 20 dB to 30 dB depending on the bandwidth and center frequency. Such low shape factors are offered for fractional bandwidths from approximately 10% to 20%. These performance features are achieved in a 1.5″×1.0″×0.2″ dual in-line package and clearly demonstrate the size advantages of SAW technology.

A representative filter shown below delivers 5.5 MHz bandwidth at 43.75 MHz center frequency and a shape factor of 1.2:1 with ±1° phase linearity and greater than 60 dB rejection. Other products offered in this bandwidth range include Nyquist filters for CATV demodulators as well as various inexpensive components for modem, translator, and convertor applications with slightly higher shape factor requirements.

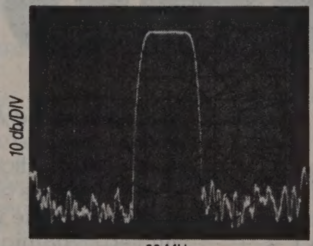


43.75 MHz
2 MHz/DIV

TEMPERATURE STABILITY

Quartz materials are frequently used in narrower band applications where increased stability is necessary. Filters with bandwidths from a few tenths percent to more than 5% are designed for quartz and exhibit total frequency shifts that are smaller than 50 PPM for a 0°C to 60°C commercial temperature range and nominally 200 PPM for most −55°C to +85°C military requirements. Shape factors from 1.5:1 to 3.6:1 are typical for these designs without sacrificing the high rejection expected of SAW devices. Insertion loss is normally 20-25 dB in order to maintain time spurious suppression of 45-50 dB. Bandwidths as large as 30% are implemented using quartz where higher insertion loss is tolerable and quartz performance is necessary. Both bandwidth and shape factor influence filter size, with larger sizes required for narrow bandwidths and low shape factors.

The performance shown below is a 60 MHz center frequency device with a 1.0 MHz bandwidth, 60 dB near-in rejection, and phase linearity of ±2°. The shape factor (55 dB:1 dB) is less than 1.8:1. Sawtek has many existing quartz filter designs at other IF frequencies.

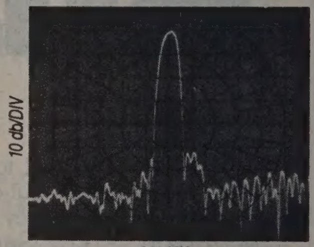


60 MHz
0.5 MHz/DIV

LOW LOSS

Sawtek offers low-loss SAW filters with insertion loss from 4 dB to 10 dB. The achievable insertion loss depends on many interrelated factors including the substrate material chosen, fractional bandwidth, the Q of matching components, the center frequency, and other design and fabrication parameters. This class of filters can also achieve triple transit suppression of 45 to 55 dB without the added insertion loss required for bidirectional filters. Rejection is typically 40 dB to 50 dB with shape factors greater than 1.6:1. These capabilities enable low-loss SAW filters to be used for front-end filters and in other applications where noise figure or dynamic range are limited by filter insertion loss.

The filter example below achieves 5 dB insertion loss on quartz at 261 MHz with a 0.5 MHz bandwidth. Passband ripple is less than 0.04 dB and triple transit suppression exceeds 50 dB. Some standard products are available and Sawtek offers rapid custom design for those applications that require this technique.



261 MHz
1 MHz/DIV

Sawtek maintains a leadership role in SAW technology through the development and production of superior SAW components and a proven track record of delivering these reliable, high performance products on time and at a very competitive price in production quantities. Product reliability for Sawtek's broad range of military and commercial parts is insured by a watchful quality control program that meets even the exacting requirements of military and space applications.

When your system demands the advantages of SAW Technology . . . Demand Sawtek.

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TTE® *miniature passive* FILTERS

TTE, Inc. is a California Corporation, established in 1954 and incorporated in 1956. Housed in its' facility in West Los Angeles are the sales offices, R&D department and manufacturing operation. Since its' beginnings TTE has designed and manufactured both Active and Passive Filters.

This one page advertisement is an overview of some of the Passive Bandpass Filters TTE® offers. TTE also offers Active Bandpass, Band Reject, High-pass and Lowpass Filters. These same types are available as Passive networks also. Please contact us with your specification and remember to request a complete catalog for your reference file.

miniature — BANDPASS FILTERS — specify any frequency from 10Hz to 20MHz

Series No.	(Fc) Center Freq. Range Minimum	(Fc) Center Freq. Range Maximum	% Bandwidth @ −3dB	Stopband Attenuation	Source (ohms) Minimum	Source (ohms) Maximum	Load (ohms) Minimum	Load (ohms) Maximum	Case Type & Number Chassis	Case Type & Number PCB
K10B	500Hz	10KHz	±1%Fc		1K	500K	1K	500K	4	17
K10C	10KHz	100KHz	±1%Fc	30dB @ .92Fc & 1.1Fc&	500	10K	500	10K	3	11
K10F	100KHz	1MHz	±1%Fc	40dB @ .86Fc & 1.2Fc	500	1K	500	1K	613 (A or B)	11
K10G	1MHz	20MHz	±1%Fc		50	75	50	75	613 (A or B)	11
K11H	500Hz	10KHz	±1%Fc		1K	500K	1K	500K	4	17
K11J	10KHz	100KHz	±1%Fc	30dB @ .92Fc & 1.06Fc	500	10K	500	10K	3	13
K11M	100KHz	1MHz	±1%Fc	40dB @ .93Fc & 1.1Fc	500	1K	500	1K	613 (A or B)	12
K11P	1MHz	20MHz	±1%Fc		50	75	50	75	613 (A or B)	12
K12D	500Hz	10KHz	±2%Fc	30dB @ .92Fc & 1.1Fc	1K	10K	1K	10K	4	17
K12H	10KHz	100KHz	±2%Fc	30dB @ .92Fc & 1.1Fc&	500	10K	500	10K	3	12
K12J	100KHz	1MHz	±2%Fc	30dB @ .92Fc & 1.1Fc	500	1K	500	1K	613 (A or B)	12
K12L	1MHz	20MHz	±2%Fc		50	75	50	75	613 (A or B)	12
K18A	30Hz	100Hz	±5%Fc	55dB @ .5FC & 2Fc	1K	500K	1K	500K	5	
K18B	100Hz	300Hz	±5%Fc	60dB @ .5Fc & 2Fc	500	10K	500	10K	4	17
K18C	300Hz	3KHz	±5%Fc	40dB @ .5Fc & 2Fc	500	15K	500	15K	3	12
K18E	3KHz	10Hz	±5%Fc	50dB @ .5Fc & 2Fc	100	50K	100	50K	3	11
K18F	10KHz	100KHz	±5%Fc	60dB @ .5Fc & 2Fc	100	100K	100	100K	3	11
K18G	100KHz	1MHz	±5%Fc	60dB @ .5Fc & 2Fc	500	10K	500	10K		11
K18H	1MHz	20MHz	±5%Fc	60dB @ .5Fc & 2Fc	500	1K	500	1K	613 (A or B)	11
					50	75	50	75	613 (A or B)	11
K20E	100Hz	1KHz	±7.5%Fc	40dB @ .57Fc & 1.75Fc	500	10K	500	10K	4	17
K20F	1KHz	10KHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	10K	500	10K	3	13
K20G	10KHz	100KHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	10K	500	10K	3	11
K20L	100KHz	1MHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	500	1K	500	1K	613 (A or B)	11
K20M	1MHz	20MHz	±7.5%Fc	40dB @ .6Fc & 1.67Fc	50	75	50	75	613 (A or B)	11
Q20	1KHz	10KHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	1K	10K	1K	10K	5	14
Q22	1KHz	10KHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	1K	10K	1K	10K	6	17
Q23	10KHz	100KHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	600	10K	600	10K	4	13
Q24	10KHz	100KHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	600	10K	600	10K	5	16
Q25	100KHz	1MHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	500	1K	500	1K	613 (A or B)	12
Q26	100KHz	1MHz	±7.5%Fc	60dB @ .75Fc & 1.3Fc	500	1K	500	1K	720 (A or B)	15/22
Q27A	1MHz	20MHz	±7.5%Fc	40dB @ .7Fc & 1.4Fc	50	75	50	75	613 (A or B)	12
Q28A	1MHz	20MHz	±7.5%Fc	50dB @ .75Fc & 1.3Fc	50	75	50	75	720 (A or B)	15/22
K30E	100Hz	1KHz	±15%Fc	40dB @ .4Fc & 2.5Fc	500	10K	500	10K	4	17
K30F	1KHz	10KHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	10K	500	10K	3	13
K30G	10KHz	100KHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	10K	500	10K	3	11
K30H	100KHz	1MHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	1K	500	1K	613 (A or B)	11
K30L	1MHz	20MHz	±15%Fc	40dB @ .45Fc & 2.2Fc	500	75	50	75	613 (A or B)	11
Q30	1KHz	10KHz	±15%Fc	30dB @ .67Fc & 1.37Fc	1K	10K	1K	10K	5	14
Q32	1KHz	10KHz	±15%Fc	50dB @ .73Fc & 1.31Fc	1K	10K	1K	10K	6	17
Q33	10KHz	100KHz	±15%Fc	30dB @ .67Fc & 1.37Fc	600	10K	600	10K	4	13
Q34	10KHz	100KHz	±15%Fc	50dB @ .73Fc & 1.31Fc	600	10K	600	10K	5	16
Q35A	100KHz	1MHz	±15%Fc	30dB @ .67Fc & 1.37Fc	500	1K	500	1K	613 (A or B)	12
Q36	100KHz	1MHz	±15%Fc	50dB @ .73Fc & 1.31Fc	500	1K	500	1K	720 (A or B)	15/22
Q37A	1MHz	20MHz	±15%Fc	30dB @ .67Fc & 1.37Fc	50	75	50	75	613 (A or B)	12
Q38A	1MHz	20MHz	±15%Fc	50dB @ .73Fc & 1.31Fc	50	75	50	75	720 (A or B)	15/22

subminiature — TELEMETERING BANDPASS FILTERS FROM *STOCK

Chan. No.	Model No.	Fc	−3dB BW	Stopband Attenuation	Source/Load (ohms)	Case No.
1	LS.4	400Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
2	LS.56	560Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
3	LS.73	730Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
4	LS.96	960Hz	±7.5%	40dB @ .5Fc & 2Fc	10K/10K	231
5	LS1.3	1300Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
6	LS1.7	1700Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
7	LS2.3	2300Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
8	LS3.0	3000Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
9	LS3.9	3900Hz	±7.5%	40dB @ .55Fc & 1.8Fc	10K/10K	231
10	LS5.4	5400Hz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
11	LS7.35	7350Hz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
12	LS10.5	10.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
13	LS14.5	14.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
14	LS22	22KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
15	LS30	30KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
16	LS40	40KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
17	LS52.5	52.5KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
18	LS70	70KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
19	LS93	93KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
20	LS124	124KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
21	LS165	165KHz	±7.5%	40dB @ .58Fc & 1.75Fc	10K/10K	231
A	LS22W	22KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
B	LS30W	30KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
C	LS40W	40KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
D	LS52.5W	52.5KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
E	LS70W	70KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
F	LS93W	93KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
G	LS124W	124KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231
H	LS165W	165KHz	±15%	40dB @ .4Fc & 2.5Fc	10K/10K	231

TTE, Inc., 11650 W. Olympic Blvd., Los Angeles, CA 90064, (213) 478-8224

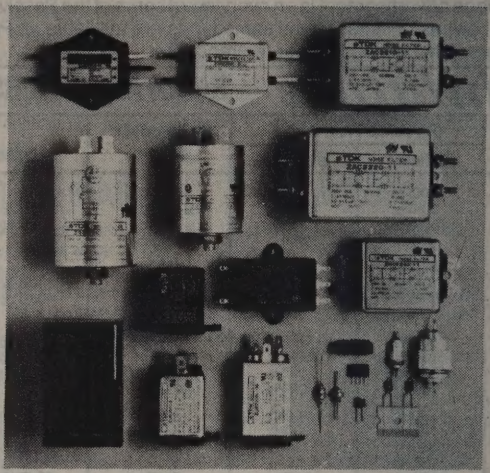
For More Information. Circle No. 207

NOISE (EMI) FILTERS

TDK®

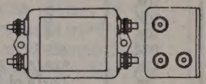
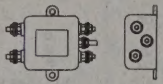
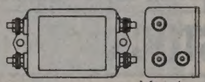
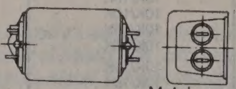
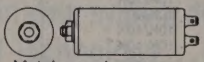
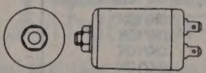
TDK CORPORATION OF AMERICA 4711 West Golf Road, Suite 300, Skokie, Illinois 60076 U.S.A. Phone: (312) 679-8200 **LOS ANGELES BRANCH** (213) 539-6631 **NEW YORK BRANCH** (516) 625-0100 **INDIANAPOLIS BRANCH** (317) 872-0370 **DETROIT OFFICE** (313) 353-9393 **TDK CORPORATION** 13-1, Nihonbashi 1-chome, Chuo-ku, Tokyo 103, Japan

The latest developments in electronics have caused more attention to be focused on problems concerning noise (EMI) due to incorrect operation as well as generated noise (EMI). TDK's noise (EMI) filters are the result of many years of research in ferrite cores, SF cores and ceramic capacitors. These filters are designed to meet a wide variety of demanding applications.



Features

1) Highly permeable ferrite cores and high saturation flux density cores are used in the inductors, the critical component in any noise (EMI) filter.
2) A high dielectric ceramic capacitor with low loss is used in these filters to reduce their size and ground the small leakage current.
3) A full series is available to permit selection based on characteristics, structure, dimensions and price.
4) Preparations to obtain UL, CSA, VDE and TÜV recognition/approval have been made.

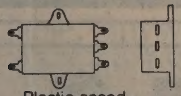
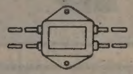
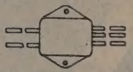
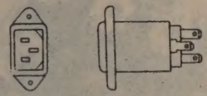
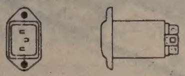
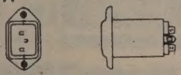
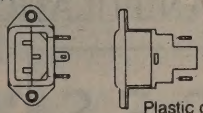
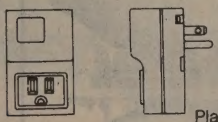
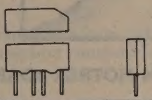
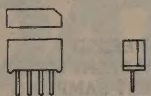
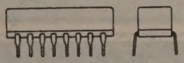
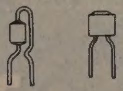
Series name	Exterior view	Function	Type	Rated current (A)	Rated voltage (V.a.c.)	Test voltage (V.a.c.)	Leakage current (mA)	Weight (g)
ZAC	 Metal cased Terminal: studs	Normal mode and common mode noise is prevented within a 0.2 to 30 MHz range. UL recognized TÜV approved	ZAC2205-00U	5	250	1500	<1.0 $\binom{250V}{60Hz}$	240
			ZAC2206-11	6	250	1500	<1.0 $\binom{250V}{60Hz}$	280
			ZAC2210-00U	6	250	1500	<1.0 $\binom{250V}{60Hz}$	250
			ZAC2210-11	10	250	1500	<1.0 $\binom{250V}{60Hz}$	300
			ZAC2215-00U	15	250	1500	<1.0 $\binom{250V}{60Hz}$	260
			ZAC2220-00	20	250	1500	<1.0 $\binom{250V}{60Hz}$	260
			ZAC1205-11	5	125	1000	<0.4 $\binom{125V}{60Hz}$	240
			ZAC1210-11	10	125	1000	<0.4 $\binom{125V}{60Hz}$	240
			ZAC1215-11	15	125	1000	<0.4 $\binom{125V}{60Hz}$	260
			ZAC1220-11	20	125	1000	<0.4 $\binom{125V}{60Hz}$	260
ZAG	 Metal cased Terminal: studs	Common mode noise is prevented within a 0.15 to 100 MHz and normal mode noise prevented within 0.15 to 30 MHz range. UL recognized	ZAG2205-11	5	250	1500	<1.0 $\binom{250V}{60Hz}$	150
			ZAG2210-11	10	250	1500	<1.0 $\binom{250V}{60Hz}$	160
			ZAG2220-11	20	250	1500	<1.0 $\binom{250V}{60Hz}$	170
ZAG-P	 Metal cased Terminal: studs	High voltage pulse noise is prevented. UL recognized	ZAG2205-11-P	5	250	1500	<1.0 $\binom{250V}{60Hz}$	280
			ZAG2210-11-P	10	250	1500	<1.0 $\binom{250V}{60Hz}$	280
			ZAG2220-11-P	20	250	1500	<1.0 $\binom{250V}{60Hz}$	290
ZHC	 Metal cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.2 to 30 MHz range. UL recognized TÜV approved	ZHC2203-11	3	250	1500	<1.0 $\binom{250V}{60Hz}$	130
			ZHC2210-11	10	250	1500	<1.0 $\binom{250V}{60Hz}$	280
ZSB	 Metal cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. VDE approved	ZSB2210-05A	10	250	1500	<1.5 $\binom{250V}{60Hz}$	120
ZSG	 Metal cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. UL recognized CSA certified	ZSG1215-06A	15	125	1500	<0.5 $\binom{125V}{60Hz}$	170

For More Information. Circle No. 208

NOISE (EMI) FILTERS

TDK

TDK CORPORATION OF AMERICA 4711 West Golf Road Suite 300 Skokie Illinois 60076 U.S.A. Phone (312) 679-8200 LOS ANGELES BRANCH (213) 539-6631 NEW YORK BRANCH (516) 625-0100 INDIANAPOLIS BRANCH (317) 872-0370 DETROIT OFFICE (313) 353-9393 **TDK CORPORATION** 13-1 Nihonbashi 1-chome Chuo-ku Tokyo 103 Japan

Series name	Exterior view	Function	Type	Rated current (A)	Rated voltage (V.a.c.)	Test voltage (V.a.c.)	Leakage current (mA)	Weight (g)
ZCB	 Plastic cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. UL recognized CSA certified TÜV approved	ZCB2203-11	3	250	1500	<0.75 (250V/60Hz)	45
			ZCB2206-11	6	250	1500	<0.75 (250V/60Hz)	45
ZGB	 Metal cased Lead wires	Normal mode and common mode noise is prevented within a 0.15 to 30 MHz range. UL recognized: –11 CSA certified: –12	ZGB1201-11, 12	1	125	1000	<0.4 (250V/60Hz)	75
			ZGB1202-11, 12	2	125	1000	<0.4 (250V/60Hz)	75
			ZGB1203-11, 12	3	125	1000	<0.4 (250V/60Hz)	75
ZMB	 Plastic cased Lead wires	Normal mode noise is prevented within a 0.15 to 30 MHz range. UL recognized: –11 VDE approved: –13	ZMB22R5-11	0.5	250	1500	<1.0 (250V/60Hz)	65
			ZMB2201-11, 13	1	250	1500	<1.0 (250V/60Hz)	65, 45
			ZMB2202-11	2	250	1500	<1.0 (250V/60Hz)	65
			ZMB2203-11, 13	3	250	1500	<1.0 (250V/60Hz)	65, 45
ZUB	 Metal cased Terminal: faston tabs	Common mode noise is prevented within a 0.15 to 300 MHz range. With fuse: –00-F UL recognized: –00 CSA certified TÜV approved	ZUB2203-00	3	250	1500	<0.5 (250V/60Hz)	50
			ZUB2203-00-F	3	250	1500	<0.5 (250V/60Hz)	70
			ZUB2206-00	6	250	1500	<0.5 (250V/60Hz)	50
			ZUB2206-00-F	6	250	1500	<0.5 (250V/60Hz)	70
ZUG-11 ZUG-11A	  Metal cased Terminal: faston tabs	Normal mode and common mode noise is prevented within a 0.15 to 300 MHz range. UL recognized CSA certified TÜV approved	ZUG2203-11	3	250	1500	<0.5 (250V/60Hz)	48
			ZUG2206-11	6	250	1500	<0.5 (250V/60Hz)	48
			ZUG2203-11A	3	250	1500	<0.5 (250V/60Hz)	48
			ZUG2206-11A	6	250	1500	<0.5 (250V/60Hz)	48
ZUG-12A	 Plastic cased Terminal: solder lugs	Normal mode and common mode noise is prevented within a 0.15 to 300 MHz range. UL recognized CSA certified TÜV approved	ZUG2203-12A	3	250	1500	<0.75 (250V/60Hz)	32
			ZUG2206-12A	6	250	1500	<0.75 (250V/60Hz)	32
ANF-U	 Plastic cased	Normal mode and common mode noise is prevented within 0.15 to 30 MHz range. –106U: 3P type UL recognized	ANF-106U	6	125	1500	<0.5 (125V/60Hz)	160
ZJK-00	 Plastic cased with lead pins	Common mode noise is prevented within a 0.2 to 200 MHz range.	ZJK51R1-00	0.1	DC. 50	DC. 125		1.5
			ZJK51R5-00	0.5	DC. 50	DC. 125		1.5
			ZJK5103-00	3	DC. 50	DC. 125		1.5
ZJK-05	 Plastic cased with lead pins	Common mode noise is prevented within a 0.2 to 200 MHz range.	ZJK51R1-05	0.1	DC. 50	DC. 125		0.8
			ZJK51R5-05	0.5	DC. 50	DC. 125		0.8
			ZJK5103-05	3	DC. 50	DC. 125		0.8
ZJY			ZJY51R5-8P	0.5	DC. 50	DC. 250		1.4
ZBF		Impedance is over 30Ω for the 10 to 1000 MHz band.	ZBF253S-01	3	DC. 50			0.5
			ZBF503S-01	3	DC. 50			0.5
			ZBF253D-01	3	DC. 50			0.5
			ZBF503D-01	3	DC. 50			0.5
			ZBF503S-01 TA	3	DC. 50			0.5

For More Information. Circle No. 208

Matthey

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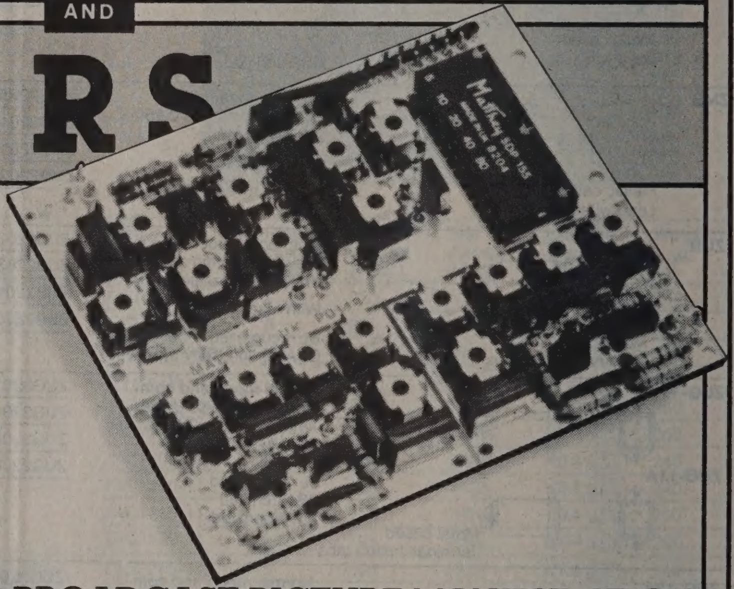
DELAY LINES

AND

FILTERS



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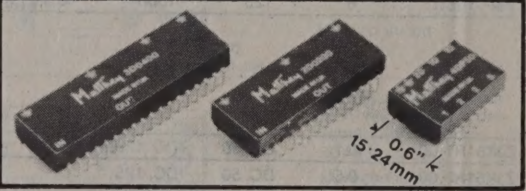
DELAY LINE FEATURES



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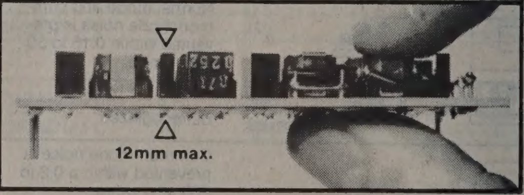
  500 NANOSECOND MAXIMUM

FILTER FEATURES



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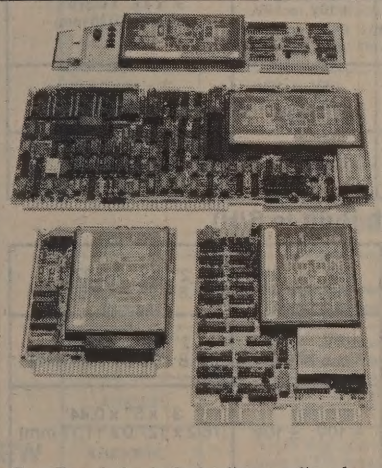

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Integrating A/D Converters

Product	Notes, Features, Characteristics	Resolution	Conversion Rate	Relative Accuracy	Input Ranges	Size
MP8037	Fastest, most accurate and stable integrating ADC.	17 Bits Binary	250/Sec.	± 1 LSB	± 10V	2" x 4" x 0.44" (51 x 102 x 11 mm)
MP2344	Versatile (BC/Binary), highly isolated, line-synchronous integration.	± 39,999 counts (16 bits binary, 4¾ decimal digits)	3/Sec. to 30/Sec.	± 1 count	± 4V	2" x 3" x 0.45" (51 x 76 x 11 mm)
MP2321	Highest performance/ratio in a premium, balanced input, 12-bit ADC.	± 1999 (3½ digits decimal)	100/Sec.	0.05% rdg. ± 1 count	± 1.999V or ± 199.9mV	2" x 4" x 0.49" (51 x 102 x 12 mm)
MP2322		12 Bits Binary	100/Sec.	0.05% rdg. ± 1 count	± 100mV ± 200mV ± 1V, ± 2V	2" x 4" x 0.49" (51 x 102 x 12 mm)
MP2316	Universal, Floating Point Programmable-Gain Converter Processor	16 Bits	37/Sec.	± .006% FSR.	Selectable ± 10mV to ± 50V	2" x 3" x 0.5" (51 x 78 x 13 mm)

Successive-Approximation A/D Converters

	Product	Notes, Features Characteristics	Resolution Binary Bits	Conversion Time	Relative Accuracy of FSR	Input Ranges	Size
NEW	AH8022	Exceptionally high-speed State-of-the-Art A/D in small package	12	500ns	± 0.025%	0-10V, ± 10V	1.00" x 2.4" x 0.3" (25.4 x 60.8 x 7.6 mm) 48 pin DIP
	MP8016	Most advanced ADC's currently available in this speed range; truly "state-of-the-art" designs, at modest prices.	16	32 µs	± 0.0015%	+ 10V, ± 10V	3" x 4.6" x 0.375" (76 x 117 x 10 mm)
	MP8015		15	15 µs	± 0.003%		
	MP8014		14	10 µs	± 0.006%		
	MP2734	Improved performance at higher speed, yet at lower cost.	14	7 µs	± 0.006%	+ 5V, + 10V ± 5V, ± 10V	2" x 4" x 0.44" (51 x 102 x 11 mm)
	MP2735-2	High speed, accurate, superb linearity around zero crossing. Low power.	15	5 µs	± 0.005%	± 5V	3" x 4" x 0.44" (76 x 102 x 11 mm)

Sampling ADC's (Successive-Approximation with Built-In S/H)

NEW	A/D/A/M-812	Two channel simultaneously sampling 12-bit ADC, 5ns skew max. between channels	12	19.5 µs/2 ch. 11.0 µs/1 ch.	± 0.012%	± 5V, ± 10V 0-10V	2" X 3" X 0.375" (50.8 X 76.2 X 9.53 mm)
	A/D/A/M-822	Two channel simultaneously sampling 12-bit ADC; 5ns skew max. between channels	12	39 s/2 ch. 21 µs/1 ch.	± 0.012%	± 5V, + 10V ± 10V	2" x 3" x 0.375" (50.8 x 76.2 x 9.53 mm)
NEW	A/D/A/M-826	Fastest ADC available, 16-bit performance; Sampling(S), Buffered(B) and Unbuffered(U) versions	16	2.3 µs (S) 2.0 µs (B) 1.5 µs (U)	± 0.0015% ± 0.0015% ± 0.0015%	+ 10V, ± 10V	3" x 5" x 0.44" (76.2 x 127.0 x 11.17 mm)
	A/D/A/M-825	Highly stable sampling ADC's. Include S/H, tri-state buffers, in fully shielded case, tested as a complete sampled-data subsystem.	15	18 kHz	± 0.003%	+ 5V, + 10V ± 5V, ± 10V	2" x 4" x 0.44" (51 x 102 x 11 mm)
	A/D/A/M-824		14	20 kHz	± 0.005%		
	A/D/A/M-724		14	6.8 µs (100 kHz thruput)	± 0.006%		3" x 4.6" x 0.375" (76 x 117 x 10 mm)
	A/D/A/M-834	Highly stable sampling converters featuring low noise, low power, and tri-state output buffered extended temperature range − 25° to + 85°C.	14	60 µs 16.6 kHz thruput	± 0.005%	+ 5V, + 10V ± 5V, ± 10V	2" x 4" x 0.39" (51 x 102 x 10 mm)
	A/D/A/M-835		15	60 µs 16.6 kHz thruput	± 0.003%	+ 5V, + 10V ± 5V, ± 10V	2" x 4" x 0.39" (51 x 102 x 10 mm)
	MP2735-1	High speed, accurate, superb linearity around zero crossing. Low Power.	15	8 µs (125 kHz thruput)	± 0.005%	± 5V	3" x 4" x 0.44" (76 x 102 x 11 mm)
	SHAD-2	High speed simultaneous dual channel sampling, ultra low noise and distortion, audio digitizing board product.	15	57 kHz (dual channel)	± 0.005%	± 5V	4.62" x 5.78" x 0.55" (117 x 147 x 14 mm)

For More Information. Circle No. 211

Sample & Hold Amplifiers

Product	Notes, Features, Characteristics	Acquisition Time for 20V Step	Aperture Uncertainty Time	Sample-Mode Non-Linearity, ± 10V range	Pedestal Non-Linearity, ± 10V range	Hold Mode Droop Rate	Size
MP272	Very high speed inclusive of input buffer settling time.	350ns max. to 0.01%	± 50 ps	± 0.005% max.	± 0.005% max.	5 μ V / μ s max.	2" x 2" x 0.44" (50.8 x 50.8 x 11.2mm)
MP271	Fastest, most accurate S/H in high-throughput class.	1.0 μ max. to 0.01%	± 0.2 ns	± 0.003% max.	± 0.002% max.	2 μ V / μ s	2" x 2" x 0.39" (51 x 51 x 10 mm)
MP270	Same high speed as MP271.	1.0 μ max. to 0.01%	± 0.2 ns	± 0.005% max.	± 0.005% max.	2 μ V / μ s	2" x 2" x 0.39". (51 x 51 x 10 mm)
MP260	Moderate speed, most accurate, small size.	5.0 μ s max. to 0.003%	± 0.5 ns	± 0.002% max.	± 0.003% max.	0.2 μ V/ μ s max.	1" x 2" x 0.44" (25 x 51 x 11 mm)
MP261	Optimized for simultaneous S/H high-accuracy systems.	15 μ s max. to 0.003%	± 0.5 ns	± 0.002% max.	± 0.002% max.	20 μ V/ms max.	1" x 2" x 0.44" (25 x 51 x 11 mm)
MP282A	High speed, dual channel internal MUX and gain ranging amplifier designed as audio/PCM front end.	3.5 μ s max. to 0.005% for 10V step	± .2 ns	± 0.002% max. (± 5V range)		0.4 μ V/ μ s max.	2" x 2" x 0.44" (51 x 51 x 11 mm)

Digital-to-Analog Converters

Product	Notes, Features, Characteristics	Resolution Binary Bits	Relative Accuracy of FSR	Full Scale Maximum Settling Time Voltage Output	Output Ranges	Size
MP8116	State-of-the-Art accuracy, stability, linearity	16	± 0.00023% typ. ± 0.00037% max. (3 σ)	25 μs to ½ LSB	± 10V, + 10V ± 5V, ± 1mA	3.9" X 7.1" X 0.5" (99 X 180 X 13 mm)
MP1916TC	Ultra-high stability, accuracy, and speed. Temperature-controlled.	16	± 0.001%	20 μ s to 1 LSB	± 10V, ± 5V + 5V, + 10V ± 2mA – 4mA	2" X 4" X 0.44" (51 X 102 X 11 mm)
MP1915TC		15	± 0.0015%	17 μ s to 1 LSB		
MP1914TC		14	± 0.003%	15 μ s to 1 LSB		
MP1926A	Sign/magnitude internal architecture; excellent linearity and stability near zero.	16	± 0.0015% max below ± ⅛ FSR ± 0.004% max above ± ⅛ FSR	3 μ s to 0.01% for a 5V step	± 5V, ± 10V – 5V magnitude output	2" X 4" X 0.44" (51 X 102 X 11 mm)
MP1926S	Ultra-stable	16	± 0.0015% max below ± ⅛ FSR ± 0.004% max above ± ⅛ FSR	40 μs to 0.01% for a 5V step	± 5V, ± 10V – 5V magnitude output	2" X 4" X 0.44" (51 X 102 X 11 mm)

Video Digital-to-Analog Converters (8-bit resolution)

Product	Notes, Features, Characteristics	Relative Accuracy of FSR	Major Carry Glitch Area	Update Rate	Input Logic Rate	Size
AH8308E	Fastest available, lowest power (1.0 watt max.)	± 0.02%	35 pV-S	150MHz	ECL	0.79" X 1.305" X 0.3" (33.14 x 20.06 X 7.62 mm)
AH8308T	Lowest power available (1.1 watt max.)	± 0.02%	35 pV sec	65MHz	TTL	0.79" X 1.305" X 0.3" (33.14 x 20.06 X 7.62 mm)
NEW AH8308TC	Triple 8-bit, low power (3.3 W max.)	± 0.02% each ch.	35 pV-S	65MHz	TTL	1.00" x 2.4" x 0.3" (25.4 x 60.8 x 7.6 mm)
MP8308	Very fast, glitchless, low, cost design generates full composite video signal.	± 0.2%	50mV-ns	40MHz	TTL	2" X 3" X 0.35" (51 X 76 X 9 mm)
MP8308ECL	Ultra-fast, glitchless, low-cost design generates full composite video signal.	± 0.2%	50mV-ns	100MHz	ECL	2" X 3" X 0.35" (51 X 76 X 9 mm)
MP8318	Very fast, glitchless, low-cost video DAC; 40MHz update	± 0.2%	75mV-ns	40MHz	TTL	2" X 3" X 0.35" (51 X 76 X 9 mm)
MP8318ECL	Ultra-fast, glitchless, low-cost video DAC; 100MHz update	± 0.2%	75mV-ns	100MHz	ECL	2" X 3" X 0.35" (51 X 76 X 9 mm)

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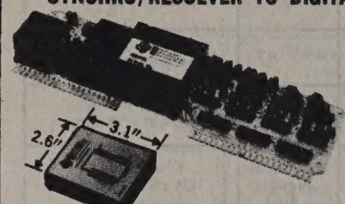
SYNCHRO CONVERTERS/DISPLAYS/ENCODERS

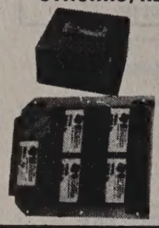
STANDARD LOW COST UNITS TO SATISFY ALMOST ANY SYNCHRO/RESOLVER OR SHAFT INTERFACING REQUIREMENT

SYNCHRO/RESOLVER TO DIGITAL Series SDC40/60



INPUT: 11.8/90 vrms L-L, 60 or 400 Hz. Ref: 26/115 vrms. **OUTPUT:** 16, 14, 12 or 10 Bits parallel binary or BCD. **ACCURACY:** ±2, ±4, ±6 or ±30 minutes of arc. **PACKAGE:** A) 2.6" x 3.1" x .82"h Module B) 2.6" x 9.25" x .9"h or 4.5" x 6.5" x .75" repairable PC card.

SYNCHRO/RESOLVER TO LINEAR DC Series SLD200

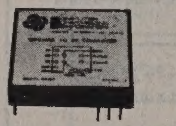


INPUT: 11.8/90 vrms L-L, 60 or 400 Hz. Ref: 26/115 vrms. **OUTPUT:** A) −10 to +10 vdc linear with angles from −180° to +180° B) −10 to +10 vdc linear with angles from −90° to +90° C) 0 to +10 vdc linear with angles from 0° to 360°. **ACCURACY:** ±15, ±30, or ±60 minutes of arc. **PACKAGE:** A) 3.2" x 3.4" x 1.8"h Module B) 4.5" x 6.5" x .75"h repairable PC Card.

SYNCHRO/RESOLVER TO SINE-COSINE DC Series SD100

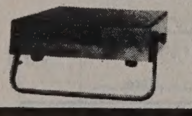
INPUT: 11.8/90 vrms L-L, 60 or 400 Hz. Ref: 26/115 vrms. **OUTPUT:** ±10 sin θ vdc; ±10 cos θ vdc. **ACCURACY:** ±2 or ±4 minutes of arc. **PACKAGE:** 1.75" x 1.75" x .6"h or 3" x 3" x .625"h Module.

INVARIANT SYNCHRO/RESOLVER TO SINE-COSINE Series SD100 I



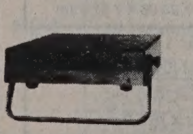
INPUT: 11.8/90 vrms L-L, 60 or 400 Hz. Ref: 26/115 vrms. **OUTPUT:** ±10 sin θ vdc, ±10 cos θ vdc. **ACCURACY:** ±4 minutes of arc. **INVARIANCY:** A ±10% change in the input or reference voltage results in a ±.5% change in the individual DC outputs. **PACKAGE:** 3" x 3" x .625"h Module.

SYNCHRO ANGLE INDICATOR Series AI400



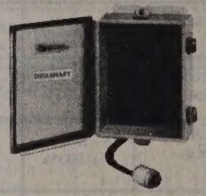
INPUT: 11.8/90 vrms L-L, 60 or 400 Hz. Ref: 26/115 vrms. **OUTPUT:** 5 digit display and BCD data. **ACCURACY:** ±.03°, ±.05°, or ±.1°. **PACKAGE:** 9.5"w x 1.75"h x 12" Deep — Bench or Rack Mounting.

BINARY ANGLE INDICATOR (BINARY TO BCD) Series BAC100



INPUT: Up to 16 bits of parallel binary data, TTL compatable. **OUTPUT:** 5 digit display of angle (0° to 359.99°) OR ANY OTHER SCALE FACTOR DESIRED FROM 0 TO 99999 REPRESENTING ENCODER POSITION, RANGE, PRESSURE, WEIGHT, ETC. **ACCURACY:** ±.01° (±1 lsb). **PACKAGE:** A) 7.0"w x 1.75"h x 8.25" deep — Bench or Rack Mounting B) 4.5" x 6.5" x 1.8"h PC Board requiring +5 vdc at 1 amp C) 2.6" x 3.1" x .82h Module.

PROGRAMMABLE LIMIT SWITCHES Series DLS

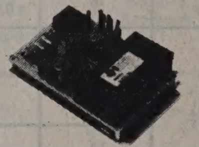


INPUT: Shaft angle position. **LIMITS:** (A) Dwell (From-to): 8 per unit; (B) Set Point — 16 per unit; (C) Closure — 16 per unit. **OUTPUTS:** (A) Logic Levels; (B) Power Transistor; (C) Relay; (D) Display (LED). **ACCURACY:** Up to ±.1°. **PICKOFF:** Resolver (size 15 or 11). **PACKAGE:** (A) 19" x 12" x 8.75"H; (B) NEMA 12 — 16" x 12" x 8".

DIGITAL TO SYNCHRO/RESOLVER Series DSC40/60

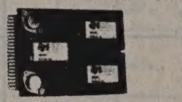
INPUT: 14, 12 or 10 bits parallel binary and 26/115 vrms reference. **OUTPUT:** 11.8/90 vrms. L-L, 60 or 400 Hz capable of driving 1VA, 2VA or 5VA LOADS: (up to 3 T.R.'s). **ACCURACY:** ±4, ±15 or ±30 minutes. **PACKAGE:** A) 2.6" x 3.1" x .82"h Module B) 4½" x 9¼" PC Card with edge connector (5VA units).

DC ANGLE TO SYNCHRO/RESOLVER Series LDS500



INPUT: ±10 vdc or ±100 vdc representing ±180° of angle. **OUTPUT:** 11.8/90 vrms L-L, 60 or 400 Hz capable of driving up to three size 11 T.R.'s (75 ohms L-L). **ACCURACY:** ±15 or ±30 minutes of arc. **PACKAGE:** 4.5" x 9.25" x 2.0"h repairable PC Board with 22 pin edge connector.

DC SIN COS TO SYNCHRO DRIVERS Series DCS400



INPUT: ±10 vdc representing sin θ and cos θ. **OUTPUT:** 11.8/90 vrms L-L, 60 or 400 Hz capable of driving up to three size 11 T.R.'s (75 ohms L-L). **ACCURACY:** ±6, ±15, ±30 minutes of arc. **PACKAGE:** A) 4.5" x 6.5" x .8"h repairable PC Card. B) 4.5" x 9.25" x 1"h PC Card.

RECTANGULAR TO POLAR Series RP600

INPUT: R sin θ and R cos θ from 50 mv to 10 vdc. **OUTPUT:** R and θ. **ACCURACY:** θ: ±15 minutes at R = 10, R: ±.1% F.S. **PACKAGE:** 3.2" x 3.4" x 1.8"h Module.

ADDITIONAL PRODUCTS

- Hi Speed Multiplexed Syn to Digital
- Multiplexed Syn to Linear DC
- Digital Sin-Cos to Synchro
- Two Speed Digital to Synchro
- Selsyn to Digital/DC
- Azimuth Change Pulse Converters

ALL SYNCHRO INPUT/OUTPUT UNITS

- Available in 0°C to 70°C or −55°C to +85°C temperature range
- TTL compatible outputs and inputs or CMOS or LP Shottky
- Operate from ±15 v, or ±15 and +5 vdc
- Transformer isolated inputs/outputs
- Solid State construction
- CAN BE MADE FIELD OR FACTORY REPAIRABLE
- Available hermetically sealed and to MIL SPECS (E-5400)
- Delivery: Stock to 4 weeks (small quantity)

SPECIAL UNITS AND PACKAGES AVAILABLE ON REQUEST

Write or phone for detailed specifications, applications assistance and evaluation units.

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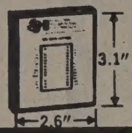
SYNCHRO CONVERTERS/DISPLAYS/ENCODERS

STANDARD LOW COST UNITS TO SATISFY ALMOST ANY SYNCHRO/RESOLVER OR SHAFT INTERFACING REQUIREMENT

SYNCHRO/RESOLVER TO BCD Series SBC

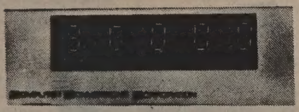


INPUT: 11.8/90vrms L-L, 60 or 400 Hz. Ref. 26/115vrms **OUTPUT:** 3 or 4 decade BCD — scaleable unipolar or bipolar. **ACCURACY:** ±30 or ±6 minutes of arc ±1 LSB. **PACKAGE:** 2.6" x 3.1" x .82" H Module. **OPTIONS:** Choice of Scale factors, Zero offset adjustments (±5%).

SYNCHRO/RESOLVER TO LINEAR DC — (HI-ACCURACY) Series SLD

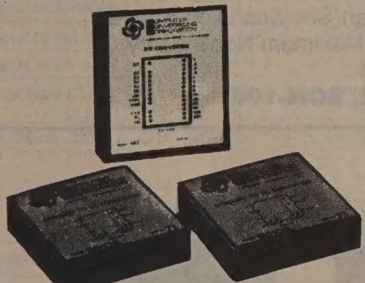
INPUT: 11.8/90vrms L-L, 60 or 400 Hz., Ref: 26/115vrms. **OUTPUT:** (A) −10 to +10 vdc linear with angles from −180° to +180° (standard) (B) 0 to +10V DC linear with angle from 0° to 360° (special): **ACCURACY:** ±6 minutes of arc at input speeds up to 1440°/sec: **PACKAGE:** (A) 2.6" x 3.1" x .82"H Module; (B) 3.06" x 2.6" x 3.18"H Can.

LOW COST ANGLE INDICATOR Series AI540



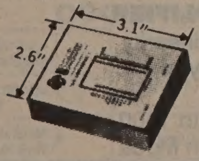
INPUT: 11.8/90vrms L-L, 60 or 400 Hz, Ref: 26/115vrms +115V 60 Hz power: **OUTPUT:** 4 digit or 3 digit, .5"H LED DISPLAY (unipolar or bipolar). **ACCURACY:** ±6 or ±30 minutes of arc ±1 LSB: **PACKAGE:** (A) 5.5"W x 7.5"L x 2.0"H PANEL MOUNT (DC supplies included): (B) 9½"W x 1¾"H, half rack mounting (DC supplies included. **OPTIONS:** Choice of scale factors, Zero offset adjustment (±5°).

MULTIPLEXED SYNCHRO TO DIGITAL Series MSH



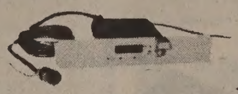
INPUT: 11.8/90vrms L-L, 60 or 400 Hz., Ref: 26/115v rms, up to 128 channels; **OUTPUT:** 12 bit parallel binary or 4 decade BCD (unipolar or bipolar: **ACCURACY:** ±6 minutes of arc ±1 LSB: **PACKAGE:** (A) Central converter — 2.6" x 3.1" x .82"H module, (B) Input Module — 1.5" x 2.0" x .6"H, (C) Transformer Module — 1.5" x 1¾₆" x .6"H (Scott "T" — 400 Hz) +1" x 1" x .8"H (Ref.). **OPTIONS:** (A) choice of scale factor on BCD output, (B) Linear DC output, (C) Systems mounted on PC boards and/or racks.

MULTISPEED SYNCHRO TO DIGITAL Series TSD



INPUT: 11.8•90vrms L-L, 60 or 400 Hz., Ref: 26/115 vrms: **SPEEDS:** 8, 16, 32, 9, 18, and 36: **OUTPUTS:** 16 to 19 bits parallel binary: **ACCURACY:** ±.02, ±.01 or ±.005 degrees: **PACKAGE:** Two or Three 2.6" x 3.1" x .82"H modules. **OPTIONS:** (A) Systems packaged on PC Cards or in racks; (B) 5 digit display.

ABSOLUTE ENCODERS Series DS90



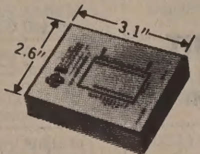
INPUT: Shaft angle position coupled to "DIGI-SHAFT" system: **OUTPUT:** four digit (.5"H) LED display (0 to 9999) +BCD or Parallel binary data (ANY SCALE FACTOR DESIRED): **ACCURACY:** ±1 part in 3600 (single turn) From shaft input to digital output: **PICKOFF:** Resolver (Size 8, 11, or 15): **PACKAGE:** (A) 5.44"W x 7.00" x 1.75"H: (B) Full or half rack: **OPTIONS:** Multi-channels, Zero offset, Presets, DC output, Multi-turn units with 5 digit (99999) output.

TYPICAL UNITS (single Turn)

Pt. No.	Output	Counts/360°
DS90-DB-12	Binary Data	2^{12}
DSR90-36-BC	0-3599 display +BCD data	3600
DSR90-10	0-999 display	1000
DSR90L-25-BC	0 to ±2500 display +BCD data	±2500

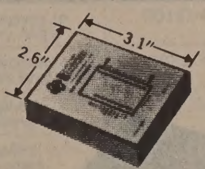
MULTITURN UNITS WITH UP TO 999999 FULL SCALE OUTPUTS AVAILABLE

SOLID STATE CONTROL TRANSFORMER Series SCT



DIGITAL INPUT ANGLE (φ): 14, 12, or 10 bits parallel binary. **SYNCHRO/RESOLVER INPUT ANGLE** (θ): −11.8/90vrms L-L, 60 or 400 Hz. **OUTPUT:** E out=(V ref ±7%) sin (θ-φ) Sin wt: **GRADIENT:** .4 or 1vrms/degree. **RANGE:** ±7 or ±12.5 degrees: **ACCURACY:** ±4, ±15, or ±30 minutes of arc. **PACKAGE:** 2.6" x 3.1" x .82"H Module.

SOLID STATE CONTROL DIFFERENTIAL TRANSFORMER Series SCDX

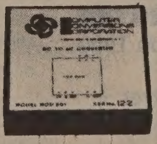


DIGITAL INPUT ANGLE (φ): 14, 12, or 10 bits parallel binary. **SYNCHRO/RESOLVER INPUT ANGLE** (θ): 11.8/90vrms L-L, 60 or 400 Hz. **OUTPUT:** (1) 9.2K (φ) Sin (θ-φ) Sin wt. [7vrms.] (2) 9.2K (φ) Cos (θ-φ) Sin wt. [7vrms.] **ACCURACY:** ±4, ±15 or ±30 minutes of arc. **PACKAGE:** 2.6" x 3.1" x .82"H.

MODULATORS Series MOD500

INPUT: 0 to ±10 or ±100 VDC and 26V/115Vrms reference: **OUTPUT:** 0 to 7vrms (other voltages available. **ACCURACY:** ±.2% F.S.: **NULL:** ±.1% F.S. **PACKAGE:** 2.6" x 3.1" x .625" Module. **OPTIONS:** Gain+Zero Adjust, external output transformers.

DEMODULATORS Series D400



INPUT: 0 to 5, 10, 25 or 100vrms, 400 to 5000 Hz, 5/26vrms reference. **OUTPUT:** 0 to ±5 or ±10VDC. **ACCURACY:** ±.2, .3 or .5% F.S. **NULL:** ±.1% F.S. **PACKAGE:** (A) 1.75" x 1.75" x .6"H Module. (B) 2.75" x 1.4" x .75"H Module.

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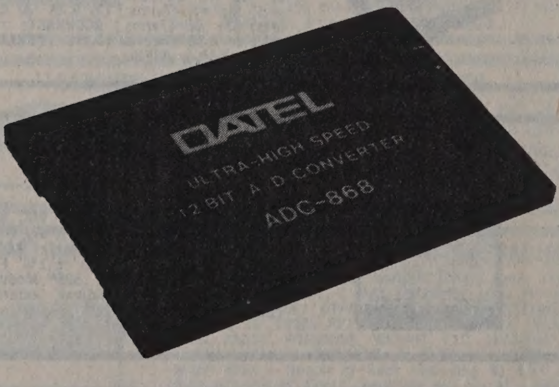
- 2.5 μSec Conversion Time
- 14-Bit Resolution
- 3-State Output

ADC-874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ADC-868

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SCM-100
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- 156 dB CMRR

SCM-100, SCM-101

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FOUR CHANNEL RTD SIGNAL CONDITIONER
SCM-102
DATEL
FOUR CHANNEL STRAIN GAGE SIGNAL CONDITIONER
SCM-103

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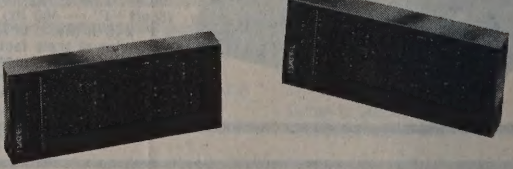
- Low Cost

SCM-102, SCM-103



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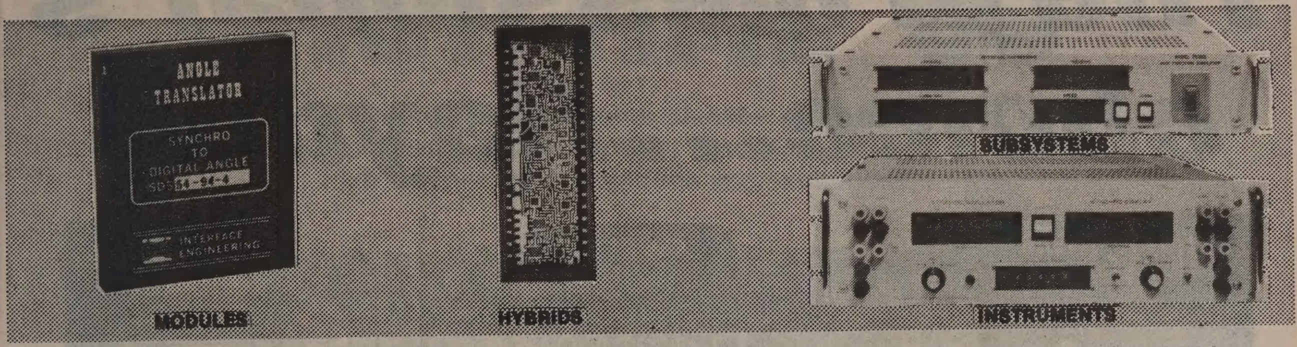

- SYNCHRO/RSLVR-DIGITAL
- DIGITAL TO SYNCHRO/RSLVR
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- SYNCHRO TO DC ANGLE
- DISPLAYS • SIMULATORS
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SYNCHRO-DIGITAL

Function	Model	Input	Output
Synchro to Digital	SD552/556	synchro	10 bit angle
Synchro to Digital	SD553/567	synchro	12 bit angle
Synchro to Digital	SD554/568	synchro	14 bit angle
Synchro to Digital	SD555	synchro	16 bit angle
S-D Multichannel	SD532	to 64 channels	13 bit angle
S-D 4 Channel	SD528	4 ch. synchro	13 bit angle
S-D Dual Speed	SD556/560	X1, X36 synchro	16-19 bit angle
Synchro to BCD	SD570	synchro	3 or 4 digit
Synchro to BCD	SD575/576	synchro	3 or 4 digit
Synchro to BCD and Binary	SD580/581	synchro	3 or 4 digit & 10/14 bit binary

Now available in low profile (0.4"H) modules.

DIGITAL-SYNCHRO

Digital to Synchro	DS340/341	14 bit angle	1-2 vA
Digital to Synchro	DS350	14 bit angle	4 or 10 VA
Digital to Resolver	DR320-A,B,C,D,E	10-20 bit angle	7 v resolver
Digital to TR	TD355/456	10, 12 bit angle	250 VA pk
Solid State CT	DS360/361	synchro vs 14 bit angle	null/error .4 to 1 vac/°
Solid State CDX	DS370	14 bit angle	7v resolver

SYNCHRO-ANALOG

Synchro to Linear DC	SA810A, B, C	synchro	+10 or ±10 vdc
Synchro to DC Sin & Cos-ABS	SA820A, B, C SA822	synchro	10 sin θ 10 cos θ
Synchro to DC Sin & Cos-Ref. scaled	SA830	synchro	10 sin θ 10 cos θ

COORDINATE CONVERTERS

DC Polar to Rectangular	SA850A, B, C	.1 to 10 v R 0 to 10 v θ	Rsin θ Rcos θ
DC Rectangular to Polar	SA860A, B, C	.1 to 10 Rsin θ & Rcos θ	+10 v = 360° .1 to 10 R
Polar to Analog Rectangular	DR320-A to D	10 - 20 bit Θ ±10VR	Rsin θ Rcos θ

ANGLE TRANSLATORS

Function	Model	Input	Output
Binary Angle to BCD Degrees	DD107-4 to -7	12, 16, 20, 21 bits	4 to 7 digits
Binary Angle to BCD Radar Mils	DD124-4 to -7	12, 16, 20, 21 bits	4 to 7 digits
BCD Degree to Acrmin. + Sec.	DD132	.999° BCD	4 digit BCD
Binary Angle to Bipolar Angle	DD117-16-21	17 or 21 bits	±17 or 21 bits
Binary Angle Combiner	DD118	16 bit θ & 16 bit ϕ	16 bit θ + ϕ or θ — ϕ
Binary Angle Comparator	DD119	16 bit θ & 16 bit θ ± ϕ	±16 bit ϕ shortest path
BCD Degrees to Binary Angle	DD127-4-5	4, 5 digit BCD	13 or 16 bits
BCD Degrees to Binary Angle	DD227-6	6 digit BCD	20 bit angle
Dual Speed Combiner	DD115A	X1 — 7 bits X36 — 14 bits	19 bit angle
Dual Speed Expanders	DD113	17-21 bits	X36-12/16 bits"

DIGITAL TRIG AND ARITHMETIC

Binary Angle to Sin and Cos	DD108/109 DD175	12, 15, 18 bits	±16 bit sine and cosine
Binary Tan to Angle	DD130A, B	10 or 13 bits	16 bit angle
Arcsin or Arccos	DD108/137	16 bits S or C	16 bit angle
Binary Angle to Tan.	DD130/137	16 bit angle	16 bit tan.
DC Angle to S & C	SA840A, B, C	+10 v = 360°	10 sinθ, 10 cosθ
DC S & C To Angle	SA880A, B, C	10 sinθ, 10 cosθ	+10 v = 360°
Binary Add/Subtract	DD129	16 bit A & B	16 bit A ± B
Binary Multiply	DD123/DP	16 bit A & B	18/32 bit AB
Binary Divide	DD163/DP	16/32A & 16B	18/32 bit A/B
Square Root	DD123/137	16 bit A	16 bit √A
Floating Point	DD154	16A + 4 bit X	8 modes
Complements	DD112	12-20 bit A	ones, two's, direct-thru
Inverse Function	DD137	16 bit X	16 bit f (X)
Inverse Function	DD141-20-28	20 or 28 bit X	16 or 24 bit f (X)

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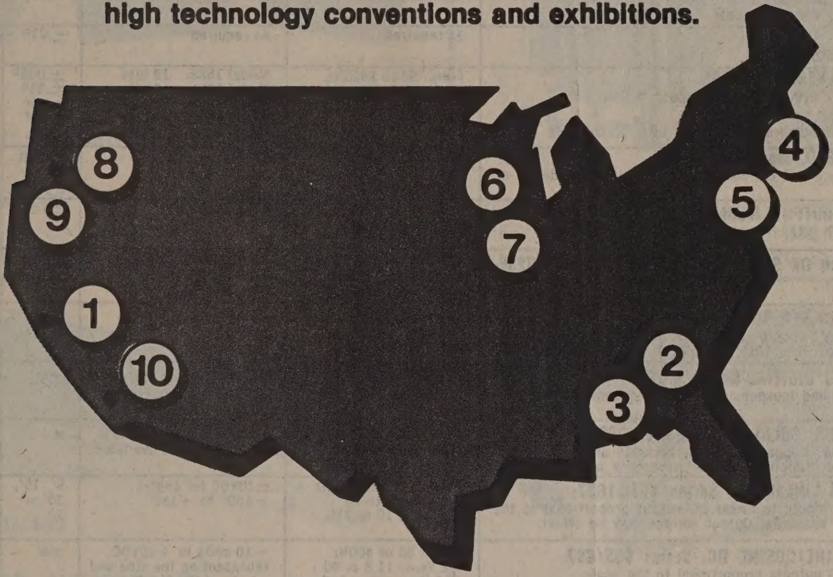

No.	Show	Dates	Location
1	Mini/Micro West	February 5, 6, 7, 1985	Anaheim Hilton Exposition Center Anaheim, California
2	Southcon	March 5, 6, 7, 1985	Georgia World Congress Center Atlanta, Georgia
3	Mini/Micro Southeast	March 5, 6, 7, 1985	Georgia World Congress Center Atlanta, Georgia
4	Electro	April 23, 24, 25, 1985	New York Coliseum New York
5	Mini/Micro Northeast	April 23, 24, 25, 1985	Albert Hall New York
6	Midcon	September 10, 11, 12, 1985	Rosemont Exposition Center Chicago, Illinois
7	Mini/Micro Midwest	September 10, 11, 12, 1985	Rosemont Exposition Center Chicago, Illinois
8	Northcon	October 22, 23, 24, 1985	Portland Memorial Coliseum Portland, Oregon
9	Mini/Micro Northwest	October 22, 23, 24, 1985	Portland Memorial Coliseum Portland, Oregon
10	Wescon	November 19, 20, 21, 22, 1985	Anaheim Convention Center Anaheim, California

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SYNCHRO AND RESOLVER DATA CONVERTERS

MODULES • MUX S/D SYSTEMS • IEEE-488 ANGLE INDICATORS AND SIMULATORS

DESCRIPTION	Input Availability	Output	Static Accuracy	Size
ANGLE POSITION INDICATORS: Dual channel, RS232C or IEEE-488 compatible.	Autoranging 10-90 V L-L 50-10KHz	To 6 Decade BCD	To ±.003°	19″ x 1¾″ x 11″
SYNCHRO/RESOLVER SIMULATORS: Dynamic mode, RS232C or IEEE-488 compatible.	5 Decade BCD	11.8/26/90 V L-L	±.01°	19″ x 3½″ x 13″
INTEL MULTIBUS: D/S and S/D. Two-speed or multiplexed.	As required	As required	±.01°	PC 12″ x 6.75″
TRACKING SYNCHRO/RESOLVER TO DIGITAL: Full transformer isolated units with jitter free output. NO-15VDC required. Valid data immediately available at trailing edge of CB.	Freq.: 50 to 1600Hz L-L V_{RMS}: 5 to 90 Ref. V_{RMS}: 10 to 115	Model 1663: 18 bits Model 1661: 16 bits Model 1651: 14 bits Model 1651B: 12 bits Model 1652: 10 bits	±.005° ±.01° ±4.0′ ±8.5′ ±21′	3.1″ x 5.1″ x 1.0″ 3.1″ x 2.6″ x 0.82″ 3.1″ x 2.6″ x 0.82″ 3.1″ x 2.6″ x 0.82″ 3.1″ x 2.6″ x 0.82″
AUTORANGING TRACKING S/D. Model 1653: Transformer isolated. Reference and L-L voltages may vary independently of each other.	Ref.: 44-1500Hz Ref. V_{RMS}: 5-125 L-L V_{RMS}: 5-115	12 bits	±ILSB	3.1″ x 2.6″ x 0.82″
TRACKING S/D WITH BCD OUTPUT. Model 1662: Transformer isolated units with jitter free output. 036° or ±179.9°	Ref.: 50-1500Hz Ref. V_{RMS}: 10-115 L-L V_{RMS}: 5-90	4 Decade BCD	±0.1°	3.1″ x 2.6″ x 0.82″
14 BIT SAMPLING SYNCHRO OR SIN/COS TO DIGITAL. Series 1623F: Includes ±5° offset capability.	Freq.: 50Hz to 10KHz L-L V_{RMS}: 5 to 90 Ref. V_{RMS}: 10 to 115	14 bit parallel binary or 4 decade BCD. TTL, DTL compatible.	±4′	3.125″ x 2.625″ x 0.82″
TWO SPEED SYNCHRO/RESOLVER TO DIGITAL. Series 1512 Single module combines binary or non-binary gear ratios from a two-speed system. Velocity output. Ratios: 9:1, 16:1, 18:1, 32:1, 36:1, 64:1, etc.	Freq: 50-1500Hz L-L V_{RMS}: 1.3-90 Ref. V_{RMS}: 5-115	16 bits binary parallel	±0.005°	3.125″ x 6.0″ x .82″
MULTIPLEXED SYNCHRO TO DIGITAL. Series MUX: Simple, noise immune, small and inexpensive Modular system, up to 128 channels.	Any combination of Synchros and Resolvers.	14 bits binary parallel to 75 μs conversion.	±5′	3.125″ x 2.65″ x 0.82″ + 1.85″ x 0.85″ x 0.82″ per channel
ANGLE POSITION INDICATOR, SOLID STATE. Series 2623: Includes ±5° offset capability. Rugged, compact, accurate and economical. With or without built-in power supplies. Internal reference available.	Freq.: 50Hz to 10KHz L-L V_{RMS}: 5 to 90 Ref. V_{RMS}: 10 to 115	Readout: 359.9, ±179.9 or 9999. Others available.	±0.1°	5.5″ x 1.75″ x 5.5″ deep
SYNCHRO OR SIN/COS TO LINEAR DC. Series K678-1637: Converts synchro or resolver inputs to linear DC output proportional to the angle. Connector termination available. Output voltage may be offset.	Freq.: 50Hz to 10KHz L-L V_{RMS}: 5 to 90 Ref. V_{RMS} 10 to 115	±10VDC for angles −180° to +180°	6′, 15′, 30′ or 1°	**K678:** 3.1 x 2.6 x .82 **K6678:** 3.1 x 2.6 x .42 **1637:** 2.5″ x 3.2″ x 0.78″
SYNCHRO/RESOLVER TO SINE/COSINE DC. Series 655/697: Generates sine and cosine DC outputs proportional to the angle.	Freq.: 60 or 400Hz L-L V_{RMS}: 11.8 or 90 Ref. V_{RMS}: 26 or 115	−10 volts to +10VDC, representing the sine and cosine of the input angle.	±6′	**400Hz:** 1.85″ x .85″ x .82″
SYNCHRO TO SINE/COSINE DC (non-variant). Series 655NV: Generates sine and cosine DC outputs proportional to the input angle. Insensitive to synchro reference and line voltage. Ideal for displays.	Freq.: 60 or 400Hz L-L V_{RMS}: 11.8 or 90 Ref. V_{MRS}: 26 or 115	−10 volts to +10VDC representing the sine and cosine of the input angle.	±6′	3.44″ x 3.19″ x 0.82″
DIGITAL TO SYNCHRO/RESOLVER. Series 1667:	16 bits TTL, levels binary coded angle.	Freq.: 50Hz to 10KHz L-L V_{RMS}: 5 to 90	±1′	3.125″ x 3.625″ x 1″
DIGITAL TO SYNCHRO/RESOLVER. Series 1673: Miniaturized, 1.5 VA, short circuit proof. 0.1% Max. amplitude variation.	14 bits, TTL levels binary coded angle.	Freq.: 50Hz to 10KHz L-L V_{RMS}: 5 to 90	±4′ ±8′	3.125″ x 2.625″ x 0.82″
BCD TO SYNCHRO/RESOLVER Series F1673:	4 Decade BCD	50Hz-10KHz 5-90 V L-L	±.1°	3.1″ x 3.6″ x .82″
DC TO SYNCHRO/RESOLVER. Series D1673	±10VDC ±180°	400Hz 26-90VL-L	±12′	3.12″ x 3.625″ x .82″
DIGITAL TO SYNCHRO/RESOLVER. Series 1680: Low cost, medium resolution version of our popular Model 1673.	10 bits, TTL levels binary coded angle.	Freq.: 50Hz to 10KHz L-L V_{RMS}: 5 to 90	±21′	3.125″ x 2.625″ x 0.82″
DIGITAL TO SYNCHRO/RESOLVER. Series B1670: Drives 3 TR's High power, solid state device converts a 14 bit input into a 3 wire synchro or 4 wire resolver output. Overload and short circuit protected.	14 lines representing angles 0 tp 360°	L-L V_{RMS}: 11.8 or 90 Ref. V_{RMS}: 26 or 115 Freq.: 60Hz or 400Hz	±4′	**PC:** 4.5″ x 8″ x .68″ above PC
ACP TO SINE/COSINE DC (non-variant). Series 1502: Model 1502-1 is ACP to Synchro.	4096 ACP & 1 ARP	±10VDC, as the sine and cosine.	±5′	3.1″ x 3.6″ x .82″
DIGITAL TO SINE/COSINE DIGITAL. Series 1500: Model 1500-1 has tristate outputs and MUX sine and cosine over 12 lines.	14 lines representing angles 0 to 360°	12 bits sine and cosine, also quadrant signs.	±2′	3.0″ x 4″ x 0.4″
DIGITAL TO SINE/COSINE DC (non-variant). Series 1501: 0.05% max. amplitude variation.	14 lines representing angles 0 to 360°	±10VDC, as the sine and cosine.	±4′ or ±15′	3.125″ x 2.625″ x 0.42″
DIGITAL VECTOR GENERATOR. Model 1504: High speed multiplying trigonometric D/A. Converts 14 bits of digital input and analog R into R sin θ and R cos θ.	14 lines representing angles 0 to 360°	±10V max. Reference will accept any wave form.	±4′	3.125″ x 2.625″ x 0.42″
DIGITAL TO RESOLVER. Series 1503: 0.035% max. amplitude variation.	14 lines representing angles 0 to 360°	2 AC voltages, 20V P-P, as the sine and cosine.	±4′	3.125″ x 2.65″ x 0.62″
CONTROL TRANSFORMER, SOLID STATE. Series 1682: Fully transformer isolated unit. 1.0% max. amplitude variation.	Synchro and 16 bits Natural parallel binary.	±5 V_{RMS} representing ±12.5°	±1′	3.125″ x 2.626″ x 0.42″
CONTROL DIFFERENTIAL TRANSMITTER, SOLID STATE. Series 1681: Model 1685 offers Synchro or Resolver output	Synchro and 14 bits Natural parallel binary.	6.5 V_{RMS}, sine/cosine or synchro/resolver	±4′	3.125″ x 2.625″ x 0.82″
SINE/COSINE TO SYNCHRO DRIVERS. Series B676: Solid state device designed to handle large current surges of TR's. Will drive three 11TR4s to a low null. Overload and short circuit protected.	±10VDC, representing the sine and cosine of the required angle.	L-L V_{RMS}: 11.8 or 90 Ref. V_{RMS}: 26 or 115 Freq.: 60Hz to 400Hz	±10′	**PC:** 4.5″ x 8.0″ x 1″
LINEAR DC TO SINE/COSINE DC. Series C670: Converts a DC voltage, representing an angle, into two output voltages that are proportional to the sine and cosine of that angle.	±10VDC representing angles from −180° to +180°	K sin θ and K cos θ K = 10VDC	±10′	3.44″ x 3.19″ x 0.82″
COORDINATE ROTATOR. Series A689: Rotates (X-Y) coordinates proportional to a linear DC input.	$Y = R \cos\theta$ $Y = R \sin\theta$ R = ±10VDC	$R \sin(\theta + \beta)$ $R \cos(\theta + \beta)$	±10′	3.19″ x 3.44″ x 0.82″
POLAR TO RECTANGULAR. Series A1618: Converts polar coordinates (R, θ) into rectangular (X, Y).	R: ±10VDC θ: ±10VDC	$X = R \cos\theta$, $Y = R$ sine θ R = ±20MV to ±10VDC	±10′	3.19″ x 3.44″ x 0.82″
RECTANGULAR TO POLAR. Series 695: Converts rectangular coordinates (X, Y) into polar (R, θ).	$X = R \cos\theta$ $Y = R \sin\theta$	$R = \sqrt{X^2 + Y^2}$ $\theta = \tan^{-1} Y/X$	±10′	3.19″ x 3.44″ x 1.78″
DEMODULATORS: Phase Sensitive Transformer isolated, single or dual channel.	840: 0 to 5 V_{RMS} 9318: To cust. spec	0 to ±4.3VDC As requested	.1% .1%	3.1″ x 1.9″ x 0.5″ 1.63″ x 1″ x 1″

Other frequencies and voltages available. Units available for either 0 to +70°C or −55°C to +105°C operation. Most units are hermetically sealed for extra protection.

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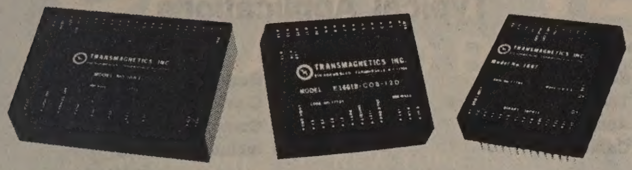
SYNCHRO AND RESOLVER DATA CONVERTERS

MODULES • MUX S/D SYSTEMS • IEEE-488 ANGLE INDICATORS AND SIMULATORS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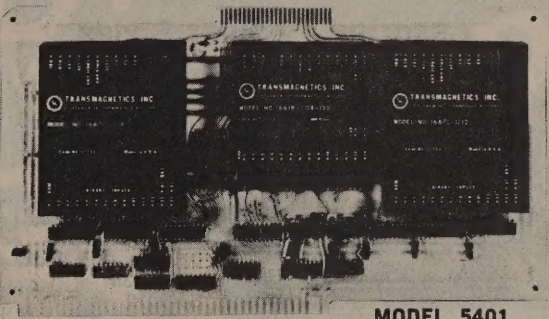
MODEL E1661B-COS-12D
Model No. 1667

MODEL 1663:
18 BIT S/D OR R/D ±20 ARC SECONDS ACCURACY.

MODEL E1661:
16 BIT S/D OR R/D ±40 ARC SECONDS ACCURACY.

MODEL 1667:
16 BIT D/S OR D/R 1.3 VA ±30 ARC SECONDS ACCURACY.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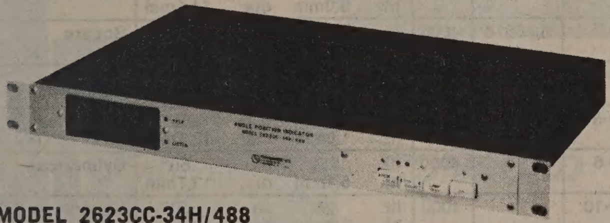
MODEL 5401

INTEL MULTIBUS 8085/8086 COMPATIBLE SYNCHRO/ RESOLVER-TO-DIGITAL AND DIGITAL-TO-SYNCHRO/ RESOLVER SYSTEM. ±30 ARC SECONDS ACCURACY.


ANGLE POSITION INDICATOR

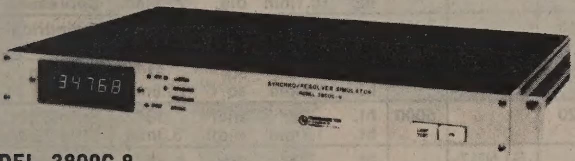
MODEL 2623CC-34H/488

SYNCHRO/RESOLVER, AUTORANGING, IEEE-488 COMPATIBLE ANGLE POSITION INDICATOR.
47-2045 Hz ±1 MINUTE ACCURACY.

TRANSMAGNETICS INC.

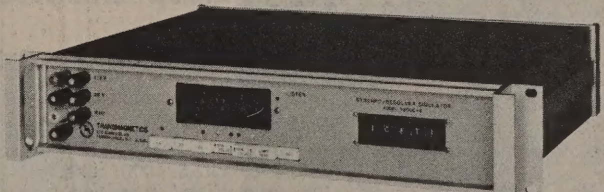
MODEL 3800C-1

DUAL CHANNEL SYNCHRO/RESOLVER SIMULATOR.
50-2045 Hz ±30 ARC ACCURACY.


34768
SYNCHRO/RESOLVER SIMULATOR

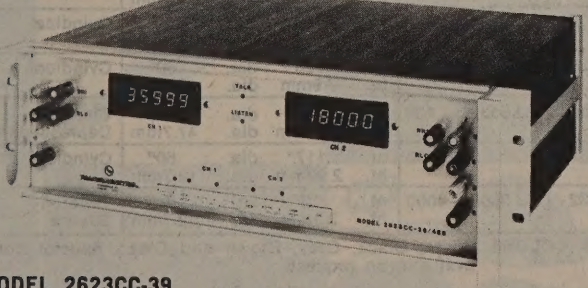
MODEL 3800C-8

SYNCHRO/RESOLVER SIMULATOR.
±30 ARC SECONDS ACCURACY.
PROGRAMMABLE VIA IEEE-488 FOR STATIC ANGLES OR CW/CCW ROTATION BETWEEN ±0.5° TO 360°/SEC.


SYNCHRO/RESOLVER SIMULATOR
TRANSMAGNETICS

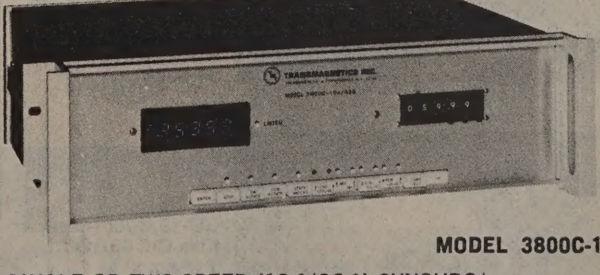
MODEL 3800C-6

SYNCHRO/RESOLVER SIMULATOR.
IEEE-488 PROGRAMMABLE.
50-2045 Hz ±30 ARC SECONDS ACCURACY.


35999
18000
TALK
LISTEN
CH 1
CH 2
MODEL 2623CC-39/488

MODEL 2623CC-39

TWO ANGLE POSITION INDICATORS WITHIN ONE ENCLOSURE. IEEE-488 COMPATIBLE, LATCHING CAPABILITY AND SYN/RSVR PROGRAMMABLE.


TRANSMAGNETICS INC.
LISTEN

MODEL 3800C-10

SINGLE OR TWO-SPEED (18:1/36:1) SYNCHRO/ RESOLVER SIMULATOR, IEEE-488 PROGRAMMABLE, DYNAMIC MODE, 50-2045 Hz ±30 ARC SECONDS ACCURACY.

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Products *corporation*

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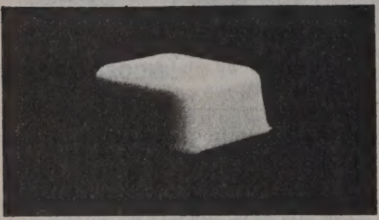
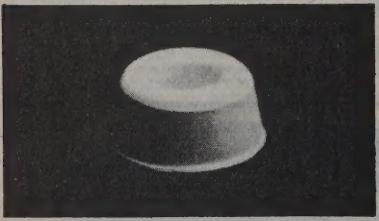
GD-1, 4000/case,
Kiss-Cut 50/pad
0.50 dia, 0.15 thick,
equals 3M
SJ-5012

GD-2, 4000/case,
Kiss-Cut 50/pad
0.45 dia, 0.20 thick,
equals 3M
SJ-5003

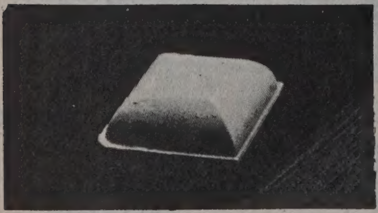


GD-4, 1000/case,
Kiss-Cut 48/pad
0.75 sq, 0.34 thick

GD-5, 4000/case,
Kiss-Cut 50/pad



GD-17, 1000/case,
Kiss-Cut 48/pad
.88″ dia. x
.40″ thick
equals 3M
SJ-5009



GD-19, 1000/case,
Kiss-Cut 48/pad
.81″ sq. x
.30″ thick
equals 3M
SJ-5023

Typical Applications

- **Electronics**
- **Telecommunications**
- **Appliances**
- **Cabinets**
- **Desk Top Equipment**
- **Computers**
- **Computer Pheripherals**
- **Isolation Mounts**

COMPARISON CHART

Bumper Product Style No.	3-M No.	Min. Order Qty.	Size	Description
GD-1	SJ 5012	4000	ht. .14″ dia. .50″ ht. 3.5mm dia. 12.7mm	Cylindrical
GD-2	SJ 5003	4000	ht. .20″ dia. .45″ ht. 5.0mm dia. 11.1mm	Hemisphere
GD-3	SJ 5018	4000	ht. .20″ sq. .50″ ht. 5.6mm sq. 12.7mm	Square
GD-4		1000	ht. .34″ sq. .75″ ht. 8.6mm sq. 19.1mm	Square
GD-5		4000	ht. .06″ dia. .50″ ht. 1.6mm dia. 12.7mm	Cylindrical
GD-6		4000	ht. .250″ dia. .50″ ht. 5.1mm dia. 12.7mm	Cylindrical
GD-10		4000	ht. .26″ sq. .50″ ht. 6.6mm sq. 12.7mm	Square
GD-11		4000	ht. .40″ dia. .62″ ht. 10.2mm dia. 15.9mm	Cylindrical
GD-13		5000	ht. .09″ width .144″ ht. 2.4mm width 3.7mm	Strip 1.150″ Strip 29.2mm
GD-15	SJ 5027	1000	ht. .32″ dia. .63″ ht. 7.9mm dia. 16.0mm	Hemisphere
GD-17	SJ 5009	1000	ht. .40″ dia. .88″ ht. 10.1mm dia. 22.3mm	Circular Depressed
GD-18		4000	ht. .14″ dia. .50″ ht. 3.5mm dia. 12.7mm	Cylindrical Concavity
GD-19	SJ 5023	1000	ht. .30″ sq. .81″ ht. 7.6mm sq. 20.6mm	Tapered Square
GD-20		5000	ht. .06″ width .13″ ht. 1.7mm width 3.3mm	Strip 3.92″ Strip 99.6mm
	SJ 5017		ht. .38″ dia. .75″ ht. 9.6mm dia. 19.0mm	Hemisphere
	SJ 5510		ht. .15″ width .50″ ht. 3.8mm width 12.7mm	Strip
	SJ 5514		ht. .52″ width .81″ ht. 13.2mm width 20.6mm	Truncated Square Cone
GD-22		5000	ht. .125″ sq. .625″ ht. 3.1mm sq. 15.9mm	Square
GD-24		5000	ht. .125″ dia. .810″ ht. 3.1mm dia. 20.5mm	Cyindical
GD-25		5000	ht. .250″ dia. .810″ ht. 6.2mm dia. 20.5mm	Cyindical
GD-26		4000	ht. .090″ dia. .50″ ht. 2.4mm dia. 12.7mm	Cyindical
GD-29		5000	ht. .325″ dia. .50″ ht. 7.9mm dia. 12.7mm	Cyindical
GD-30	SJ 5532	100	ht. .66″ dia. 1.88″ ht. 16.7mm dia. 47.7mm	Circular Depressed
GD-31		4000	ht. .117″ dia. .50″ ht. 2.90mm dia. 12.7mm	Cyindical
GD-32	SJ 5008	4000	ht. .12″ sq. .50″ ht. 3.1mm sq. 12.7mm	Tapered Square

STOCK COLORS: White, Black, Grey, Brown and Clear. Special colors available on request.

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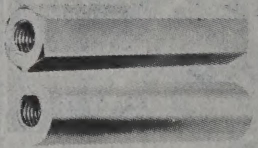
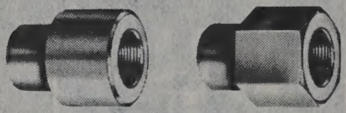


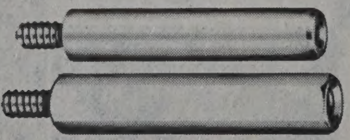
Threaded, Unthreaded
Shapes: round—square—hex
Diameters: ⅛" through ⅝"
Materials: brass, aluminum, stainless steel, cold rolled steel, nylon, teflon, linen base phenolic, 10% glass filled Lexan®

Standoffs—Swage and Rivet Type



Threaded, Unthreaded
Shapes: round—hex
Diameters: ⅛" through ⅜"
Materials: brass, aluminum, stainless steel, cold rolled steel

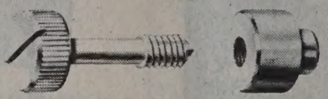
Standoffs—Male to Female



Shapes: Round—square—hex
Diameters: ⅛" through ½"
Materials: brass, aluminum, stainless steel, carbon steel, nylon

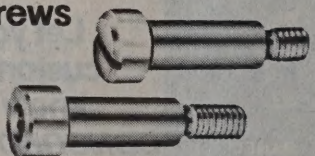
Captive Panel Hardware

Screws and Retainers



Head configurations: knurled and slotted, knurled and unslotted, slotted hex, unslotted hex
Materials: brass, aluminum, stainless steel, carbon steel, nylon, 10% glass-filled Lexan
Threads: 4-40 through 5/16-24
Retainers: standard and spring-loaded

Precision Shoulder Screws



Head shapes: slotted round, Allen round
Diameters: ¼" to ¾"
Material: Type 303 stainless steel—other materials on special order

Handles

Shapes: round, oval, rectangular, half-round
Styles: internal thread, external thread, straight, offset, hinged, extruded
Materials: brass, aluminum, stainless steel, carbon steel

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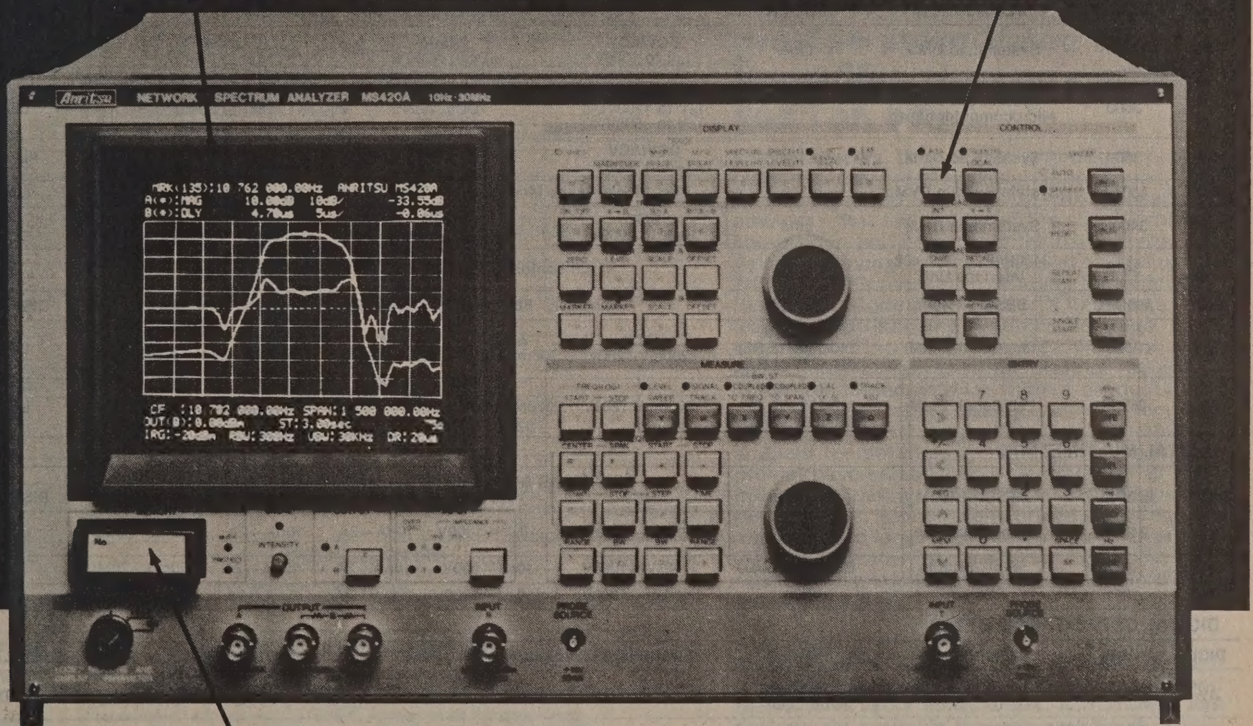
Anritsu
NETWORK SPECTRUM ANALYZER MS420A 10Hz-30MHz
MRK(135):10 762 000.00Hz ANRITSU MS420A
A(*):MAG 10.00dB 10dB/ -33.55dB
B(*):DLY 4.70us 5us/ -0.06us
CF :10 702 000.00Hz SPAN:1 500 000.00Hz
OUT(B):0.00dBm ST:3.00sec
IRG:-20dBm RBW:300Hz VBW:30KHz DR:20us
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Also features two traces for simultaneous wideband and high-resolution sweeps. Built-in CRT for digital readouts of center frequency, signal level, sweep width and other critical measurements.

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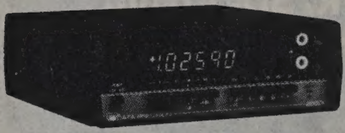
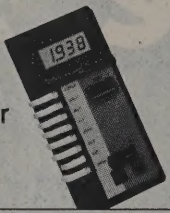
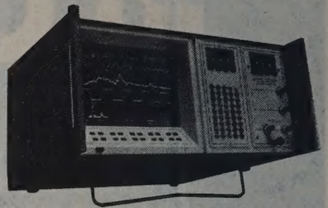


5½ Digit DMM
Model 2590



Capacitance Meter
Model 938



Universal
Waveform
Analyzer
Data 6000

IEEE-488

LABORATORY & SYSTEMS INSTRUMENTATION

DIGIT	MODEL	DESCRIPTION	POWER	FUNCTIONS & RANGES (MIN.—MAX. READINGS)			DISPLAY
5½	7500	System/Lab DMM	Line	**DCV/ACV** 1μV to 1000V	**Ratio** DCV, ACV, Ω	**Ohms** 1mΩ to 20MΩ	LED
5½	3600	System/Lab DMM Microcomputer-based	Line	**Volts** 1μV to 1200VDC 1μV to 800VAC	**Ratio** DCV, ACV	**Ohms** 1mΩ to 20MΩ	LED
5½	3500	System/Lab DMM	Line	**DCV/ACV** 1μV to 1000V	**DC Ratio** .01:1 to 120:1	**Ohms** 1mΩ to 12MΩ	Planar
5½	3501-5	System Build-in DVMs	Line	**Five Single-Range Models:** ±.12, ±1.2, ±12, ±120, ±1200VDC			LED
4½	3400R	System/Lab DMM	Line	**DCV** 10μV to 1000V	**ACV** 10μV to 750V	**Ohms** 10mΩ to 20MΩ	LED
4½	3410	3400R/IEEE STD 488 Interface Unit	Line	in full conformance with IEEE STD 488 (1978)			

DIGIT	MODEL	DESCRIPTION	POWER	FUNCTIONS & RANGES					DISPLAY
5½	2590	Lab/Bench DMM	105-125V 210-250V (E,RE) 91-109V (J,RJ)	**DCV** 200mV-1200V	**ACV** 200mV-800V	**DCI** 200μA-2000mA	**ACI** 2mA-2000mA	**Ohms** 200Ω-20MΩ	LED
5½	2590R	Lab/Bench DMM	105-125V 210-250V (E,RE) 91-109V (J,RJ)	2000mV-1200V	2000mV-800V	200μA-2000mA	2mA-200mA	200Ω-20MΩ	LED

DIGITAL MULTIMETERS

DIGIT	MODEL	DESCRIPTION	POWER	FUNCTIONS & RANGES (MIN.—MAX. READINGS) DCV	ACV	DCI	ACI	Ohms	DISPLAY
4½	2480R	Bench/Portable	Line (Opt. Batt.)	10μV—1000V	10μV—1000V	10nA—2A	10nA—2A	100mΩ—20MΩ	LED
4½	248	Mini-Portable	Battery & Line*	10μV—1000V	10μV—500V	10nA—2A	10nA—2A	100mΩ—20MΩ	LED
3½	1351	Bench	Line	100μV—1200V	100μV—1000V	0.1μA—2A	0.1A—2A	100mΩ—20MΩ	LED

DIGITAL CAPACITANCE METER

DIGIT	MODEL	DESCRIPTION	POWER	MEASUREMENT RANGES (MIN.—MAX.)	BASIC ACCURACY	DISPLAY
3½	938	Hand-Held	Battery (Opt. Line)**	0.1pF to 2000μF	±0.1% rdg./±1 digit	LCD

DC VOLTAGE STANDARD

DIGITS	MODEL	DESCRIPTION	POWER	FUNCTIONS & RANGES (MIN.—MAX. OUTPUTS)		DISPLAY
5	8100	Secondary DC Voltage Standard	Line	**Dual Output** 0 to ±11.1110VDC 0 to ±111.110mVDC	**Accuracy** 50ppm ±50μV 150ppm ±0.5μV	Rear-illuminated Annunciator
6	8200	DC Voltage Current Standard	Line	**Ranges** 0.1μV—100mV; 10μV—10V; 100μV—100V 1μA—100mA	**Basic Accuracy** 10ppm rdg. + 1ppm range 0.01% rdg. + 1μA	0.8" LED

WAVEFORM ANALYZER/DIGITAL STORAGE OSCILLOSCOPE

MODEL	DESCRIPTION	POWER	FUNCTIONS & RANGES			DISPLAY
D6000	Universal Waveform Analyzer	105-125V 210-250V (50-60Hz)	**Digitizing Plug-Ins** 610/611 (2 or 4 ch.) 620 (2 ch.)	**Ranges** DC-30KHZ; 500mV, 5V, 50V DC-20MHZ; 1.2V, 3.6V	**Basic Accuracy** 610/611 System: .05% 620 System: .5%	9" Diagonal Screen

*Rechargeable battery module and charger included.

**Battery supplied, battery eliminator optional.

For More Information. Circle No. 220

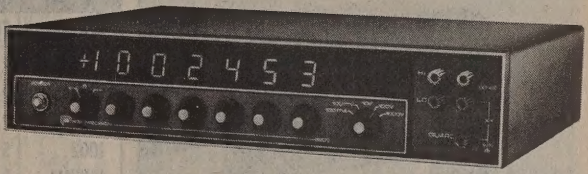
Of Measurement

5½ Digit DMM
Model 3600

IEEE-488

DC Calibrator
Model 8200

IEEE-488



MODEL	SPECIAL FEATURES & OPTIONS
7500	Up to 1000 readings/sec. Remotely programmable, BCD output. IEEE STD 488 and True RMS AC Sensing options.
3600	Modular, field installable plug-ins provide dozens of cost effective functions. Remote programmable/BCD output, RMS Sensing option, high impedance DCV input to 20V.
3500	2 and 4-wire Resistance. Remotely programmable, BCD output.
3501-5	BCD output. Ratio options. Autopolarity.
3400R	True RMS AC Sensing. 2 and 4-wire Resistance. Remotely programmable, BCD output.
3410	Dedicated MC6800 μC with 2K of ROM and 128 words of RAM, extendable by 1K words of PROM.
2590	Model 2590: average responding.
2590R	Model 2590R:True RMS. Basic accuracy .007%, 1μV, 1mΩ, 1ηA resolution. Automatic 2/4 Wire Ohms.

MODEL	SPECIAL FEATURES & OPTIONS
2480R	True RMS AC Sensing (Model 2480R) Average Sensing AC (Model 2480).
248	True RMS AC Sensing.
1351	Hi/LoΩ, 20 amp. AC/DC (Model 1351). Average Sensing AC.

MODEL	SPECIAL FEATURES
938	One-hand operation. 200-hour battery life.

MODEL	SPECIAL FEATURES & OPTIONS
8100	NBS traceability. Wide load tolerance. Low noise.
8200	NBS traceability. Manual or ATE operation via IEEE-488 interface. "Incrematic" adjustment facilitates access to all functions and ranges. Return-to-zero feature automatically prevents inadvertent overvoltage.

MODEL	SPECIAL FEATURES & OPTIONS
D6000	IEEE-488 compatible, RS-232-C compatible. Plotter option, Memory option, Floppy Disk option. Standard Features include: Spectral Analysis (FFT-based), Auto/Cross Correlation, Transient capture and analysis, complete waveform analysis capability.

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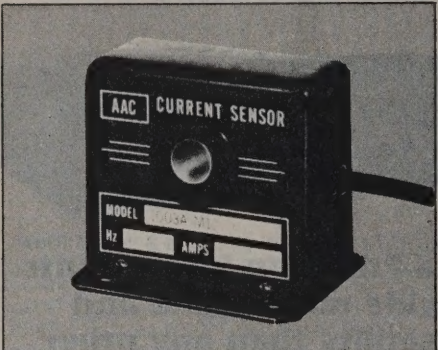

Figure 1 Size: 2 1/16" x 2" x 1 3/4"

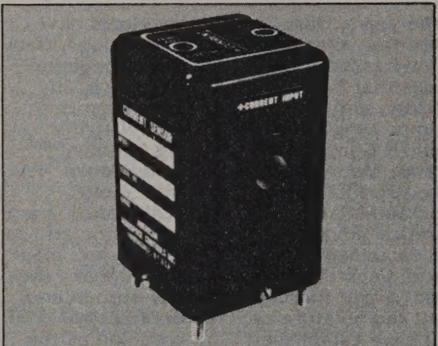

Figure 2 Size: 2 11/16" x 1 5/8" x 1 5/8"

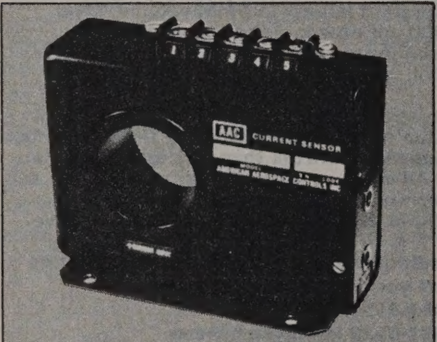

Figure 3 Size: 3 1/2" x 4 1/4" x 2 3/16"

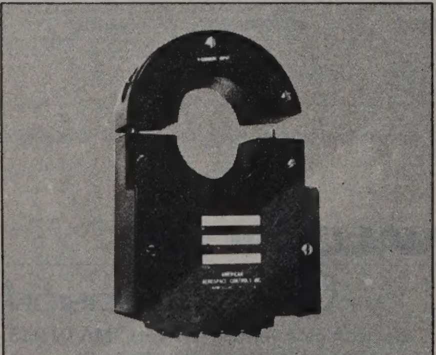

Figure 4 Size: 5" x 3 1/4" x 1 9/16"

AC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
C	1, 2, 5, 10, 20A	+1mA DC	0.25%FS	400ms	6
1003AM1	2, 5, 10, 15, 20, 30, 50, 100A	+5VDC	1%FS	150ms	1
1004	2, 5, 10, 20, 50, 100A	+5VDC	1%FS	150ms	5
1002	5, 10, 25, 50, 100A	+5VDC	1%FS	50ms	—
1002M1	5, 10, 25, 50, 100, 150, 200, 250A	+5VDC	1%FS	50ms	5
1003AM2	30, 50, 75, 100, 150, 200, 250A	+5VDC	1%FS	150ms	—
1004M7	100, 150, 200, 250A	+5VDC	1%FS	150ms	5
1003AM3	150, 250, 500, 800, 1000, 1200, 1500A	+5VDC	1%FS	150ms	—
1001	150, 250, 500, 1000, 2000, 2500, 5000A	+5VDC	2%FS	150ms	4

DC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
904B	.1, .2, .5, 1, 2, 5mA	+5VDC	1%FS	50ms	—
903B	5, 10, 20, 50, 100, 200, 500mA & 1, 2, 5A	+5VDC	1%FS	50ms	5
903C	5, 10, 20, 50, 100, 200, 500mA & 1, 2, 5A	+5VDC	2%FS	50ms	5
S209-903B	5, 10, 20, 50, 100, 200, 500mA & 1, 2, 5A	+1mA DC	1%FS	50ms	5
S218-903	100, 200, 500mA & 1, 2, 5A	+5VDC	1%FS	50ms	3
936	50 & 500mA	+5VDC	2%FS	100ms	—
937	10, 20, 30, 50, 100A	+5VDC	2%FS	200µs	—
913A	10, 20, 50, 100A	+5VDC	1%FS	1ms	2
913B	10, 20, 50, 100A	+5VDC	1%FS	1ms	5
913C	10, 20, 50, 100A	+5VDC	2%FS	1ms	5
S155-913B	10, 20, 35, 50, 75, 100A	+5VDC	1%FS	1ms	5
946	10, 15, 20, 25, 30, 50A	+5VDC	1%FS	30ms	—
950	10, 20, 30, 40, 50A	+5VDC	0.5%FS	10ms	5
951	10, 20, 30, 40, 50A	+5VDC	0.5%FS	30ms	5
952	100, 250, 400, 500, 1000, 1500, 2000A	+5VDC	0.5%FS	50µs	5
934	100, 200, 250, 300, 500, 750, 1000A	+5VDC	2%FS	200µs	5

BIDIRECTIONAL CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
905B	±50, 100, 200, 500mA & 1, 2, 5A	±5V	1%FS	50ms	5
905C	±50, 100, 200, 500mA & 1, 2, 5A	±5V	2%FS	50ms	5
925B	±10, 20, 50, 100A	±5V	1%FS	1ms	5
925C	±10, 20, 50, 100A	±5V	2%FS	1ms	5
907	±25, 50, 100, 150, 200, 250, 300A	±5V	2%FS	100µs	—
907A	±25, 50, 100, 150, 200, 250, 300A	±5V	2%FS	40µs	—
908	±25, 50, 100, 150, 200, 300A	±250mV	2.5%FS	5µs	—
910	±25, 50, 100, 150, 200, 250A	±250mV	2%FS	5µs	—
927B	±150, 200, 250, 300, 500, 750, 1000A	±5V	1%FS	100µs	5
927C	±50, 100, 150, 200, 250, 300, 500, 750, 1000A	±5V	2%FS	100µs	5
942A	±100, 200, 300, 500, 800, 1000, 2000A	±5V	1%FS	100µs	3
909	±150, 250, 500, 750, 1000, 1500, 2500, 5000A	±250mV	2.5%FS	200µs	4
909M4	±150, 250, 500, 750, 1000, 1500, 2000, 2500A	±5V	2.5%FS	200µs	4
921	±250, 500, 750, 1000, 2000A	±250mV	2%FS	20µs	5

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CURRENT, VOLTAGE AND POWER INSTRUMENTATION

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AC & DC CURRENT LEVEL DETECTORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
850	1, 2, 5, 10, 15, 20, 50, 100, 200, 250A AC	RELAY	2%FS	500ms	—
S212-850	500mA AC (75A AC OVERLOAD)	RELAY	±75mA	200ms	5
901B	20, 50, 100, 250, 500mA & 1, 2, 5A DC	+5V & SW	1%FS	50ms	—
S204-800	100mA DC (10A DC OVERLOAD)	RELAY	N/A	3ms	5
S58-800	200mA DC (10A DC OVERLOAD)	SWITCH	N/A	1ms	5
S201-800	1A DC (100A DC OVERLOAD)	RELAY	±150mA	200ms	5

AC VOLTAGE SENSORS

SERIES	FULL SCALE (FS) INPUT VOLTAGE RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
109	120, 125, 135, 240, 250, 270VAC	+1mA DC	0.5%V max	300ms	—
110	120, 125, 135, 240, 250, 270VAC	+1mA DC	0.5%V max	300ms	—
108	130, 150, 270, 500, 600VAC (0 to FS)	+5VDC	2%FS	200ms	—
S190-108	130, 150, 270, 300, 600VAC (0 to FS)	+10VDC	2%FS	200ms	—
V	150, 300, 500VAC (0 to FS)	+1mA DC	0.25%FS	400ms	6
101M3	150VAC @ 60Hz (SUPPRESSED ZERO)	+5VDC	2%V max	17ms	—
102M3	175VAC @ 400Hz (SUPPRESSED ZERO)	+5VDC	2%V max	3ms	—
105	465, 490, 505, 540VAC (SUPPRESSED ZERO)	+5VDC	2%V max	17ms	—

WATT & VAR TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT POWER RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
415A	1KW-100KW 120 or 220VAC 60Hz	+5VDC	2%FS	400ms	8
416A	4KW-200KW 440VAC 60Hz	+5VDC	2%FS	400ms	8
S217	2KW-80KW 220 & 440VAC 60Hz	+5VDC	2%FS	400ms	8
S73-413	1KW-50KW 120 or 220VAC 60Hz	+5VDC	2%FS	400ms	8
S206-415A	1KW-100KW 120 or 220VAC 400-1KHz	+5VDC	2%FS	150ms	8
W106	0.5KW-2KW (1 ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
W156	1KW-4KW (1½ ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
W206	1KW-4KW (2 ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
W256	1KW-4KW (2½ ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
W306	1KW-4KW (3 ele) 120, 220, or 440VAC	±1mA DC	0.25%FS	400ms	7
Q106	0.5-2KVAR (1 ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
Q156	1-4KVAR (1½ ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
Q206	1-4KVAR (2 ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
Q256	1-4KVAR (2½ ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
Q306	1-4KVAR (3 ele) 120, 220 or 440VAC	±1mA DC	0.25%FS	400ms	7
407	0.3-60KW DC 12-240VDC & 25-250A DC	250mV	2%FS	5μs	—
401	2.7-150KW DC 18-150VDC & 150-1000A DC	250mV	2.5%FS	200μs	4

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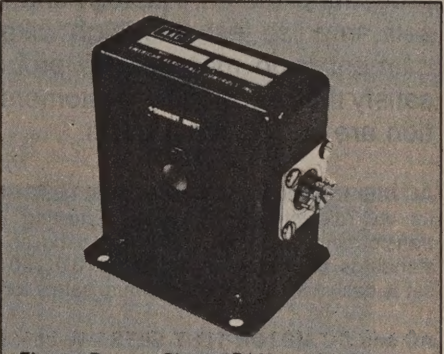

Figure 5 Size: 2⅞" x 2⁹⁄₁₆" x 2"

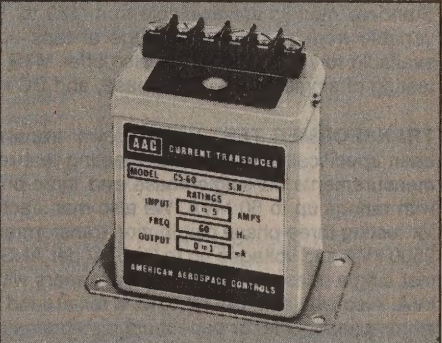

Figure 6 Size: 4" x 4" x 2"

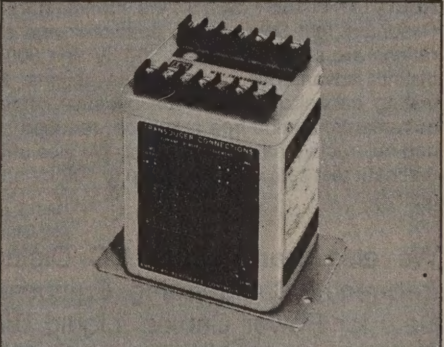

Figure 7 Size: 5⁷⁄₁₆" x 5⅛" x 3⅜"

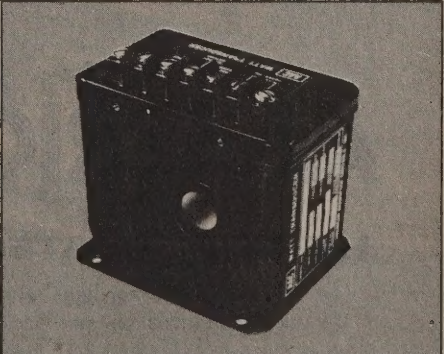

Figure 8 Size: 4" x 4⅛" x 3⅜"

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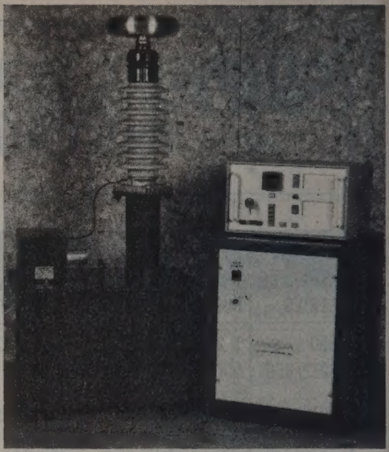
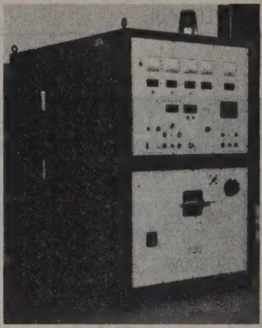
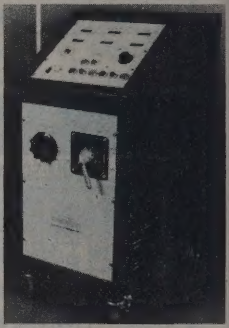
AMERICAN HV TEST SYSTEMS manufactures a complete line of high voltage test equipment for testing in accordance with CSA, IEEE, NEMA, AEIC, IPCEA, ANSI, UL, ASTM, and other applicable standards. We are also the U.S. distributor for the high voltage test products of ASEA, Haefely, and Micafil, including large AC/DC test sets, impulse test sets, high voltage standard capacitors. Our commitment is to manufacture products of the highest quality which satisfy the needs of our customers. Technical excellence and innovation are our constant goals.


6100-30D

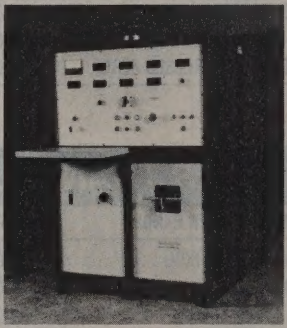
AC DIELECTRIC AND INSULATION TEST SETS. We offer four standard lines for AC dielectric and insulation testing of motors, cables, switchgear, transformers, bushings, capacitors, and so on, according to all applicable standards. Models are available from 3 to 300 kV and from 0.5 to 300 kVA. Each set is designed to provide optimum safety for the operator and the test object.

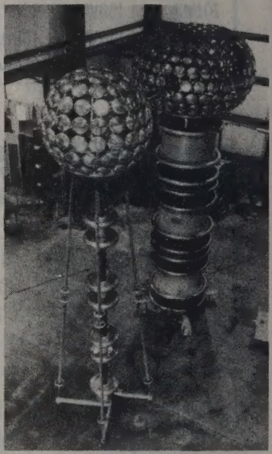
AC and DC MOTOR TEST SETS. We offer a complete line of conservatively designed test sets for testing large, multi-horsepower AC motors, traction motors, and for other applications requiring a variable AC or DC power source. Standard models are available from 150 to 1000 kVA with output completely variable from zero to full voltage at taps up to 7200 volts. DC options are available to 750 V/400 A. We also offer MTS 80-50D for No Load start-up and testing of single-phase, poly-phase, and DC motors up to 200 hp.


MTS 300


MTS 80-50D

TRANSFORMER TEST SETS. Power transformer test systems have been specifically designed for meeting test requirements and making measurements on single-phase and three-phase power transformers with ratings up to 50 MVA. We also manufacture TTS 155 specifically for testing three-phase distribution transformers with ratings from 75 to 2500 kVA and voltages up to 34.5 kV per ANSI C57. TTS 155 can also test single-phase distribution transformers with ratings from 10 to 500 kVA. Also available is TTS 17M, a roll-around unit designed for testing single-phase, pole- or pad-mount distribution transformers with ratings from 10 to 167 kVA.


TTS 155


1050 kV/3 A

RESONANT TEST SETS. We manufacture a complete line of AC Resonant Test Sets in both dead-tank and cascade designs. Output ratings are available up to 1500 kV and 6000 kVA. These sets offer distinct advantages over the conventional AC test transformer for testing capacitive type loads because of reduced input power requirements, corona-free operation, reduced size and weight, and the non-destructive nature of the test. We also offer a line of transportable resonant test sets with ratings up to 100 kV and 400 kVA for generator testing.

TTS 17M

We also manufacture DC Dielectric Test Sets, High-frequency Cable Aging Equipment, Load-Cycling Test Sets for Power Cables, Liquid Dielectric Test Sets, and Portable Megohmeters and Dielectric Test Sets.

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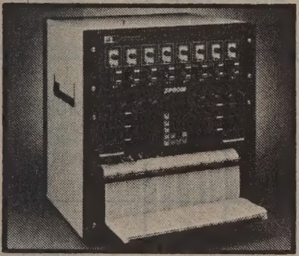
There's an Astro-Med OEM recorder for every medical, scientific and industrial application.

WORLD-CLASS 8-CHANNEL RECORDER



The ZF-8000, offered with 8 or 6 channels, features a full range of computer interfaces. Point writing, Z-fold charts, and more than 743 precise speeds. Prints date, time and chart speed. Plug-in signal conditioners. Ideal for aerospace, medical, scientific and industrial uses.

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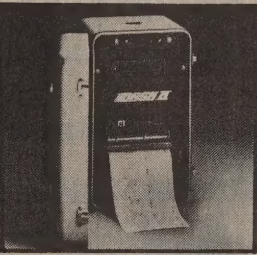
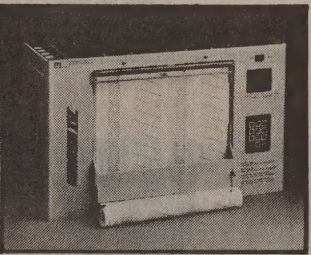
The Z-1000 1-channel physiological/lab recorder. Superb point writing. Battery/AC power with more than 40 chart speeds. Convenient Z-fold chart presentation. Use it for a wide variety of physiological recording applications.

WORLD'S ONLY TRUE FIELD RECORDER



The Dash II 2-channel field recorder. Reliable under the most brutal conditions. Battery/line power. Supplied complete with compact, sturdy carrying case. Acknowledged by industry as the standard for field testing.

THE INTELLIGENT 4-CHANNEL RECORDER

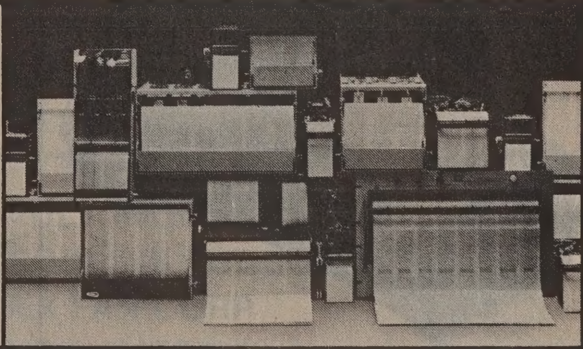


The versatile Dash IV 4-channel recorder. Small and lightweight, but packed with advanced technology. Automatic date, time, and chart speed printing. More than 40 microprocessor-controlled chart speeds. Plug it in and put it to work anywhere.

All Astro-Med recorders feature position feedback galvanometers with more than 99% accuracy, DC to 125 Hz response, and reliable low-cost thermal writing. All Astro-Med recorders are produced at our plant in West Warwick, R.I., U.S.A.

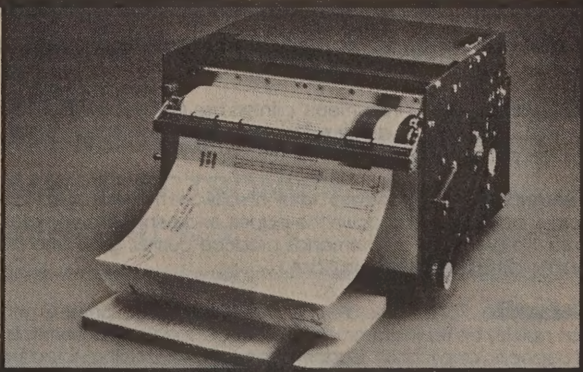
OEM recorders

Astro-Med is the world leader in the design, manufacturer and sales of OEM graphic recorders. We have a model to meet your every need: 1 through 8 channels. Configurations to meet all requirements. A wide range of electronically-selected chart speeds; fast snap-in or cartridge chart loading. Knife edge or point writing. Roll type or Z-fold chart handling. Thermal printers and event markers are standard options.



Astro-Graph™ digital recorder

The Astro-Graph—the world's first high speed, high resolution direct writing digital recorder that produces waveforms, line printing and graphics in a single instrument with no moving parts. Under control of the operator, copyrighted softwear permits these three data formats to be recorded separately, or in any combination or sequence. An obvious low-cost replacement for electrostatic recorders and photographic oscillographs.



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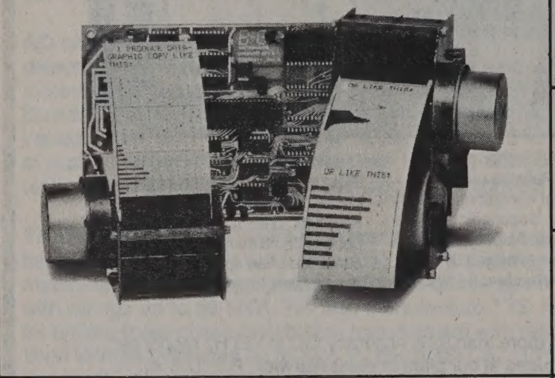
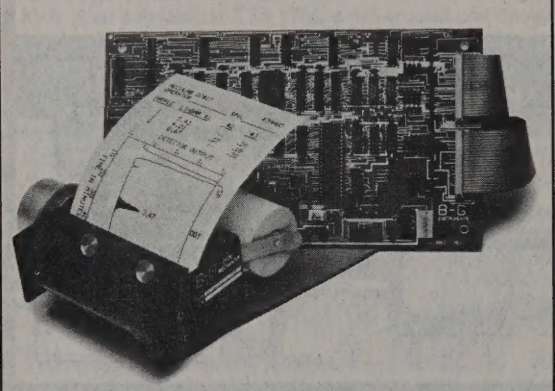
Atlan-Tol Industrial Park, West Warwick, Rhode Island 02893
Telephone (401) 828-4000 TWX No. 710-382-6409

Smart 2¼ and 4½ inch printer/plotters.

Feature on-board microprocessing and custom programming for data-recording applications.

Standard Features.





Model Number	Paper Width (inches)	Columns	Graphics Resolution (dots/line)	Printing Speed (lines/second)	Vertical Printing	Input Data Format	*Price Range
PP-101	2.25	17	101	2.2	No	Parallel BCD and analog	$350 to $600
PP-201	2.25	17	101	2.2	No	Parallel or serial ASCII	$350 to $560
PP-301	2.25	17	101	2.2	No	Parallel ASCII	$310 to $460
DataPlot 401	4.5	34	202	1.1	Yes	Parallel or serial ASCII and/or analog	$550 to $970
DataPlot 416	4.5	34 or 68	416	2 to 5	Yes	Parallel or serial ASCII and/or analog	$700 to $1200

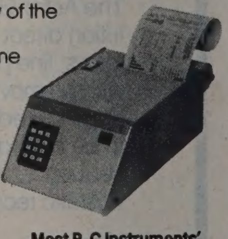
*Exact price depends on quantity ordered and options specified.

Reliable. All B-G Instruments' printers use fixed-dot, thick-film thermal printheads to achieve fast, quiet operation, long life and reliable performance.

Powerful. B-G's standard DataPlot software makes it easy to print across the paper, print down the paper, and print while you plot data. Simple plotting commands produce curves, grids and bar graphs directly from the input data.

Versatile. For a moderate one-time fixed charge, any B-G printer can quickly be reprogrammed to meet the special requirements of a specific application. Custom character sets, printing stored forms with inserted data, clock/calendar functions, special calculations, conditional operations—these are but a few of the many features that have been included in specially programmed B-G printers. In some cases, a custom-programmed B-G printer serves as the entire logic system for a fairly complex instrument.

For more information. Detailed brochures, a price list and application notes will be mailed to you as soon as we receive your inquiry. If you have an upcoming OEM application, we would be pleased to discuss it with you in detail and arrange a demonstration.



Most B-G Instruments' printer/plotters are also available with cabinets and power supplies.

B-G Instruments P.O. Box 67, Alta Loma, CA 91701
(714) 989-4802, (714) 980-2826 TWX 910-581-2792

For More Information. Circle No. 224

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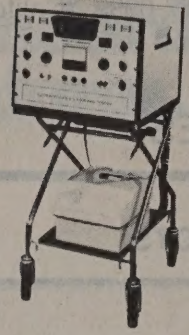
CABLEMASTER DIVISION
(213) 341-9200

AUTOMATIC CABLE HARNESS AND CONNECTOR TESTERS

CABLEMASTER 400-C



The Cablemaster Model 400-C is a 400 point sequential tester which measures continuity, insulation resistance and dielectric strength (hipot) quickly — accurately — economically. It is ideal for use in receiving inspection, production, quality control, laboratories, field maintenance, operational sites and in a wide range of applications where complete and reliable cable or connector testing is desired with one compact unit. It is equipped with a removable mobile carrier. The 400-C sequences thru the 400 points at a rate of up to 120 steps per minute checking each point for the parameter under test.

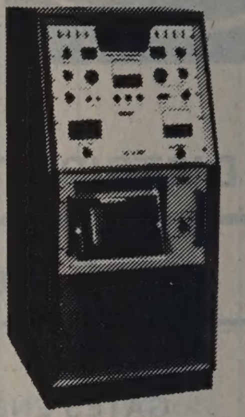
CHECK THESE OUTSTANDING FEATURES

- Continuity to 59 ohms, and to 3 amps
- Insulation resistance to 5K meg variable voltage
- Dielectric strength (hipot) AC and DC to 3000 volt
- Simplified multiple circuit testing. (More than 2 ends to each wire)

CABLEMASTER 400S

The Model 400-S Cablemaster is a modified Model 400-C, designed to test long, installed cables in ships, aircraft, launch facilities and nuclear plants where test points may be hundreds of feet apart. It contains a scanning feature for finding crossed wires which is used in making retrofits and troubleshooting new systems.

CABLEMASTER 1200-C

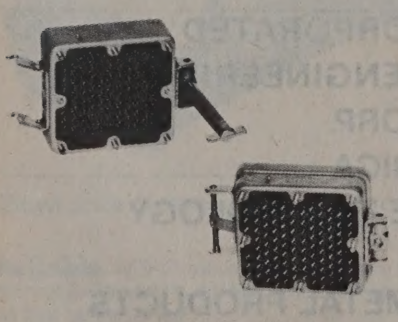


The Model 1200-C Cablemaster incorporates all of the features of the Model 400-C and functions identically except that it has the capability to test up to 1200 points. To accommodate the additional number of output modules it is mounted in a mobile console. When accessories such as a printer, low ohm analyzer, etc. are incorporated they are mounted within the same console. The 1200-C is modular in design and construction.

OPTIONS

- Printed record
- AC current monitor for actual current readings
- AC capacitance compensation
- Megohmmeter panel for exact resistance measurements
- Low ohms analyzer for discrete low resistance values
- Digital readout of discrete values for each of the above accessories
- Digital printout of measurement values
- Rise time control for application of high voltage
- 220 Volt units available

HIGH VOLTAGE CONNECTORS WITH QUICK DISCONNECT

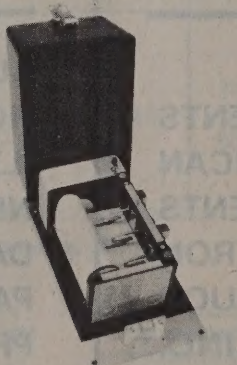


High voltage, high current connector with hinge action mating; comes in 50 pin and 100 pin configurations. Will accommodate 50 or 100 No. 16 wires, and is nominally rated at 2000 volts at RMS 60 Hz at sea level. Available with various types of contacts.

IMPACT-O-GRAPH DIVISION
(213) 341-3000

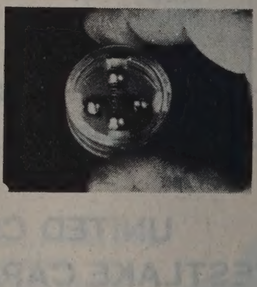
IMPACT & VIBRATION INDICATORS, ACCELEROMETERS AND RECORDERS

IMPACT-O-GRAPH RECORDER



Impact-O-Graph recorders are available in sensitivities of 2g to 300g full scale deflection. Recording period of various models is from (1) one minute to (6) six months. Independent styli record time, direction and magnitude of impacts in (3) three separate axes. Lightweight and compact. Self-contained — no outside power necessary. Used to monitor shipping and handling abuse and to design packaging.

IMPACT INDICATOR



Resettable and non-resettable impact indicators (accelerometers) are used to monitor impacts accurately from all directions to give a visual indication that a specific "g" level has been exceeded. Used to monitor shipping and handling abuse. Available up to 300g.

CHATSWORTH DATA CORPORATION

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VOLT-AMPERE WATTMETERS

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A variety of Models to choose from...

- **ALL** are TRUE RMS reading.
- **ALL** are waveshape independent.
- **ALL** are DC coupled.
- **ALL** are usable to zero power factor.
- **ALL** measure CURRENTS from 250 uAmperes to 7 Amperes directly.
- **ALL** have 12 POWER ranges including all VOLTAGE and CURRENT combinations as well as 12 POWER x 10 scales.
- **ALL** have options including isolated BCD, analog, and energy outputs and isolated REMOTE control inputs.
- **ALL** are capable of easy integration with range extending transformers, shunts, and/or capacitive voltage dividers.
- **ALL** have an isolated IEEE-488 bus as an option.

NEW!

Model 258

1% accuracy from 10 Hz to over 1000 kHz. Variety of current transformer inputs. Full scale currents from 50.00 mA to 50.00 A. Full scale voltage inputs from 1.000 V to 200.0 V. Option offers complete control via IEEE-488 bus.

Price: $2330.00

Model 259

0.25% accuracy from DC thru 30 kHz. Calibrated to 50 kHz. Usable as AC/DC transfer instrument. 34 V, 340 V and 170 V or 650 V ranges. Remote control of both functions and ranges as an option.

Price: $2145.00

Model 255/256

0.6% accuracy from 30 Hz through 100 kHz. Calibrated to 300 kHz. 10mW to 5000W 34 V, 340 V, and 1000 V ranges. (Model 256 has 170 V range instead of 1000 V range.)

Price: $1365.00

TYPICAL AREAS FOR MEASUREMENT INCLUDE:

Switching Power Supply Efficiency. Transformer and Motor Losses, Fluorescent Lamp Ballast Efficiency, Ultrasonic Power Losses. MOV (Varistor) Testing, Gyroscope and Servo System Testing, Television Set Testing and Ferrite Loss Measurements.

MODEL 273A

DIGITAL ESR METER

The Model 273A is the industry standard for the measurement of 100 kHz ESR (Capacitor Loss). Measures Equivalent Series Resistance values from 0.1 milliohm to 20 ohms. Deals with ANY capacitance larger than 5000 pF.

MODEL 425/427

BROADBAND CALIBRATOR/AMPLIFIERS

The Model 425 combines a broadband power amplifier with precision leveling circuitry and a set of non-inductive precision power resistors to provide constant currents and voltages from 50 Hz to over 1000 kHz. RMS voltage levels from 2 to 20 V together with resistors from 10 ohms to 400 ohms provide currents from 5 mA up to 2 A and powers from 10 mW up to 40 W. Open circuit position allows use with reactive, or customer specified loads.

The Model 427 combines the components of the Model 425 with an internal sine wave oscillator settable, or remotely programmable, to any one of 40 frequencies from 50 Hz to 100 kHz.

POWER FACTOR/V-A-W METER

Portable, Auto-ranging, True RMS

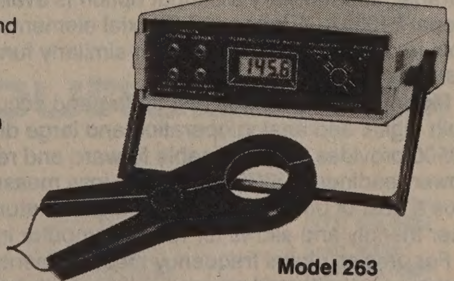
The Model 263 measures the true POWER FACTOR in low power factor and/or highly distorted waveshapes (50-400Hz).

The Model 263 has FOUR autoranging POWER scales (199.9W, 1.999kW, 19.99kW and 120kW), TWO auto-ranging CURRENT (19.99 and 199.9A), and VOLTAGE (199.9 and 600V) scales.

The Model 263 handles HIGH CREST FACTOR waveshapes such as those found in capacitive input filters or SCR circuits.

The instrument may be operated either via a line cord (90V-250V) or from the VOLTAGE input leads (90V-500V). In either case, operation is possible from 50Hz-400Hz. (NO BATTERIES).

The Model 263 is supplied complete with a clamp-on current transformer, voltage leads and a heavy duty carrying case.



Model 263

Price: $895

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Wattmeter

Model 7510
Digital Frequency
Counter and
Wattmeter

Model 85A
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Wattmeter

with Coaxial Dynamics.

Radio frequency power measurement and computation — wherever you need them — with rugged, cost-efficient instrumentation.

In-line or with accessory cables up to 200 feet away, Coaxial Dynamics' new **Model 81000A** is versatile and durable; and auxiliary DC input option is available as Model 81001A. A full line of Coaxial elements are available for use with these and other similarly functioning instruments.

Model 83500 provides fast tuning and accuracy. With both digital and analog operation and large display, the 83500 provides programmable forward and reflected power readings, VSWR and return loss measurements plus a host of other functions. Its digital feature makes it user friendly and allows for future computer interface.

For precise digital frequency measurements, forward and reflected power readings both from a single instrument, use our **Model 7510** X-AMINER.

Our **Model 85A** provides four power ranges with just the flip of a switch. This easily readable temperature compensated dry wattmeter functions in any physical orientation.

In addition to the above, Coaxial Dynamics manufactures directional wattmeters for use in higher power transmission line systems, such as, 1-5/8″ and 3-1/8″ sizes.

Coaxial's proven capabilities to custom design couplers and filters that are rugged, reliable, lightweight and compact, meet the requirements of government and military programs and are available for your specific needs.

A variety of dry dummy loads are available, having power ratings from 5 watts through 200 watts plus. These loads provide low VSWR over RF frequency ranges extending as high as 4000 MHz. Coaxial serves the electronics market with the newest RF technology.

For specifications or information on these instruments or Coaxials' full line, please call or write the factory for the name of your local distributor or representative.

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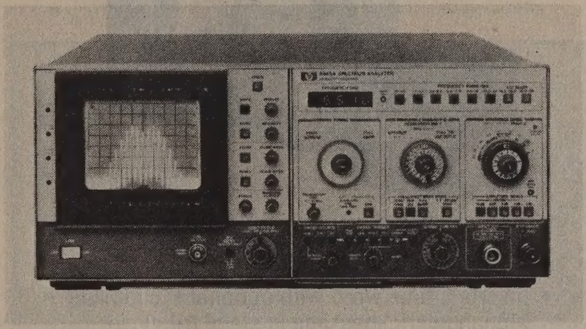
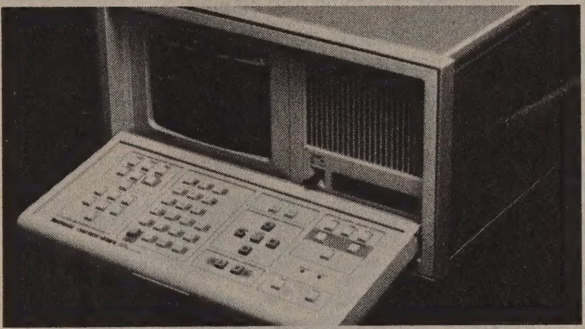
FLUKE 2280 DATALOGGER





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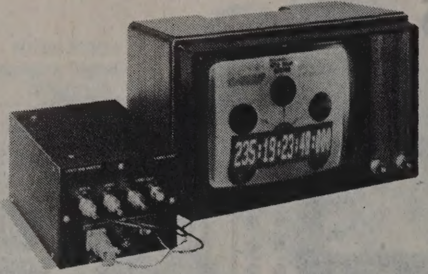


TIME AND DATA INSERTION IN THE VIDEO RASTER

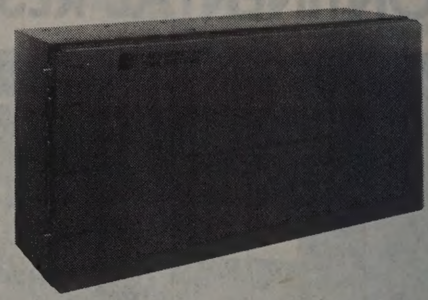
- Inserts a time word with optional second line alphanumeric message in standard video signals for recording and display.
- Up to 16 characters per row with serial or parallel data input.
- Multiple independent video signal inputs and outputs.

AUTOMATIC MAGNETIC TAPE SEARCH SYSTEMS

- Connect to and control most instrumentation magnetic tape recorders/reproducers.
- Occupy as little as 3½ inch panel height in a standard 19 inch wide equipment cabinet.
- High speed, automatic searching and playback of pre-recorded magnetic tapes at selected start and stop times.
- Standard computer compatible digital interfaces available for complete remote control of search operations.

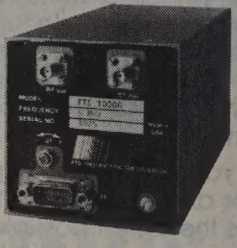
OTHER TIMING PRODUCTS

- Airborne/portable time code generator.
- Time code generators and decoders in modules and on PC cards.
- Combination time code generator/translators.
- Central timing system with dual and triple redundancy.
- Distribution amplifiers for time code and DC level shift signals.
- VBI data encoding and decoding instruments.



MODULAR CESIUM BEAM FREQUENCY AND TIME STANDARDS

- Ultra-stable atomic frequency and time standards in modular enclosures.
- Suitable for land-mobile, airborne and marine applications.
- Two independent 5-MHz sinusoidal, and one 1-pps output.
- Accessible control and monitor connections.



QUARTZ CRYSTAL OSCILLATORS

- High stability, low noise.
- Ideal as local oscillators in microwave multiplier chains, phase noise calibration and test equipment, and frequency standards.
- Designed for both laboratory and hostile environments.
- Independently buffered outputs of 5 MHz, 5.115 MHz, 10 MHz and 10.23 MHz.

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- Satellite timing receivers
- Digital Clocks
- Control and Monitor modules
- Battery supplies
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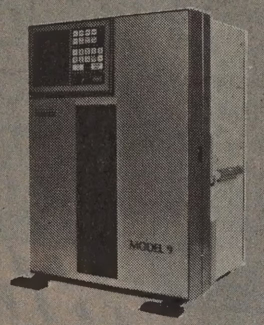
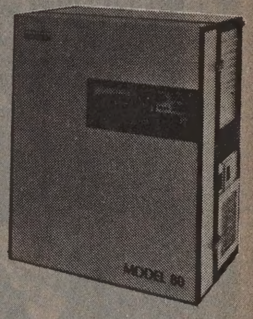
MODEL 9



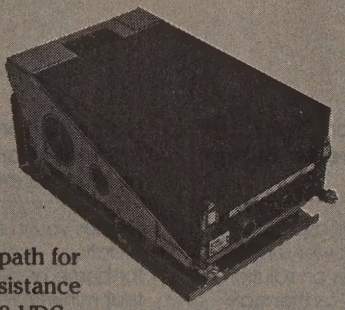
- 14, 28, 32 or 42 channel capacity
- Useable reel sizes 10½, 14 or 15 inch
- Tape speed range 120 to 15/16 ips
- All program controls via touch membrane on the face of a 7" CRT
- Fast self test for Direct, FM and HDR

MODEL 80



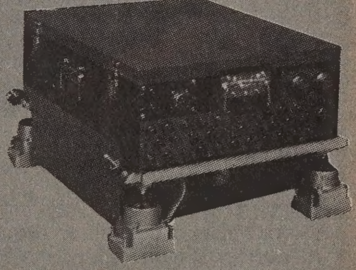
- 7 or 14 channel capacity
- Useable reel sizes 10-½ and 14 inch
- Tape speed range 120 to 15/16 ips
- Operates from 12 or 26 VDC, 117 or 234 VAC plug-in power modules
- 3000 hours/3 year head warranty

MODEL 12



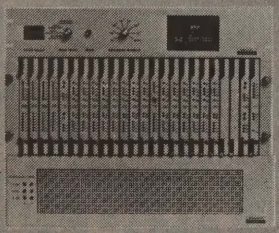
- 7, 14 or 28 channel capacity
- Useable reel size of 10-½ inch
- Tape Speed Range 120 to 15/16 ips
- Raised zero loop tape path for maximum vibration resistance
- Operates from 18 to 30 VDC

MODEL 15



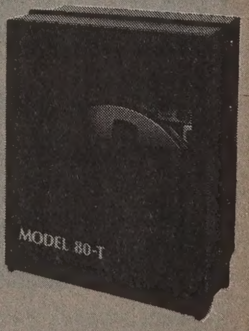
- 7, 14, 28 or 32 channel capacity
- Useable reel sizes 10-½, 14 and 15 inch
- Tape speed range 120 to 15/16 ips
- Standard tape width ½ or 1 inch
- Built-in autotest and calibration

"EDCS"



- Total system capability, incorporating deskew and spectral correction allows wrap around to any quality instrumentation data recorder without the need for special signal electronics.
- Data bandwidth to 3.6 MB/S per track at 120 ips.
- 24 bit parity outperforms shorter parities.
- Built in error monitor.
- Error rate performance in 10^{10} or better.

MODEL 80-T



- Tempest qualified
- 7, 14, or 28 channel capacity
- Useable reel sizes 10-¼ and 14 inch
- Tape speed range 120 to 15/16 ips
- Two channel reproduce monitor
- Programmable stitcher mode of operation, standard

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For More Information. Circle No. 525

FREQUENCY METERS
- 3.95 to 40 GHz
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WIDEBAND AMPLIFIERS
- Bandwidth 0.5 MHz to 1 GHz
- 5 watt output
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Waveguide
- 2.6 to 40 GHz
- 60 db Range
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- Minimal Phase Shift
- Single Knob adjustment
- Full band with Coverage
- Dial or gauge readouts

Coaxial
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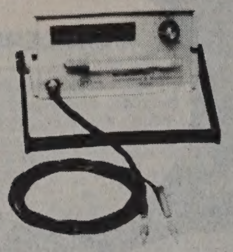
For More Information. Circle No. 231

IET LABS, INC.

DEPT. GB, 534 MAIN STREET, WESTBURY, NY 11509, (516) 334-5959

MODEL IMF-600 DIGITAL IMPEDANCE AND MULTIFUNCTION METER

COMBINES MOST OF THE COMMONLY NEEDED LABORATORY MEASUREMENTS



FUNCTIONS

- VOLTAGE (DC & TRUE RMS)
- CURRENT (DC & TRUE RMS)
- RESISTANCE
- CAPACITANCE
- INDUCTANCE
- CONDUCTANCE
- DISSIPATION
- FREQUENCY
- EVENT COUNTER

FEATURES

- AUTOMATIC MEASUREMENT
- HIGH ACCURACY
- WIDE RANGE
- CRYSTAL CONTROLLED
- PROTECTED CIRCUITRY
- ANALOG & DIGITAL OUTPUTS
- 4-TERMINAL KELVIN CONNECTORS
- COMPANION COMPARATOR

CAPACITANCE (C)
Number of ranges: 7
Full scale ranges: 200.0 pF to 200.0 µF; up to 20,000 µF may be measured using the inductance function
Accuracy: ±(0.25% +1 LSD +1% of G reading in absolute digit counts on same range)
Bias: Up to 100 VDC may be applied in series with unknown impedance
Test voltage: 1.4 VRMS on Ranges 1-6; 0.14 VRMS on Range 7
Input protection: 220 VRMS
Impedance model: C G

INDUCTANCE (L)
Number of ranges: 7
Full scale ranges: 200.0 µH to 200.0 H
Accuracy: ±(0.25% +1 LSD +1% of R reading in absolute digit counts on same range)
Test current: 110 mA on Range 1; 11 mA on Ranges 2-3; 1.1 mA on Range 4; 110 µA on Range 5; 11 µA on Range 6; 1.1 µA on Range 7
Input protection: 220 VRMS
Impedance model: L R

RESISTANCE (R)
Type of measurement: 1 kHz AC resistance
Number of ranges: 7
Full scale ranges: 2.000Ω to 2000 kΩ; up to 1000 MΩ may be measured using the conductance function
Accuracy: ±(0.25% +1 LSD +1% of L reading in absolute digit counts on same range)
Test current: Same as inductance
Input protection: 220 VRMS
Impedance model: See INDUCTANCE

CONDUCTANCE (G)
Type of measurement: 1 kHz AC conductance
Number of ranges: 7
Full scale ranges: 2.000 µS to 2000. mS (S = 1/Ω)
Accuracy: ±(0.25% +1 LSD +1% of C reading in absolute digit counts on the same range)
Test voltage: Same as capacitance
Input protection: 220 VRMS
Impedance model: See CAPACITANCE

DISSIPATION (D or 1/Q)
Type of measurement: $D = G/2\pi fC$ (see impedance model); $D = 1/Q = R/2\pi fL$ (see impedance model)
Full scale range: 2.000; higher values may be computed from readings
Accuracy: ±(1% +2 LSD) for C or L >500 counts; 1% +4 LSD for C or L 200-500 counts

DC VOLTAGE (V DC)
Number of ranges: 5
Full scale ranges: 200.0 mV to 1000. V
Accuracy: ±(0.1% +1 LSD)
Input impedance: 10 MΩ
Maximum input: 1000 V peak; common mode voltage (low terminal to ground): 500 V peak

DC CURRENT (I DC)
Number of ranges: 5
Full scale ranges: 200.0 µA to 2000. mA
Accuracy: ±(0.2% + 1 LSD)
Burden voltage: 0.3 V maximum on Ranges 1-5; 1.4 V maximum on Range 5
Maximum input: 2 A fuse and diode network protected

TRUE RMS VOLTAGE (V TRMS), AC COUPLED
Number of ranges: 5
Full scale ranges: 2.000 mV to 750. V
Accuracy: ±(percentage of reading + number of least significant digits)

FREQ.	50-100 Hz	100-500 Hz	500 Hz-1 kHz	1-10 kHz	10-20 kHz
200.0 mV	0.5% +2	0.5% +2	0.5% +2	0.5% +2	1% +2
2.000 V	1% +2	0.5% +2	0.5% +2	0.5% +2	1% +2
20.00 V	1% +2	0.5% +2	0.5% +2	1% +2	1% +2
200.0 V	1% +2	1% +2	2% +2	not specified	
750 V	1% +2	2% +2	not specified		

Input impedance: 10 MΩ
Maximum input: Same as DC VOLTAGE

TRUE RMS CURRENT (I TRMS), AC COUPLED
Number of ranges: 5
Full scale ranges: 200.0 µA to 2000. mA
Accuracy: ±(percentage of reading + number of least significant digits)

FREQ	50-100 Hz	100-500 Hz	500 Hz-1 kHz	1-10 kHz	10-20 kHz
200.0 µA	0.5% +2	0.5% +2	0.5% +2	1% +2	2% +2
2.000 mA	0.5% +2	0.5% +2	0.5% +2	1% +2	2% +2
20.00 mA	1% +2	1% +2	1% +2	2% +2	2% +2
200.0 mA	1% +2	1% +2	1% +2	2% +2	2% +2
2000 mA	2% +2	2% +2	2% +2	3% +2	3% +2

Burden voltage: Same as DC CURRENT
Maximum input: Same as DC CURRENT

FREQUENCY (F)-Model IMF-600F
Display: Overrange will be indicated when the frequency option is not present
Number of ranges: 6
Range: 100.0 Hz to 15.00 MHz; 30.0 Hz to 17.00 MHz typical
Resolution: 3½ digits, may be extended to one additional least significant digit by downranging. This does not apply to Range 1 (200.0 Hz)
Gate time: 10 seconds for 200.0 Hz range; 1 second for 2.000 kHz range; 0.1 second for 20.00 kHz range; 10 ms for 200.0 kHz range; 1 ms for 2.000 MHz range; 0.1 ms for 20.00 MHz range
Sampling period: 20 seconds for 200.0 Hz range; 2 seconds for 2.000 kHz range; 0.25 seconds for all other ranges
Impedance: >1 Megohm, diode protected
Coupling: AC
Sine wave sensitivity: 3 VRMS at 30 Hz; 1 VRMS at 100 Hz; 0.3 VRMS for 1 kHz-15 MHz
Maximum input: 100 V peak 30 Hz-1 kHz; 75 V peak 1 kHz-10 MHz: 50 V peak to 10 MHz-15 MHz
Time base: 1 MHz crystal oscillator

TEST CONDITIONS
Performance specifications apply
1) after correction for test lead zero reading
2) after 10 minute warmup
3) between 15-35°C

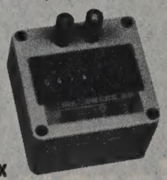
GENERAL SPECIFICATIONS
Test frequency: 1 kHz for impedance functions
Reading rate: 4 measurements per second
Display: 3½ digit 0.5″ (1.2 cm) LED, with corresponding annunciator showing units; all decimal points on indicate overrange or illegal condition
Analog outputs: L, R, C, or G scaled at 0.1 V/1000 counts; output impedance: 900 ohms
Digital output: BCD parallel output representing 3½ digit reading for any quantity
Test terminals: 4-terminal shielded Kelvin test leads, 50 inches (127 cm) long
Operating controls: Push button ON-OFF and function select switches; rotary range select switch
Power requirements: 105-125 V or 210-250 V; 50-60 Hz; 5 W
Dimensions: 8.5″ W x 9.25″ D x 4.44″ H (22 cm x 24 cm x 12 cm)
Weight: 6 lbs. (2.7 kg) nominal

ORDERING INFORMATION:

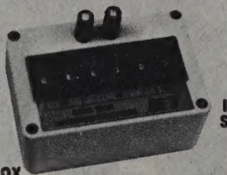
Model IMF-600 Impedance & Multifunction Meter	$989.00
—F Option (Frequency Measurement)	199.00
—FEC Option (Frequency & Event Counter)	269.00
—DO Option (Digital Output)	169.00
Model LC-603 Single Channel Digital Limits Comparator (Requires DO option. May be cascaded.)	429.00
10 kHz Option	Consult IET
High Sensitivity Option — 20.00 pF or 20.00 µH	Consult IET

DIGITAL DECADE SUBTITUTERS FOR: • RESISTANCE • CAPACITANCE • INDUCTANCE

RS Series Resistance Substituter
0.1Ω
99.9999999 MΩ
R-Box

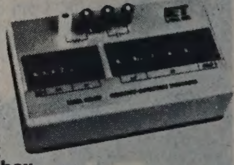


CS Series Capacitance Substituter
10 pF-
99.99999 µF
C-box



LS Series Inductance Substituter
100 µH-
99.9999H
L-Box

RCS Series Resistance-Capacitance Substituter Combines R-box & C-box
RC-box



Greatest Substituter Value Available — More Accuracy — Wider Range

■ DIRECT READING — NO FUMBLING WITH SWITCHES OR KNOBS ■ ERROR PROOF ■ HUMAN ENGINEERED ■ COLOR-CODED ■ COMPACT, CONVENIENT & DURABLE

Model	RS-200	RS-201	RS-200W	RS-201W	CS-300	CS-301	RCS-500	RCS-502	LS-400	LS-400A
Type of Substituter	Resistance	Precision Resistance	Wide Range Resistance	Wide Range Precision Resistance	Capacitance	Precision Capacitance	Resistance-Capacitance	Precision Resistance-Capacitance	Wide Range Inductance	Inductance
Accuracy	1%	0.1%	1%	0.1%	4%	1%	Combines the RS-200 and CS-300	Combines the RS-201 and CS-301	1.5% max, 1% typical	
Decades	7		9		6				4	3
Range	1-9,999,999Ω		0.1-99,999,999.9Ω		100 pF-99.9999 µF				1 mH-9.999 H	1 mH-999 mH
Type of Components	Metal Film Resistors (0.1-0.9Ω Wirewound Resistors)				100-900 pF: Mica .001-.009 µF: Polystyrene .01-0.9 µF: Polycarbonate 1-9 µF: Polyester 10-90 µF: Polarized Tantalum				Toroidal Inductors	
Rating	0.5 watt				100 volts (20V 10-100 µF)				20-500 mA	
Residual Impedance	0.3Ω (.04Ω/decade)		0.4Ω (.04Ω/decade)		30 pF (5 pF/decade)				0.2Ω (.04Ω/decade)	
Physical	3.2x3.1x2.2 in, 6.5 oz (8.1x7.9x5.6 cm, 184 g)		4.7x3.1x2.2 in, 8.3 oz (12x7.9x5.6 cm, 235 g)		4.7x3.1x2.2 in, 8.3 oz (12x7.9x5.6 cm, 235 g)		7.4x4.3x2.4 in, 14 oz (18.8x11x6 cm, 410 g)		4.7x3.1x2.2 in, 8 oz (12x7.9x5.6 cm, 230 g)	
Price	$114.00	$229.00	$199.00	$399.00	$124.00	$249.00	$229.00	$459.00	$459.00	$344.00

PROGRAMMABLE UNITS AVAILABLE — CONSULT IET

CUSTOM MODELS

IET can supply your choice of substituter in any number of decades with or without case in various tolerances. Generate a part number to meet your requirements from the table below. Consult IET for price.

RS — F — 4 — 0.1 — WC (0.1-999.9µ, 1%, Resistance Substituter in a case)

TYPE
RS Resistance
CS Capacitance
LS Inductance

TOLERANCE
A .05%
B 0.1%
F 1%
G 2%
H 4%

NO. OF DECADES
1 to 9

IMPEDANCE PER STEP FOR LOWEST DECADE
0.1Ω to 10 MΩ; 1 pF to 10 µF; 100 µH to 10 H

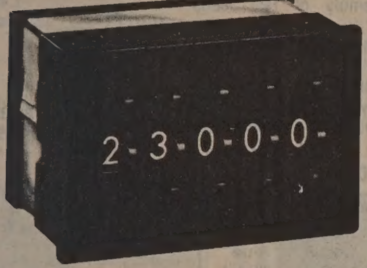
PACKAGING
WC Packaged in a standard case with binding posts.
PM Supplied without case for panel mounting or other use.

IET LABS, INC.

DEPT. GB, 534 MAIN STREET, WESTBURY, NY 11509, (516) 334-5959

DP 500 SERIES DIGITAL POTENTIOMETER

PRECISION DIGITAL REPLACEMENT FOR ORDINARY POTENTIOMETERS



- Eliminates the need for dials & multiturn potentiometers
- TRUE potentiometer circuit
- Unlimited choice of resistance values
- In-line digital readout
- Convenient (snap in) panel mounting with bezel
- 1, 2, 3, 4, 5, and 6 decade units are available
- Suitable for use in voltage and current dividers

GENERAL SPECIFICATIONS:

Minimum potentiometer resistance: .04 Ω/decade
Power across input terminals: 5 watts
Temperature coefficient: 50 ppm/°C
Operating temperature: −25°C to +90°C

ORDERING INFORMATION:

IET can supply any resistance value in a number of tolerances and decades. A part number is determined as follows:

DP500 — B — 50k — 5 — PM

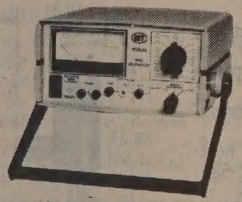
TOLERANCE
A 0.05%
B 0.1%
F 1%

PACKAGE STYLE
PM Panel mounting
WC Case with binding posts

Total Resistance (ohms)	No. of Decades					
	1	2	3	4	5	6
1, 2, 5	•					
10, 20, 50	•	•				
100, 200, 500	•	•	•			
1k, 2k, 5k	•	•	•	•		
10k, 20k, 50k	•	•	•	•	•	
100k, 200k, 500k	•	•	•	•	•	•
1M, 2M, 5M	•	•	•	•	•	•
10M, 20M, 50M	•	•	•	•	•	•

Other resistance values available on request.

MODEL MV-800 HIGH SENSITIVITY ANALOG RMS VOLTMETER



- TRUE RMS READING
- HIGH ACCURACY
- WIDE BANDWIDTH
- READS FROM −105 TO +53 dBm (30 µV-300V)
- SWITCHABLE AUDIO FILTER
- ACCEPTS VARIETY OF PLUG-IN FILTERS
- SEPARATE AC AND DC OUTPUTS
- RECHARGEABLE BATTERY OPERATION
- COMPACT, RUGGED CONSTRUCTION

RMS Voltmeter Ranges:	30 µV, 100 µV, 300 µV, 1 mV, 3 mV, 10 mV, 30 mV, 100 mV, 300 mV, 1V, 3V, 10V, 30V, 100V, 300V; full scale; linear scales.
dB Ranges:	−90 dB to +50 dB in 10 dB steps. 0 dB relative to 1 mW into 600Ω; log scale.
Meter:	3.7 inches taut band, ruggedized.
Scale Length:	3.2 inches mirrored, 2 color.
Frequency Range:	5 Hz to 2 MHz.

Accuracy and Frequency Response:

dB Range	±3% Full Scale	±3 dB	dB Range	±3% Full Scale	±3 dB
−90	10-100kHz	5-200kHz	−10	10-200kHz	5-1.7MHz
−80	10-100kHz	5-600kHz	0	10-900kHz	5-2MHz
−70	10-100kHz	5-800kHz	+10	10-400kHz	5-1MHz
−60	10-100kHz	5-1MHz	+20	10-500kHz	5-2MHz
−50	10-800kHz	5-1.5MHz	+30	10-500kHz	5-2MHz
−40	10-800kHz	5-2.2MHz	+40	10-500kHz	5-2MHz
−30	10-800kHz	5-1.7MHz	+50	10-500kHz	5-2MHz
−20	10-1.1MHz	5-1.9MHz			

Above accuracy is over a temperature range of 18°-28°C, and a crest factor of 1-2; error increases by 1% at crest factor of 6.

Filter Switch:	1. Flat: Flat response; no filter. 2. Audio: Provides a bandpass of 20 Hz and 20 kHz. Down 3 dB at 20 Hz and 20 kHz. Filter slope is 6 dB per octave; (see curve). 3. Ext.: Accesses an external plug-in filter per customer's requirements. (See listing of stock filter modules available).
Input Impedance:	9 MΩ on all ranges.
Maximum Continuous Input:	630V (AC peak + DC).
Response Time:	Less than 3 seconds, worst case.
Outsputs:	1. Analog preamplifier output is provided on rear panel. 2. DC output is provided on rear panel; 0-1V DC proportional to meter deflection.
Connectors:	Banana jacks (for maximum safety with a battery operated instrument).
Power Supply:	Internal rechargeable batteries operate the unit for more than 20 hours continuously. Charger/adapter may be used to operate the unit while recharging.
Size:	8.5 in. wide x 4.4 in. high x 9.2 in. deep (216 mm x 110 mm x 235 mm).
Weight:	6 lbs. (2.7 kg).
Accessories Supplied:	110 Volt AC Charger/Adapter, and Instruction Manual. Unit comes with carrying handle which serves as a tilt stand.

ORDERING INFORMATION:

Model MV-800 Analog RMS Voltmeter	$625.00
Model A-810 Insulated Banana Plugs to Alligator Clips Coaxial Cable Test Leads	29.00
Model A-820 220 Volt Adapter	39.00
Model F-801 Hum Filter Module (Bandpass 800 Hz to 3 MHz)	76.00
Model F-802 "A" Weighted Noise Filter	99.00
Model F-803 Low Pass Filter (100 kHz cutoff)	76.00
Model F-804 Empty Filter Module Used to House Custom Filter	24.00

Consult factory for prices and availability of custom filter modules.

MODEL CM-500 PROFESSIONAL QUALITY AUTORANGING DIGITAL CAPACITANCE METER

- AUTORANGING MISTAKE PROOF CAPACITANCE MEASUREMENT
- HIGH ACCURACY
- WIDE MEASUREMENT RANGE
- EASY TO READ
- CUTS TIME AND COSTS
- TROUBLE-FREE POWER SUPPLY
- CONVENIENT PORTABLE PACKAGING
- DIGITAL OUTPUT
- COMPANION COMPARATOR

Range:	9 ranges for measuring from 1 pF to 200,000 µF. The full scale value is automatically selected from one of the following to give maximum resolution: 2000. pF, 20.00 nF, 200.0 nF, 2.000 µF, 20.00 µF, 200.0 µF, 2000. µF, 20.00 mF, 200.0 mF.
Accuracy:	2000. pF to 20.00 µF scales: 0.1% ±1 LSD; 200.0 µF to 2000. µF scales: 0.8% ±1 LSD; 20.00 mF to 200.0 mF scales: 1.0% ±1 LSD; Temperature Range: 10°C to 40°C.
Reading Rate:	2000. pF to 200.0 µF scales: 0.25 sec./2000. µF to 20.00 mF scales: 0.8 sec./200.0 mF scale: 6.4 sec.
Test Parameters:	Determination of the time constant of the unknown capacitor and a known resistor. The maximum voltage is less than 3.2 volts.
Power Supply:	Battery Operation: 5 standard D cells. AC Adapter: IET Labs AC Adapter Model CM5001 (110 volts) or Model CM5002 (220 volts) may be used with or without the batteries in place.
Digital Output:	The range, the BCD capacitance value, the overrange signal, the sampling strobe signal, the power supply, and the system ground are available through a 26 pin header connector.
Input Protection:	The capacitance test terminals are shorted as long as the Measure button is not depressed. During this time a charged capacitor will be automatically discharged. No fuse is required.
Physical:	Dimensions: 7.4"L x 4.33"W x 2.36"H. Weight: 31 oz. (batteries included). Test Terminals: Connector Strips, Component Clip, and Banana Plug-Alligator Clip Test Leads. Display: 0.5" high, 3½ digit LED display with 4 LED scale indicators.

ORDERING INFORMATION:

Model CM-500 Autoranging Digital Capacitance Meter	$299.00
Model CC-25 Component Clip	8.00
Model TL-26 Alligator Clip Test Leads	5.00
Model CM-5001 110 Volt AC Adapter	15.00
Model CM-5002 220 Volt AC Adapter	25.00
Model CLC-502 Capacitance Limits Comparator	429.00
Model CB-27 Connector Cable (for CM-500 BCD output)	16.00

All products are warranted for one year. Specifications and prices subject to change without notices.

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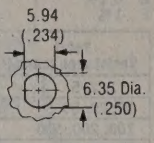
FREE 1984 CATALOG

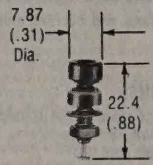
WRITE OR CALL FOR YOUR FREE 126 PAGE ELECTRONICS TEST ACCESSORIES CATALOG

MINIATURE INSULATED BANANA JACK

Model No.	Color
2142-0	Black
2142-1	Brown
2142-2	Red
2142-3	Orange
2142-4	Yellow
2142-5	Green
2142-6	Blue
2142-7	Violet
2142-8	Gray
2142-9	White



PANEL CUTOUT



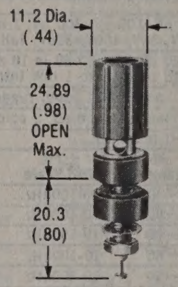
(Pkg. Ten Per Color, unassembled)

***NET .65 EA.**

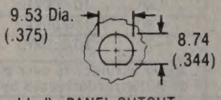
STANDARD BINDING POST

Accepts standard banana plug. Thin line design for high-density packaging. Binding post body and captive thumb nut, brass. Available gold plated or tin plated. Lexan* Polycarbonate insulation. 8-32 hex nut and lockwasher included. 2.54 mm (.100) dia. cross hole is perpendicular with flat on insulator. Mounts in panels 1.59 mm (.062) to 6.35 mm (.250) thick.

RATINGS: 2500 W VDC 15 amps cont.
+115°C. (+239°F.) Max.



Gold Plated Model No.	Tin Plated Model No.
3750*	3760*
***NET 2.75**	***NET 1.85**



(unassembled) PANEL CUTOUT

* Color Code

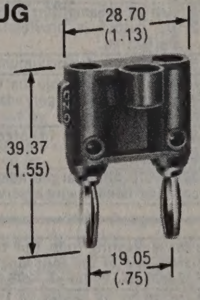
0 - Black	2 - Red	4 - Yellow	6 - Blue	8 - Gray
1 - Brown	3 - Orange	5 - Green	7 - Violet	9 - White

STANDARD DOUBLE BANANA PLUG

Double banana plug on 19.05 mm (.750) centers. Setscrews secure leads; simplifies cable construction or component mounting; banana jacks permit top stackup for multiple connections.

INSULATION: ABS, +50°C. (+122°F.) Max.
NICKEL PLATED
RATED: 5000 WVDC, 15 AMP. CONT.

Model No.	Color	Model No.	Color
MDP-0	Black	MDP-5	Green
MDP-1	Brown	MDP-6	Blue
MDP-2	Red	MDP-7	Violet
MDP-3	Orange	MDP-8	Gray
MDP-4	Yellow	MDP-9	White



***NET 1.60**

BNC FEMALE TO STANDARD DOUBLE BANANA PLUG

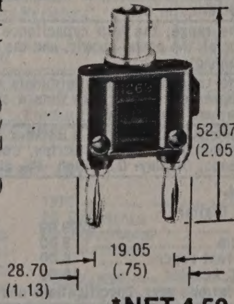
Permits BNC male to be used with equipment having banana jacks. Excellent for adapting laboratory VTVM, oscilloscopes and signal generator inputs to readily available coaxial cables.

UPPER: BNC female.

LOWER: Double banana plug, on 19.05 mm (.750) centers. Cross holes 4.22 mm (.166) dia. in body provide side stackup connections. Nickel plated per QQ-N-290.

INSULATION: ABS, black, +50°C. (+122°F.) Max. **RATED: 500V rms**

Model No.
1269



***NET 4.50**

SOLDERLESS STACKUP BANANA PLUG

Wire firmly held in place with internal setscrew, eliminating soldering. Assembly of test leads simplified.

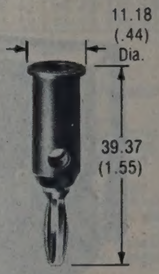
UPPER: Banana jack, 4.22 mm (.166) dia.; brass, nickel plated.

LOWER: Banana plug. Spring, one piece heat-treated beryllium copper, berylco 25 per QQ-C-533. Fits standard 4.22 mm (.166) dia. banana jack.

INSULATION: ABS, +50°C. (+122°F.) Max.

RATED: 5000 WVDC, 15 AMP. CONT.

Model No.	Color	Model No.	Color
1325-0	Black	1325-5	Green
1325-1	Brown	1325-6	Blue
1325-2	Red	1325-7	Violet
1325-3	Orange	1325-8	Gray
1325-4	Yellow	1325-9	White



(Pkg. Ten Per Color)

***NET .90 EA.**

SOLDERLESS STACKUP STANDARD BANANA PLUG WITH SAFETY COLLAR

Features integral safety collar that insulates exposed wire leads. Wire firmly held in place with internal setscrew, eliminates soldering, simplifies assembly of test leads.

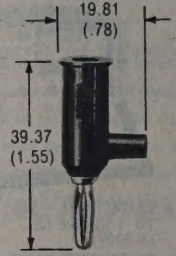
UPPER: Banana jack, 4.22 mm (.166) dia.; brass, nickel plated.

LOWER: Banana plug. Spring, one piece heat-treated beryllium copper, berylco 25 per QQ-C-533. Fits standard 4.22 mm (.166) dia. banana jack.

INSULATION: ABS, +50°C. (+122°F.) Max.

RATED: 5000 WVDC, 15 AMP. CONT.

Model No.	Color	Model No.	Color
1825-0	Black	1825-5	Green
1825-1	Brown	1825-6	Blue
1825-2	Red	1825-7	Violet
1825-3	Orange	1825-8	Gray
1825-4	Yellow	1825-9	White



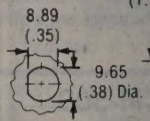
(Pkg. Ten Per Color)

***NET .90 EA.**

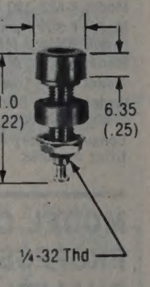
STANDARD BANANA JACK

- Tin plated brass body, per MIL-T-10727.
- Closed entry receptacle, 4.22 mm (.166) dia. x 23.37 mm (.920) deep.
- Nickel plated lockwasher and hex nut.
- Mounts in panels from 1.60 mm (.063) to 9.53 mm (.375) thick.
- Molded in Lexan* polycarbonate.
- Rated 2500 WVDC 15 amps cont. +115°C. (+239°F.) Max.

Model No.	Color	Model No.	Color
1581-0	Black	1581-5	Green
1581-1	Brown	1581-6	Blue
1581-2	Red	1581-7	Violet
1581-3	Orange	1581-8	Gray
1581-4	Yellow	1581-9	White



PANEL CUTOUT



(Pkg. Ten Per Color, unassembled)

***NET .60 EA.**

STANDARD DOUBLE BINDING POSTS TO BNC MALE

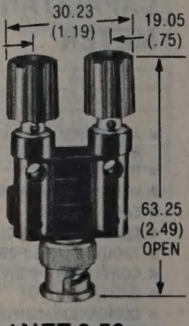
Permits single or double banana plugs to be used with equipment having a BNC female.

UPPER: Insulated binding post to allow top stackup for multiple connections with 4.22 mm (.166) dia. banana jacks, 1 red, 1 black on 19.05 mm (.750) centers. Insulation: Polycarbonate, +115°C. (+239°F.) Max. Nickel plated per QQ-N-290.

CENTER: Cross holes 4.22 mm (.166) dia. in plug body provides side stackup connections. Insulation: ABS, black, +50°C. (+122°F.) Max.

LOWER: BNC male. **RATED: 500V rms**

Model No.
1296



***NET 8.50**

For More Information. Circle No. 233

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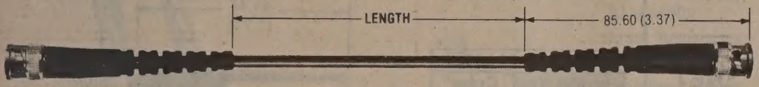
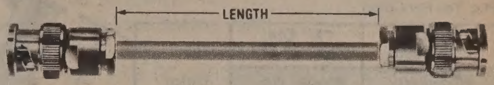
BNC MALE BOTH ENDS WITH STRESS RELIEF BOOT



CONN: 1st END Crimp male BNC
CABLE: Shielded coaxial, RG58C/U 4.95 mm (.195) O.D.
RG59B/U 6.15mm (.242) O.D.
RG62A/U 6.15mm (.242) O.D.
RG174/U 2.54mm (.100) O.D.
CONN: 2nd END Crimp male BNC.

RG58C/U 50 Ohm	*Net	RG59B/U 75 Ohm	*Net	RG174/U 50 Ohm	*Net	RG62A/U 93 Ohm	Length	*Net
2249-C-12	9.95	2249-E-12	11.25	2249-K-12	18.25	2249-M-12	304.8(12.0)	12.95
2249-C-24	9.95	2249-E-24	11.25	2249-K-24	18.25	2249-M-24	609.6(24.0)	12.95
2249-C-36	9.95	2249-E-36	11.25	2249-K-36	18.25	2249-M-36	914.4(36.0)	12.95
2249-C-48	10.55	2249-E-48	11.85	2249-K-48	18.85	2249-M-48	1219.2(48.0)	13.55
2249-C-60	11.15	2249-E-60	12.45	2249-K-60	19.45	2249-M-60	1524.0(60.0)	14.15
2249-C-72	11.75	2249-E-72	13.05				1828.8(72.0)	
2249-C-120	14.15						3048.0(120.0)	
2249-C-180	17.15						4572.0(180.0)	

BNC MALE BOTH ENDS



CONN: 1st END
BNC, male.

CONN: 2nd END
BNC, male.

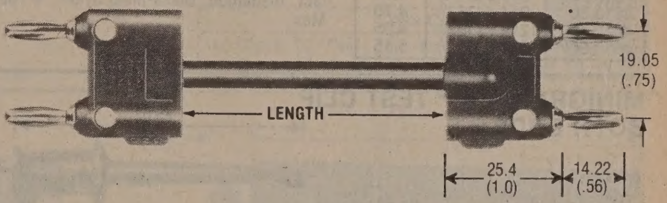
CABLE:
Shielded mic. 4.95 mm (.195) O.D.
RG58C/U 4.95 mm (.195) O.D.
RG59B/U 6.15 mm (.242) O.D.
RG62A/U 6.15 mm (.242) O.D.

Shielded Mic. Cable 50 Ohms	RG58C/U 50 Ohms	*Net	RG59B/U 75 Ohms	RG62A/U 93 Ohms	Length	*Net
BNC-B-18	BNC-C-18	10.95	BNC-E-18	BNC-M-18	457.2 (18.0)	11.95
BNC-B-24	BNC-C-24	10.95	BNC-E-24	BNC-M-24	609.6 (24.0)	11.95
BNC-B-30	BNC-C-30	10.95	BNC-E-30	BNC-M-30	762.0 (30.0)	11.95
BNC-B-36	BNC-C-36	10.95	BNC-E-36	BNC-M-36	914.4 (36.0)	11.95
BNC-B-48	BNC-C-48	11.55	BNC-E-48	BNC-M-48	1219.2 (48.0)	12.55
BNC-B-60	BNC-C-60	12.15	BNC-E-60	BNC-M-60	1524.0 (60.0)	13.15

STANDARD DOUBLE PLUG BOTH ENDS

CABLE TYPE DESCRIPTION

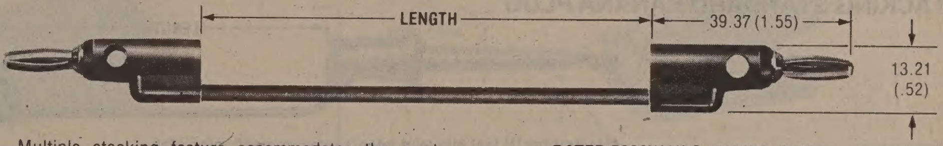
Two cond. twisted pair: 18 AWG, strand 65 x 36 T.C. vinyl insulation. Vinyl Jacket, 6.35 mm (.250) O.D. Nom. Cap. 30 pf/ft. Color: Gray.
Shielded microphone cable: Polyethylene insulation. Vinyl jacket, 4.95 mm (.195) O.D. nom. cap. 30.8 pf/ft. Color: Gray.
RG58C/U: Polyethylene insulation, vinyl jacket, nominal impedance 50 Ohms, 30.8 pf/ft., 4.95 mm (.195) O.D. Color: Black.
RG59B/U: Polyethylene insulation, vinyl jacket, nominal impedance 75 Ohms, 20.5 pf/ft., 6.15 mm (.242) O.D. Color: Black.
NOTE: Molded double plug matches color of cable.



Two Cond. Twisted Pr.	*Net	Shielded Mic. Cable	*Net	RG58C/U	*Net	RG59B/U	Length	*Net
2BA-18	10.95	2BB-18	9.95	2BC-18	9.95	2BE-18	457.2 (18.0)	9.95
2BA-24	10.95	2BB-24	9.95	2BC-24	9.95	2BE-24	609.6 (24.0)	9.95
2BA-36	10.95	2BB-36	9.95	2BC-36	9.95	2BE-36	914.4 (36.0)	9.95
2BA-48	11.55	2BB-48	10.55	2BC-48	10.55	2BE-48	1219.2 (48.0)	10.55
2BA-60	12.15	2BB-60	11.15	2BC-60	11.15	2BE-60	1524.0 (60.0)	11.15

STACKUP STANDARD BANANA PLUG PATCH CORD

Model No.	Length	*Net
B-4 *	101.6 (4.0)	2.40
B-8 *	203.2 (8.0)	2.40
B-12*	304.8 (12.0)	2.40
B-18*	457.2 (18.0)	2.40
B-24*	609.6 (24.0)	2.40
B-36*	914.4 (36.0)	2.40
B-48*	1219.2 (48.0)	2.60
B-60*	1524.0 (60.0)	2.80
B-72*	1829.0 (72.0)	3.00

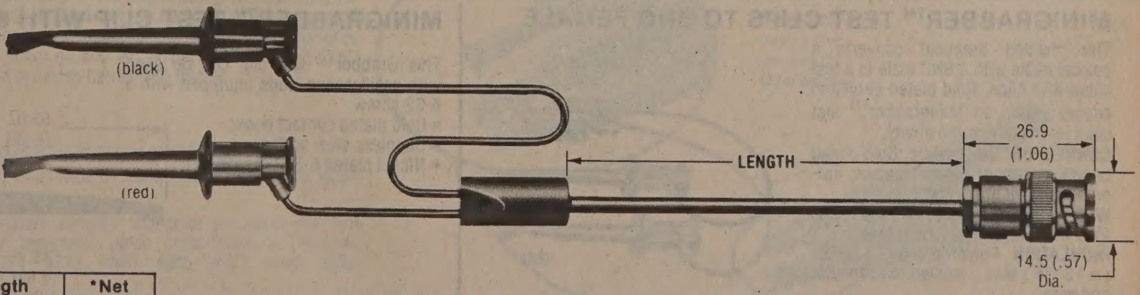


Multiple stacking feature accommodates the most complex stacking; keeps circuitry neater. Greatly simplifies circuit connections and changes. Reliable solder-bonded connections withstand pull test in excess of 50 lbs. Banana plugs both ends.

RATED 5000W VDC, 7AMPS. CONT.

*COLOR CODES				
0-Black	2-Red	4-Yellow	6-Blue	8-Gray
1-Brown	3-Orange	5-Green	7-Violet	9-White

MINIGRABBER™ TEST CLIPS TO BNC MALE



Model No.	Length	*Net
3787-C-18	457.2 (18.0)	10.95
3787-C-24	609.6 (24.0)	10.95
3787-C-36	914.4 (36.0)	10.95
3787-C-48	1219.2 (48.0)	11.55
3787-C-60	1524.0 (60.0)	12.15

For use with equipment having BNC receptacles. Gold plated beryllium copper hooks on Minigrabber™ test clips for maximum sensitivity.

CABLE; Shielded coax., RG58C/U, 4.95 mm (.195) O.D., nom cap 30.8 pf/ft. Color: black.

CONNECTOR: BNC male, gold plated brass center contact. Brass body, tarnish resistant finish.

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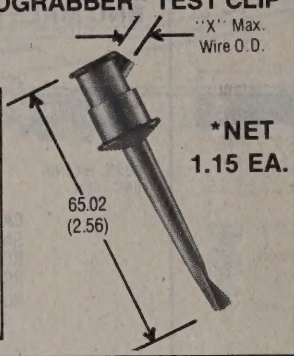
DO-IT-YOURSELF MICROGRABBER™ TEST CLIP

BERYLLIUM COPPER CONDUCTOR, GOLD PLATED
GLASS FILLED NYLON BODY
(Pkg. Ten Per Color)

"X" Dia. 2.29 (.090)	"X" Dia. 3.66 (.144)	
Model No.	Model No.	Color
3925-0	4555-0	Black
3925-1	4555-1	Brown
3925-2	4555-2	Red
3925-3	4555-3	Orange
3925-4	4555-4	Yellow
3925-5	4555-5	Green
3925-6	4555-6	Blue
3925-7	4555-7	Violet
3925-8	4555-8	Gray
3925-9	4555-9	White

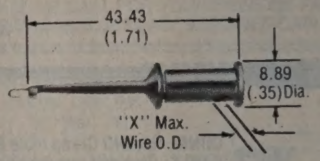


***NET 1.15 EA.**

DO-IT-YOURSELF MINIGRABBER™ TEST CLIP

BERYLLIUM COPPER CONDUCTOR, GOLD PLATED
GLASS FILLED NYLON BODY

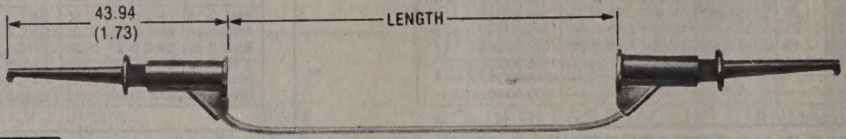
"X" Dia. 2.29 (.090)	
Model No.	Color
4233-0	Black
4233-1	Brown
4233-2	Red
4233-3	Orange
4233-4	Yellow
4233-5	Green
4233-6	Blue
4233-7	Violet
4233-8	Gray
4233-9	White



This do-it-yourself Grabber™ test clip is designed for testing of high density packaging. Lightweight and small size permits multiple usage of units in confined areas.

(Pkg. Ten Per Color) ***NET 1.20 EA.**

MICROGRABBER™ TEST CLIP BOTH ENDS

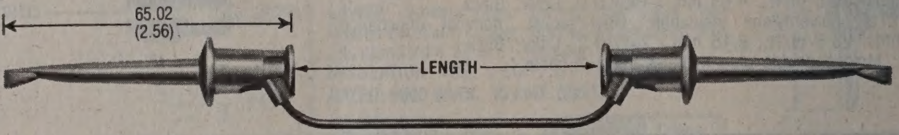


Model No.	Length	*Net
4613-12-*	304.8 (12.0)	4.75
4613-24-*	609.6 (24.0)	4.75
4613-36-*	914.4 (36.0)	4.75
4613-48-*	1219.2 (48.0)	4.95
4613-60-*	1524.0 (60.0)	5.15

MICROGRABBER™: Gold plated beryllium copper contact. Insulation: Glass-filled nylon, +102°C. (+216°F.) Max.

WIRE: 20 AWG, 41/36 TC, PVC jacket, 2.21 mm (.087) O.D.
***COLORS AVAILABLE**: -0 Black, -2 Red.

MINIGRABBER™ TEST CLIP BOTH ENDS



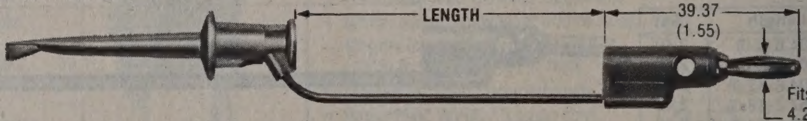
Model No.	Length	*Net
3781-8-*	203.2 (8.0)	2.95
3781-12-*	304.8 (12.0)	2.95
3781-18-*	457.2 (18.0)	2.95
3781-24-*	609.6 (24.0)	2.95
3781-36-*	914.4 (36.0)	2.95
3781-48-*	1219.2 (48.0)	3.15
3781-60-*	1524.0 (60.0)	3.35

Minigrabber™ test clip on both ends for rapid interconnection of test points. Connects quickly and firmly to test points without damage from sharp teeth. Gold plated beryllium copper hook for maximum sensitivity.
WIRE: 20 AWG, 41/36 TC, PVC jacket, 2.21 mm (.087) O.D.

*

Color Code				
0 - Black 1 - Brown	2 - Red 3 - Orange	4 - Yellow 5 - Green	6 - Blue 7 - Violet	8 - Gray 9 - White

MINIGRABBER™ TEST CLIP TO STACKING STANDARD BANANA PLUG



Model No.	Length	*Net
3782-12-*	304.8 (12.0)	2.95
3782-24-*	609.6 (24.0)	2.95
3782-36-*	914.4 (36.0)	2.95
3782-48-*	1219.2 (48.0)	3.15
3782-60-*	1524.0 (60.0)	3.35

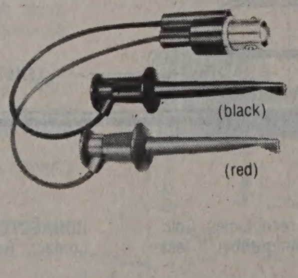
Minigrabber™ test clip lead adapts to equipment using standard banana jacks. Gold plated beryllium copper hook for maximum sensitivity.
BANANA PLUG: Spring, one piece heat-treated beryllium copper, berylco 25 per QQ-C-533, nickel plated. Polypropylene insulation molded to plug body and wire, +55°C. (+131°F.) Max.

*

Color Code				
0 - Black 1 - Brown	2 - Red 3 - Orange	4 - Yellow 5 - Green	6 - Blue 7 - Violet	8 - Gray 9 - White

MINIGRABBER™ TEST CLIPS TO BNC FEMALE

This molded breakout converts a coaxial cable with a BNC male to a test cable with clips. Gold plated beryllium copper hooks on Minigrabber™ test clips for maximum sensitivity.
CONNECTOR: BNC female; Gold plated beryllium copper center contact; Tarnish resistant brass body.
WIRE: 20 AWG strand. 41 x 36 T.C. PVC Insul. 2.21 mm (.087) O.D.
INSULATION: Polypropylene, +55°C. (+131°F.) Max., molded to connector and wire.
OVERALL LENGTH: 177.8 mm (7.0).



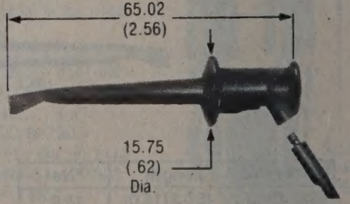
Model No.
3788

Photo approximately one-half actual size.

***NET 6.95**

MINIGRABBER™ TEST CLIP WITH 6-32 THREAD

This Grabber™ test clip can be used with oscilloscope leads equipped with a 6-32 screw.
- Gold plated contact hook.
- Stainless steel spring.
- Nickel plated 6-32 brass insert.



Model No.	Color
4011-0	Black
4011-2	Red

***NET 2.60**

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ITT POMONA ELECTRONICS

OSCILLOSCOPE PROBE

***NET 49.50**

Model No.
4550

SPECIFICATIONS (3 POSITION):

Position x 1

Bandwidth:	DC to 10MHz
Input Resistance:	1MΩ (oscilloscope input)
Input Capacity:	40pF. Plus oscilloscope capacity
Working Voltage:	600 Volts DC (including Peak AC)
Cable Length:	1.5 meters (4.92 ft.)

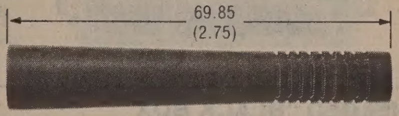
Position Ref.
Probe tip grounded via 9MΩ resistor, oscilloscope input grounded

Position x 10

Bandwidth:	DC to 100 MHz
Risetime:	3.5 nanoseconds
Input Resistance:	10MΩ when used with oscilloscopes which have 1MΩ input. (Probe resistance 9MΩ ± 1%)
Input Capacity:	11.5pF when used with oscilloscopes which have a 30pF input capacity. For other values see graph.
Compensation Range:	10-60pF
Working Voltage:	600 Volts DC (including Peak AC)

STRESS RELIEF BOOT

For use with crimp-on type connectors.
MATERIAL: PVC, +50°C. (+122°F.)



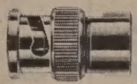
Model No.	Fits Cable Types	Cable O.D.	*Net
5155-*	RG 58, 141	.185 - .200	.45 EA.
5156-*	RG 59, 62, 210	.237 - .247	.45 EA.
5157-*	RG 174, 187, 188	.090 - .110	.45 EA.

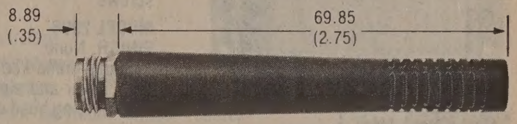
(Pkg. Ten Per Color)

Color Code				
0 - Black 1 - Brown	2 - Red 3 - Orange	4 - Yellow 5 - Green	6 - Blue 7 - Violet	8 - Gray 9 - White

BNC CONNECTOR WITH STRESS RELIEF BOOT

Make your own stress relieved cable. This model attaches to the end of a cable in the same way as an ordinary BNC connector.
BOOT: PVC, +50°C. (+122°F.) Max.
BNC MALE: Body, brass, tarnish resistant finish. Gold plated brass contact.



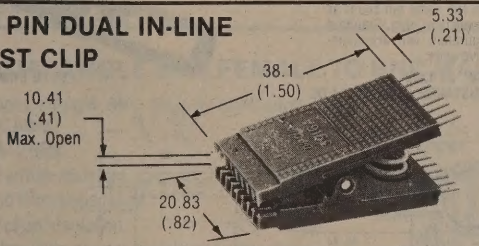


Model No.	Fits Cable Types	Cable O.D.	*Net
5066-*	RG 58, 141	.185 - .200	4.95
5067-*	RG 59, 62, 210	.237 - .247	4.95
5068-*	RG 174, 187, 188	.090 - .110	4.95

*

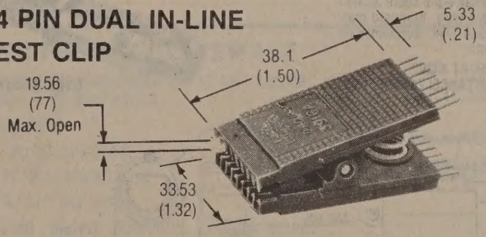
Color Code				
0 - Black 1 - Brown	2 - Red 3 - Orange	4 - Yellow 5 - Green	6 - Blue 7 - Violet	8 - Gray 9 - White

16 PIN DUAL IN-LINE TEST CLIP



Model No.	Contact Material	Net Price*
3916A	Tarnish Resistant Nickel Silver	4.95
5116	Gold Plated Beryllium Copper	7.50

24 PIN DUAL IN-LINE TEST CLIP



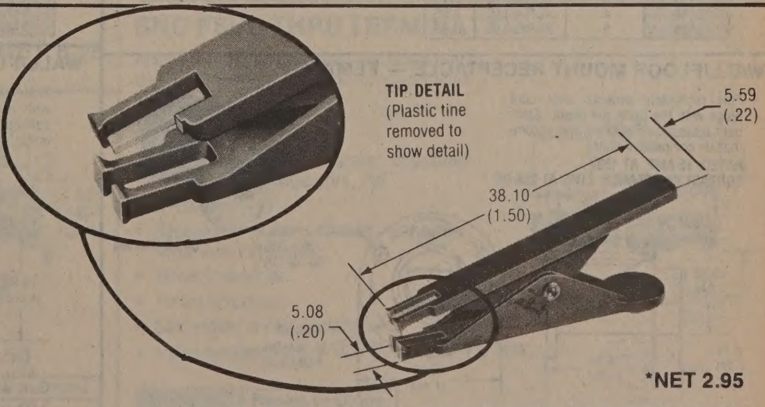
Model No.	Contact Material	Net Price*
4124A	Tarnish Resistant Nickel Silver	12.85
5124	Gold Plated Beryllium Copper	15.85

DIP GRIP™ IC TEST CLIP

Pomona Electronics DIP GRIP™ test clip is designed especially for testing single contacts on Dual-In-Line Package (DIP) Integrated Circuits on 2.54 mm (.100) spacing. The DIP GRIP™ assures positive electrical contact on one leg of the DIP across its 7.62 mm (.300) width and provides hands free testing.

FEATURES

- Beryllium copper contact gold plated per MIL-G-45204.
- Contact 1.02 mm (.040) wide on lower end is serrated for good electrical connection.
- 0.64 mm (.025) square serrated test point on upper end will accept square pin receptacle patch cords such as Pomona Models: 4741, 4771, 4772, 4910, 4945, 4974, 4992, 5069 and 5070.
- Torsion spring: Music wire per QQ-W-470A.
- Molded barrier on either side of contact allows connections to be made on live boards without accidental shorting of adjacent contacts.
- Insulation: Glass-filled nylon, +102°C. (+216°F.) Max.



***NET 2.95**

Model No.	Color Code				
5083	0 - Black 1 - Brown	2 - Red 3 - Orange	4 - Yellow 5 - Green	6 - Blue 7 - Violet	8 - Gray 9 - White

For More Information. Circle No. 233

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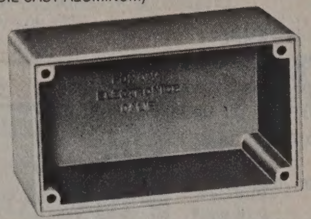
1984 ELECTRONICS TEST ACCESSORIES CATALOG

ITT POMONA ELECTRONICS

SHIELDED "BLACK BOX"

(DIE CAST ALUMINUM)

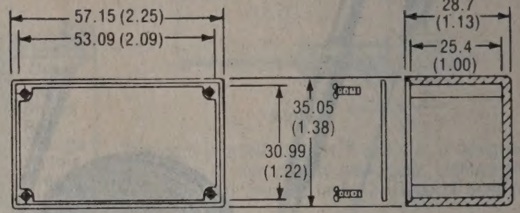


NOISE REJECTION: GREATER THAN 70dB
COVER: CLEAR ANODIZED ALUMINUM

MODEL 2417
FINISH: Blue baked enamel.
Includes 1.02 mm (.040) thick cover with part number and four 2-32 x .250 self-tapping pan head cover screws.

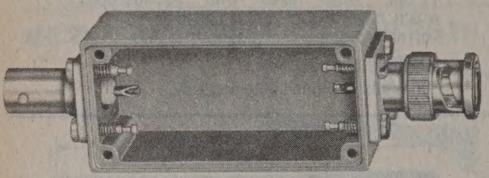
MODEL 2428
FINISH: None.
Includes unmarked 1.02 mm (.040) thick cover and four 2-32 x .250 self-tapping pan head cover screws.

Model No.	*Net
2417	5.25
2428	4.95


57.15 (2.25)
53.09 (2.09)
28.7 (1.13)
25.4 (1.00)
35.05 (1.38)
30.99 (1.22)

COMPONENT MOUNTING — BNC FEMALE TO BNC MALE ("A" SIZE)

(DIE CAST ALUMINUM)



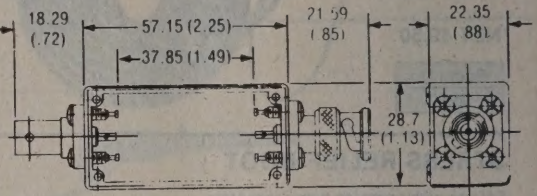
CONN: 1st END
BNC female.

CONN: 2nd END
BNC male.

Model No.
2391

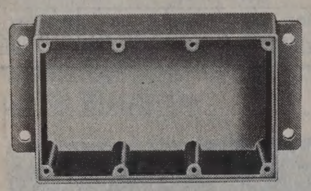
***NET 18.75**

Includes 1.02 mm (.040) thick cover and four 2-32 x .250 self-tapping pan head cover screws.


18.29 (.72)
57.15 (2.25)
37.85 (1.49)
21.59 (.85)
22.35 (.88)
28.7 (1.13)

SHIELDED "BLACK BOX"

(DIE CAST ALUMINUM)

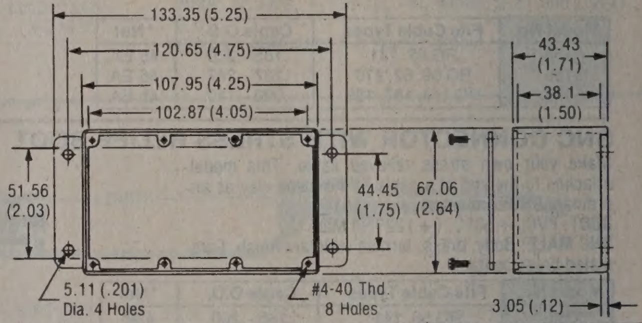


Model No.	*Net
2901	11.95
2906	10.95

MODEL 2901
FINISH: Blue baked enamel.
Includes 2.03 mm (.080) thick cover with part number and eight 4-40 NC-2A x .250 binding head cover screws.

MODEL 2906
FINISH: None.
Includes unmarked 2.03 mm (.080) thick cover and eight 4-40 NC-2A x .250 binding head cover screws.

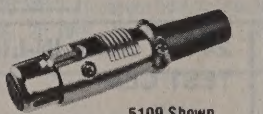
Photos approximately one third actual size.


133.35 (5.25)
120.65 (4.75)
107.95 (4.25)
102.87 (4.05)
43.43 (1.71)
38.1 (1.50)
51.56 (2.03)
44.45 (1.75)
67.06 (2.64)
5.11 (.201) Dia. 4 Holes
#4-40 Thd. 8 Holes
3.05 (.12)

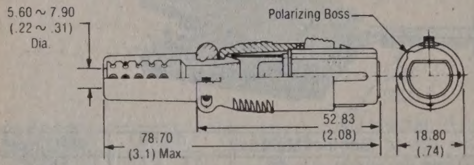
STRAIGHT CORD PLUG — FEMALE

This cord plug accepts all male receptacles with the same pin count as well as the male cord plug. Standard mating configuration will accommodate competitive units.

RATED: 15 AMP. AT 133V
CONTACT RESISTANCE: 21MV AT 25A DC



5109 Shown


5.60 ~ 7.90 (.22 ~ .31) Dia.
Polarizing Boss
52.83 (2.08)
78.70 (3.1) Max.
18.80 (.74)

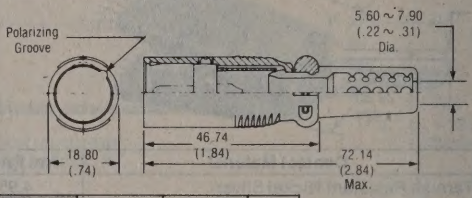
Model No.	Sockets	XL Style	*Net
5109	3	XLR-3-11C	3.25
5118	4	XLR-4-11C	4.55
5125	5	XLR-5-11C	5.95

STRAIGHT CORD PLUG — MALE

This cord plug accepts all female receptacles with the same pin count as well as the female cord plug. Standard mating configuration will accommodate competitive units.

RATED: 15 AMP. AT 133V
CONTACT RESISTANCE: 21MV AT 25A DC

5110 Shown

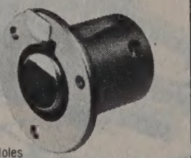

Polarizing Groove
5.60 ~ 7.90 (.22 ~ .31) Dia.
18.80 (.74)
46.74 (1.84)
72.14 (2.84) Max.

Model No.	Pins	XL Style	*Net
5110	3	XLR-3-12C	2.35
5119	4	XLR-4-12C	3.00
5126	5	XLR-5-12C	3.15

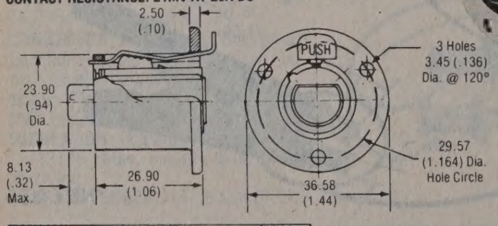
WALL/FLOOR MOUNT RECEPTACLE — FEMALE

This receptacle accepts male cord plugs with the same pin count. Standard mating configuration will accommodate competitive units.

RATED: 15 AMP. AT 133V
CONTACT RESISTANCE: 21MV AT 25A DC



5111 Shown


2.50 (.10)
23.90 (.94) Dia.
8.13 (.32) Max.
26.90 (1.06)
PUSH
3 Holes 3.45 (.136) Dia. @ 120°
29.57 (1.164) Dia. Hole Circle
36.58 (1.44)

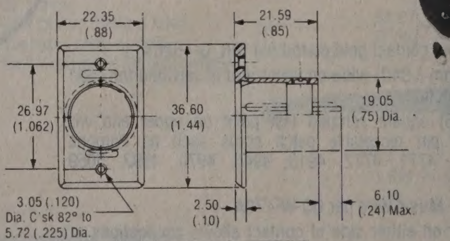
Model No.	Sockets	XL Style	*Net
5111	3	XLR-3-13	4.65
5121	4	XLR-4-13	5.30
5127	5	XLR-5-13	6.30

Note: Requires 24.2 mm (.954) dia. panel cutout.

WALL/FLOOR MOUNT RECEPTACLE — MALE

This receptacle accepts female cord plugs with the same pin count. Standard mating configuration will accommodate competitive units. **RATED: 15 AMP. AT 133V**
CONTACT RESISTANCE: 21MV AT 25A DC

5117 Shown


22.35 (.88)
21.59 (.85)
26.97 (1.062)
36.60 (1.44)
19.05 (.75) Dia.
3.05 (.120) Dia. C'sk 82° to 5.72 (.225) Dia.
2.50 (.10)
6.10 (.24) Max.

Model No.	Pins	XL Style	*Net
5117	3	XLR-3-32	2.15
5131	4	XLR-4-32	2.20
5130	5	XLR-5-32	2.35

Note: Requires 19.8 mm (.780) dia. panel cutout.

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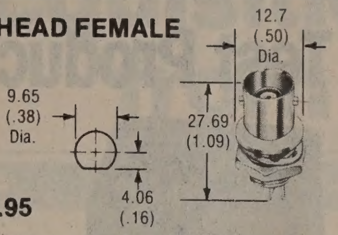
TRIAXIAL BULKHEAD FEMALE

Ideal for triaxial interconnect requirements. Mounts in panels up to 6.35 mm (.25) thick. See hole pattern layout. Includes mounting hardware.



Model No.
3580

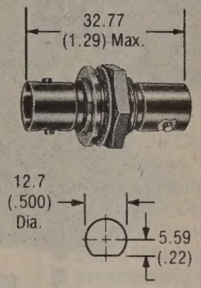
***NET 11.95**

ISOLATED GROUND BNC FEMALE TO FEMALE

Outer conductor is isolated from the panel. Excellent for feeding through panels which require a floating shield.

FEATURES:

- Tarnish resistant.
- 50 Ohm impedance.
- Teflon insulation.
- Gold plated beryllium copper center contacts.
- Mounts in panels up to 4.57 mm (.18) thick.



Model No.
3846

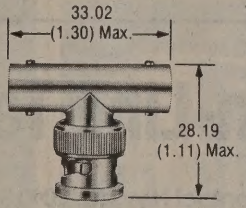
***NET 12.75**

BNC "T" — FEMALE, MALE, FEMALE

With this adapter, equipment or coaxial cables having a single BNC female are changed to two BNC Females.

FEATURES:

- Tarnish resistant.
- 50 Ohm impedance.
- Teflon insulation.
- Beryllium copper female center and male outer finger contacts.
- Gold plated female and male center contacts.



Model No.
3285

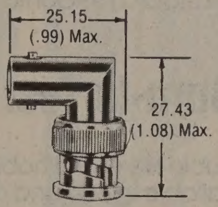
***NET 9.50**

RIGHT ANGLE BNC FEMALE TO BNC MALE

Adapts straight BNC male to right angle BNC male.

FEATURES:

- Tarnish resistant.
- 50 Ohm impedance.
- Teflon insulation.
- Beryllium copper female and male outer finger contact.
- Gold plated female and male center contacts.



Model No.
3534

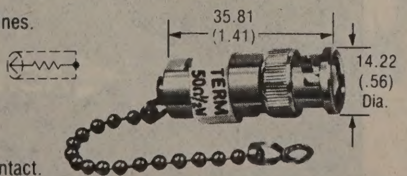
***NET 8.95**

BNC RESISTOR TERMINATED MALE PLUG

Ideal for terminating coaxial lines.

FEATURES:

- 1%, ½ watt, deposited carbon resistor.
- Tarnish resistant.
- Teflon insulation.
- Gold plated male center contact.
- 88.9 mm (3.5) bead chain with 3.56 mm (.14) dia. hole in lug.
- Resistance value marked on white nylon anti-roll sleeve.
- Nylon temperature: +102°C. (+216°F.) Max.



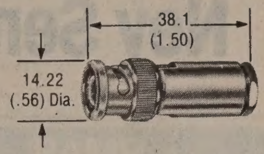
***NET 8.50**

Model No.	Resist. in Ohms
3840-50	50
3840-75	75
3840-93	93
3840-100	100
3840-600	600

TRIAXIAL MALE CABLE PLUG

MODEL 3600

For use with Belden 9272 twinax cable. Jacket O.D. 6.15 mm (.242). 78 Ohms impedance. Cabling instruction will be furnished on request.



Model No.
3600

(FOR TWINAX CABLE)

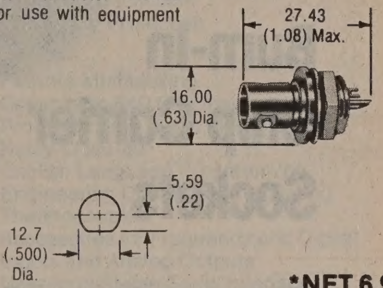
***NET 13.50**

BNC ISOLATED GROUND FEMALE BULKHEAD RECEPTACLE

This connector has the outer conductor isolated from the panel. Excellent for use with equipment requiring a floating ground.

FEATURES:

- Tarnish resistant.
- 50 Ohm impedance.
- Teflon insulation.
- Gold plated beryllium copper center contact.
- Mounts in panels up to 4.44 mm (.18) thick.



Model No.
3778

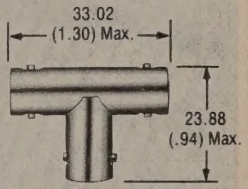
***NET 6.95**

BNC "T" — 3 FEMALES

Allows the interconnection of three coaxial cables with BNC males.

FEATURES:

- Tarnish resistant.
- 50 Ohm impedance.
- Teflon insulation.
- Gold plated beryllium copper center contacts.



Model No.
3284

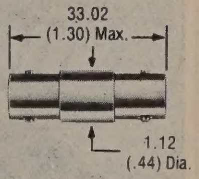
***NET 10.95**

BNC FEMALE TO FEMALE

Allows the interconnection of two coaxial cables with BNC males.

FEATURES:

- Tarnish resistant.
- 50 Ohm impedance.
- Teflon* insulation.
- Gold plated beryllium copper center contacts.



Model No.
3283

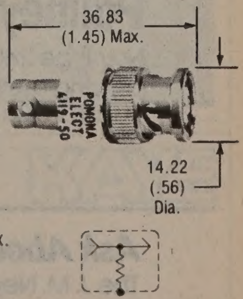
***NET 3.95**

BNC FEED-THRU TERMINATION

Ideal for terminating pulse, microwave or UHF instruments in their characteristic impedance.
1st end: Female BNC.
2nd end: Male BNC.
Termination metal film resistor, deposited nichrome over ceramic core, 2W.

FEATURES:

- Resistance value marked on white nylon anti-roll sleeve.
- Tarnish resistant.
- Teflon insulation.
- Gold plated center contacts.
- Nylon temperature: +102°C. (+216°F.) Max.

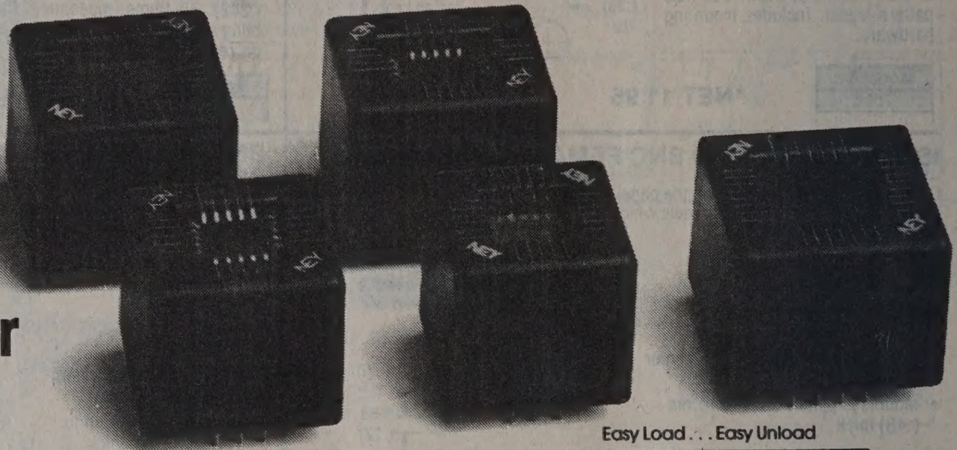


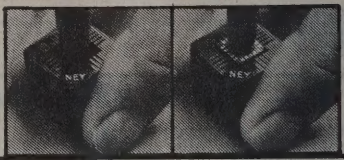
Model No.	Resist. in Ohms
4119-50	50
4119-75	75
4119-93	93
4119-600	600

***NET 39.95**

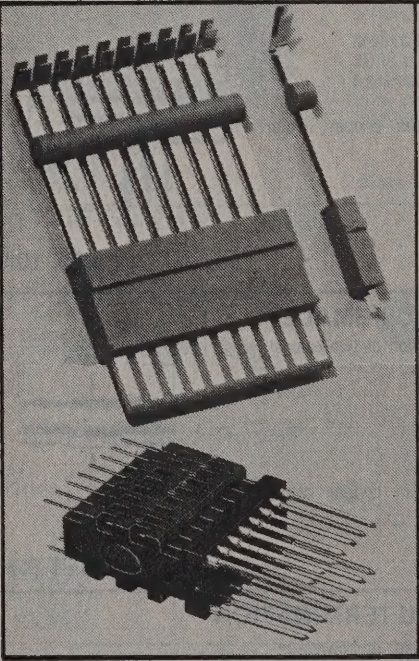
Ney Semiconductor Test Products

LCC & PCC Test and Burn-In Chip Carrier Sockets




Easy Load . . . Easy Unload

- ■ Reliable up to 150°C wear resistant nickel boron plated beryllium copper Contacts
- ■ Higher Temperature Materials also Available
- ■ Molded from Ryton (polyphenylene)



Dual-In-Line Test Probes

10 Station test contact Ney std. 2010 Solid noble contacts (Paliney® #7) • Simulates size and shape of dual-in-line package leads • Simultaneously checks both contact condition and continuity through PC board • Modular design for easy repair and replacement • (any pin count)

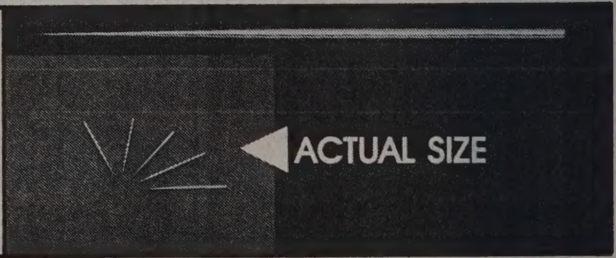
ALSO AVAILABLE: Ney Standard 2001 and 2000 Single Station Contact or Ney Standard Pin Contacts 2034 and 2033

Modular Burn-In Test Probes

Reversible for double life • Solid noble metal contacts (Ney Paliney® #7) • Available in 300 and 600 mil centers (any pin count)

Paliney® #7 Needle Probes

Ney Type 2601 offers: More reliable I.C. Chip test probing method • Tighter tolerances • Long life • Cash value when returned as precious scrap



Ask About Our Test Contactors

The J. M. Ney Company, Electronics Division
Ney Industrial Park, Bloomfield, CT 06002 (203) 242-2281
Telex 9-9238

Data Acquisition and Control from Kaye

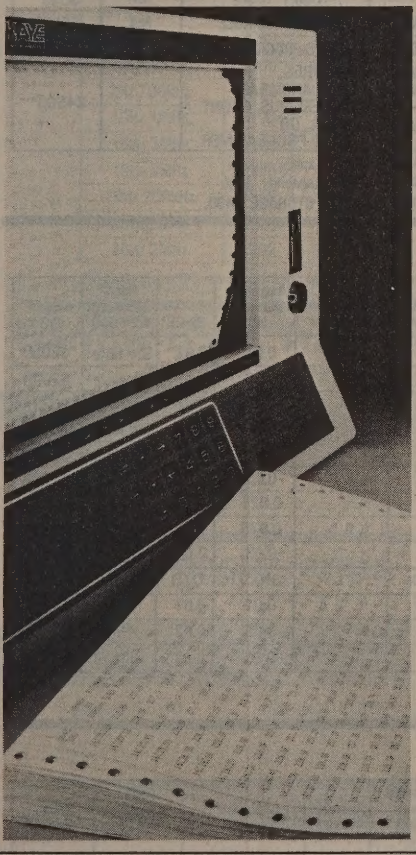
DIGISTRIP . . .

Applications:

- Process Monitoring and Annunciation
- Quality Assurance and Compliance
- Machinery Protection
- Energy Management and Accounting
- Production Monitoring

Features:

- Full-width Page Printout with Headers
- Independent Alarms on Each Channel
- Programmable Alarm Messages
- Capacity to 128 Channels
- RS232 and Current-loop Computer Interface
- English Language Programming
- Engineering Conversion including Thermocouples
- Full Mathematical Capability
- Cassette Program Loading Capability



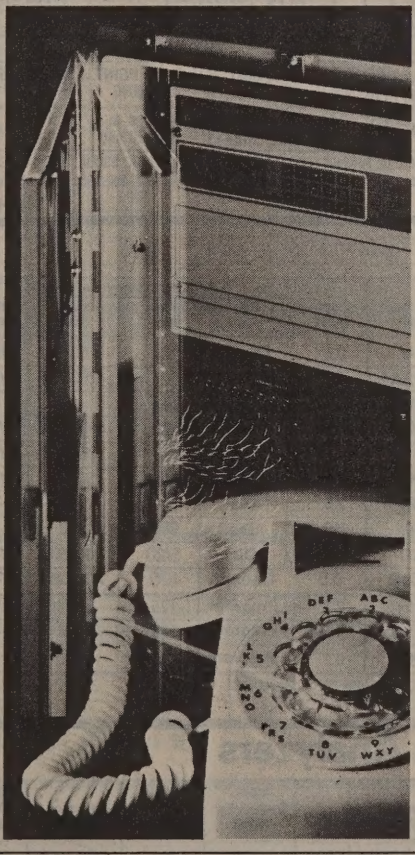
DIGI-LINK . . .

Applications:

- Remote-site Data Acquisition and Control
- Machinery Protection
- Distributed Process Monitoring and Control
- Energy Management
- Factory Automation

Features:

- Full ASCII Communications Capabilities
- Local or Remote Programming
- Automatic Dial and Answer for Modem Connections
- Local Display
- Engineering Conversions
- Alarms
- Full Mathematical Capability
- English Language Programming
- Multiple RS232 and Current-loop Ports
- Capacity to 128 Channels



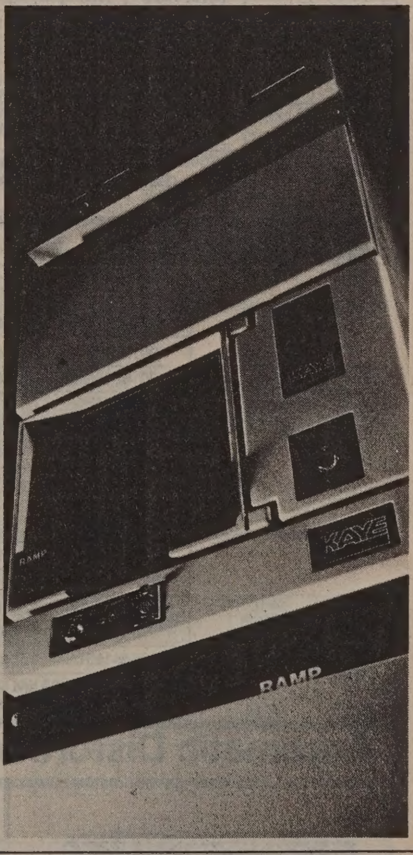
RAMP . . .

Applications:

- Stand-alone Process Monitor
- Computer Front-end
- Distributed Analog Data Acquisition
- Process Annunciator
- Machinery Protection

Features:

- Remote Multiplexing
- Capacity to 640 Channels
- Programmable Alarm Limits and Relay Closures
- English Language Programming
- Engineering Conversions including Thermocouples
- Accessories for Frequency and Digital Inputs and Analog Outputs
- User-formattable Serial Interface
- Cassette Program Loading Capability



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Our team of sales engineers is ready to help you choose the right system for your application. Call us. Our TOLL FREE number is 800-343-4624.

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TWX 710-326-1598
Telex 6817183

KAYE

KROHN-HITE CORPORATION

Avon Industrial Park
Avon Massachusetts 02322
(617) 580-1660
TWX 710-345-0831

Function & Sweep Generators

Frequency Range	Model	Output Waveforms						Maximum Output	Output Impedance (Ohms)	Auxiliary Outputs	DC Offset	Ext. V.C.	Additional Features	Rack Mounting Kit—$50	Base Price
		∿	⊓	⋀	◁	⊓⊔	⩘								
.2Hz-3MHz	1000A	•	•	•				20V p-p	50	TTL	—	1500:1	1500:1 Tuning	RK-39	$ 395
.2Hz-3MHz	1200A	•	•	•				20V p-p	50	TTL, ⊿	±10V	1500:1	Linear Sweep	RK-39	$ 525
.2Hz-3MHz	1400	•	•	•		•		20V p-p	50	TTL, ⊿,CV	±10V	1500:1	Lin Swp, Trig, Gate, Burst	RK-314	$ 795
.2Hz-3MHz	1600	•	•	•		•		20V p-p	50	TTL, ⊿,CV MKR, PEN LIFT	±10V	1500:1	Lin/Log Swp, Pause-Mkr, Trig, Gate, Burst	RK-314	$ 895
.003Hz-30MHz	2000	•	•	•		•	•	30V p-p	50	TTL, CV	±15V	1000:1	dB Attenuator Symmetry Control	RK-58	$1050
.003Hz-30MHz	2200	•	•	•		•	•	30V p-p	50	TTL, ⊿, ⊿,CV, MKR, PEN LIFT	±15V	1000:1	Lin/Log Swp, Pause-Mkr, Trig, Gate, Burst	RK-519	$1495
.003Hz-30MHz	2400	•	•	•		•	•	30V p-p	50	20V ∿ ⊓ ∿	±15V	1000:1	AM, FM, ϕ Lock, Swp, Trig, Gate	RK-519	$1650
.002Hz-3MHz	5100B	•	•	•	•	•	•	20V p-p	50	5V ⊓	±5V	1000:1	Symmetry Control Output Protection	RK-58	$ 850
.002Hz-3MHz	5200A	•	•	•	•	•		20V p-p	50	⊓ ⊿	±5V	1000:1	Lin Swp, Trig, Gate, Burst, Output Protection	RK-58	$1050
.002Hz-3MHz	5300A	•	•	•	•	•		20V p-p	50	⊓ ⊿ ⊓	±5V	1000:1	Lin/Log Swp, Trig, Gate, Burst, Output Protection	RK-58	$1095
.002Hz-5MHz	5400B	•	•	•	•	•	•	30V p-p	50	5V ⊓	±10V	1000:1	Symmetry Control Output Protection	RK-58	$ 950
.002Hz-2MHz	5600	•	•	•				15V p-p	50/600 Bal.	1V ∿ ⊓ ∿	±5V	—	Battery Operated	N/A	$ 695
.002Hz-2MHz	5700	•	•	•				15V p-p	50/600 Bal.	1V ⊓	±5V	—	1000:1 Tuning	N/A	$595
.0001Hz-5MHz	5500AR	•	•	•		•	•	30V p-p	50	5V ⊓	±7.5V	1000:1	PROGRAMMABLE	N/A	$2500
.0001Hz-5MHz	5900 IEEE-488	•	•	•		•	•	30V p-p	50	TTL ⊓	±15V	200:1	AUTO-PROGRAMMER	RK-519	$3000
0.0001Hz to 5MHz	5910 IEEE-488	ALL FEATURES OF 5900 PLUS ARBITRARY WAVEFORMS						DATA POINT GRID AMPL: 4000 X TIME: 1024		DATA POINT TIMING 200ns to 10,000 sec	DATA POINT SLEW RATE 20V/ µsec		FEATURES: LOAD ARBITRARY VIA IEEE BUS, FRONT PANEL, OR AUTO-PROGRAMMER		$4500**

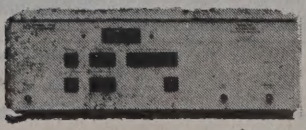
WAVEGUARD™ (output protection): Standard on Models 1000A, 1200A, 5100B, 5200A, 5300A, and 5400B. All other models specify option 001: $45 ($90; Models 5500 AR, 5900 and 5910) *Battery kit, Model 5600. Part No. BK-560: $150. **Option 002: Talker capability: $350.
**Option 003: EARPROM STORAGE: $400.

RC Oscillators

Frequency Range	Model	Freq. Acc.%	Output Each Phase			Quad. Output	Output Waveforms	Amplitude Flatness (dB)	Dist.%	Rack Mounting Kit—$50	Base Price
			Freq. Tuning	Power (mw)	Impedance (Ohms)						
.001Hz-100kHz	4024A	0.5	Decade	125	200/600	Yes	∿ ⊓ ⊓	0.01	0.01	See Note*	$2050
.001Hz-100kHz	4025A*	0.1	Decade	125	200/600	Yes	∿ ⊓ ⊓	0.01	0.01	See Note*	$2395
.01Hz-1MHz	4100A	0.5	P. Button	500	50	—	∿ ⊓	0.05	0.02	See Note*	$1095**
.1Hz-100kHz	4000A	0.5	Decade	125	200/600	Yes	∿	0.01	0.01	See Note*	$1550
.1Hz-100kHz	4001A	0.1	Decade	125	200/600	Yes	∿	0.01	0.01	See Note*	$1850
1Hz-110kHz	4400A	1.0	Decade	5/20	50/600	Yes	∿∿Ʊ	0.05	0.001	RK-39	$ 695
10Hz-10MHz	4200A	2.0	Dial	500	50	—	∿∿	0.025	0.1	RK-58	$ 795**
10Hz-10MHz	4300A	2.0	Dial	500	50	—	∿⊓∿	0.025	0.1	RK-58	$ 850**
1Hz-110KHz	4500	10.0	Dial	5/20	50/600	Yes	∿ ⊓	0.05	0.001	RK-39	$ 695
.1Hz to 100khz	4030R	0.5	Decade	125	200/600	Yes	∿ ⊓ ⊓	±0.01	0.01	N/A	$2550
.1Hz-100kHz	4031R	0.1	Program.	125	200/600	Yes	∿ ⊓ ⊓	0.01	0.01	N/A	$2995
1Hz-1MHz	4141R	0.1	Program.	500	50	—	•∿ ⊓	0.05	0.02	N/A	$2400
1Hz-1MHz	4180* IEEE-488	0.1	Program.	500	50		∿ ⊓	0.05	0.02	RK-519	$3000*

*Rack Model (19" panel) add $50. Add suffix 'R' to Model No.
**WAVEGUARD™, option 001: $45

Automatic Distortion Analyzers



Model 6880

IEEE-488

Frequency Range	Model	Input Sensitivity VRMS	Display	Distortion Range%	Voltmeter Range VRMS	Internal Osc.	Additional Features	Rack Mounting Kit—$50	Base Price
1Hz-110kHz	6800	1-130	3 Digit	.000-12.0	0.1-130	1kHz 5V RMS	Distortion Output Analog Output	RK-319	$1600*
10Hz-110kHz	6801	0.1-13	3 Digit	.000-12.0	.01-13	1kHz 5V RMS	Distortion Output Analog Output	RK-319	$1600*
10Hz-110kHz	6880	0.1-130	3 Digit	.000-50.0	.01-130	1kHz 5V RMS	FREQ COUNTER GPIB PROG	RK-519	$3500**
5Hz-1MHz	6900	0.1-130	3 Digit	.000-19.9	.01-130	1KHz 5VRMS	Complete Auto-Ranging	RK-319	$1995‡

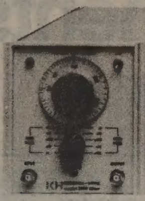
*Models 6800, 6801: Option 001; BCD Output: $225. Option 002, %/dB Readout: $200. Option 003, 30kHz, 80kHz LP Filters: $200.
** Model 6880: Option 001, 1Hz-110kHz: $250. ‡Option 001, BCD output: $225

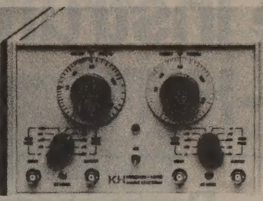
For More Information. Circle No. 236

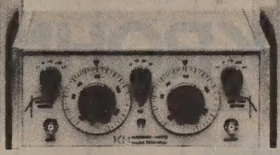
KROHN-HITE CORPORATION

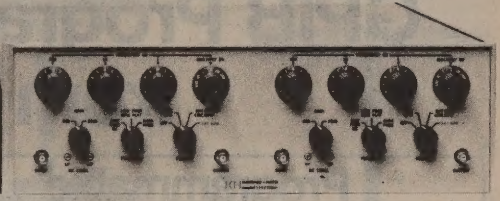
Dept. GB Avon Industrial Park
Avon Massachusetts 02322
(617) 580-1660
TWX 710-345-0831

Tunable Active Filters


Model 3200


Model 3202

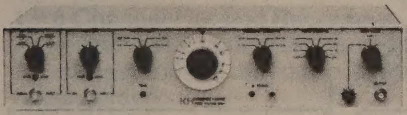

Model 3550


Model 3342

Frequency Range	Filter Model	BAND PASS	BAND REJECT	HIGH PASS	LOW PASS	Freq. Acc.%	Attenuation Slope db/Octave	Hum and Noise (RMS)	Max. Attenuation (dB)	Output Volt/Amps (RMS)	Bandwidth (−3dB Points)	Battery Kits No./Price	Rack Mounting Kit—$50	Base Price
.001Hz-99.9kHz	3320			X	X	2	24	500uV	80	5v/50ma	DC-1MHz	BK332/$100	RK-58	$1075
.001Hz-99.9kHz	3322	X	X	X	X	2	24/48	500uV	80	5v/50ma	DC-1MHz	BK334/$200	RK-519	$2050
.001Hz-99.9kHz	3340			X	X	2	48	500uV	80	5v/50ma	DC-1MHz	BK332/$100	RK-58	$1495
.001Hz-99.9kHz	3342	X	X	X	X	2	48/96	500uV	80	5v/50ma	DC-1MHz	BK334/$200	RK-519	$2895
.01Hz-99.9kHz	3321			X	X	2	24	500uV	80	5v/50ma	DC-1MHz	BK332/$100	RK-58	$ 995
.01Hz-99.9kHz	3323	X	X	X	X	2	24/48	500uV	80	5v/50ma	DC-1MHz	BK334/$200	RK-519	$1895
.01Hz-99.9kHz	3341			X	X	2	48	500uV	80	5v/50ma	DC-1MHz	BK332/$100	RK-58	$1395
.01Hz-99.9kHz	3343	X	X	X	X	2	48/96	500uV	80	5v/50ma	DC-1MHz	BK334/$200	RK-519	$2650
.02Hz-20kHz	3750	X	X	X	X	5	6, 12, 18, 24	500uV	80	10v/2ma	DC-1MHz	BK375/$220	RK-519	$1350
.2Hz-20kHz	3700	X				5	24	200uV	80	5v/1ma	N/A	BK370/$110	RK-38	$ 895
2Hz-200kHz	3550	X	X	X	X	5	24	200uV	60	5v/10ma	.2Hz-3MHz	N/A	RK-38	$ 950
10Hz-1MHz	3100A	X				5	24	100uV	80	3v/10ma	N/A	N/A	RK-314	$ 850
10Hz-3MHz	3103A	X				5	24	100uV	80	3v/10ma	N/A	N/A	RK-314	$ 950
10Hz-3MHz	3103A-4	X				5	18	100uV	80	3v/10ma	N/A	N/A	RK-314	$ 950
20Hz-200kHz	3500	X				10	24	200uV	60	5v/3.5ma	N/A	N/A	RK-38	$ 795
20Hz-2MHz	3200			X	X	5	24	100uV	80	3v/10ma	DC-10MHz	N/A	See Note*	$ 695
20Hz-2MHz	3202	X	X	X	X	5	24/48	100uV	80	3v/10ma	DC-10MHz	N/A	See Note*	$1295

*Rack Model (19" panel) add $50. Add suffix 'R' to Model No.

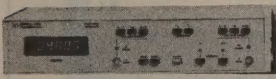
Narrow Band Tracking Filter

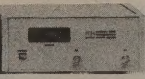

Model 3800

Frequency Range	Model	Bandwidths	Peak Output Volts/mA	Max. Attenuation	Output* Noise (RMS)	Tuning Modes	Rack Mounting Kit—$50	Base Price
1Hz-100kHz	3800	.001Hz, .01Hz, .1Hz, 1Hz, 10Hz, 100Hz, 1kHz, EXT	10V/5mA	40dB	100uV	REF, REF TRAK, DIAL, SIG TRAK	RK-319	$2200

*Referred to input

Digital Phasemeters

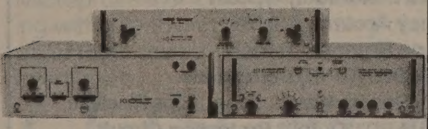

Model 6500


Model 6200A

Model	Phase Accuracy	Frequency Range	Resolution	Input Waveforms	Input Voltage Range	Display Range	Rack Mounting Kit—$50	Base Price*
6500	.05°	3Hz-5MHz	.01°	∿ ⎍ ∿ ⎍	.01V-120V RMS	0° to 360°	RK-319	$2595
6400	0.1°	3Hz-5MHz	0.1°	∿ ⎍ ∿ ⎍	.01V-120V RMS	0° to 360°	RK-319	$1995
6200A	0.5°	10Hz-1MHz	0.1°	∿ ⎍	0.1V-120V RMS	−180° to +180°	RK-38	$ 895

*Option 001, BCD Ouptut: $225.

Wideband Amplifiers


Model 7500 Model MT-56R Model DCA-10

Frequency Range	Model	Output Power (watts)	Dist. %	Freq. Resp. dB	Input Volts (RMS)	Max. Voltage Gain	Matched Load (Ohms)	Max. Output Volts (RMS)	Max. Output Current	Rack Mounting Kit—$50	Base Price
DC-1MHz	DCA-10	10	0.1	±1.0	10	10	600-1000	105	130ma	See Note*	$1595
DC-1MHz	7500	75	0.1	±0.1	1.25	100	200	125	625ma	RK-519	$1795
30Hz-1MHz	MT-56R	75	—	—	125	—	2-1000	100	6.5A	N/A	$ 550

*Rack Model (19" panel) add $50. Add suffix 'R' to Model No.

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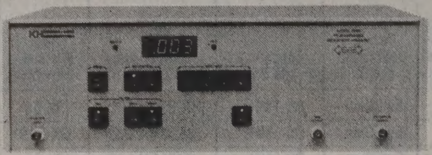
GPIB Programmable Instruments from KROHN-HITE

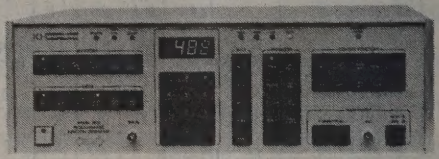
Programmable Distortion Analyzer



Model 6880

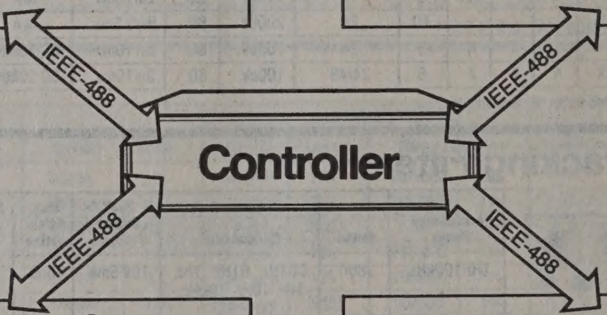
- **Frequency Range:** 10Hz to 110kHz
- **Totally Automatic Distortion Measurements:** Completely Eliminates Frequency and Amplitude Adjustments
- **Measures Total Harmonic Distortion down to .003%/-90dB**
- **Measures AC Voltage and % Deviation from 0.1 Volts to 130 Volts RMS**
- **Measures Frequency from 1.000Hz to 999kHz**
- **IEEE-488 Bus (GPIB) Compatible**
- **$3,500**

Programmable Function Generator

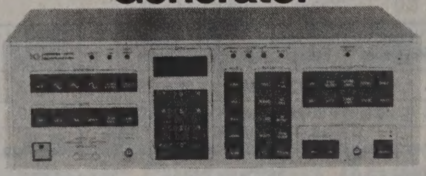


Model 5900

- **Frequency Range:** .0001Hz to 5MHz
- **Sine, Square, Triangle, Pulse and Sawtooth Waveforms**
- **Unique, Self-Contained AUTO-PROGRAMMER**
- **IEEE-488 Bus (GPIB) Compatible**
- **Internal, Information Storage Registers**
- **Computerized Self-Test**
- **Continuous, Gate, Trigger, Burst and Digital Lin/Log Sweep Modes**
- **$3,000**



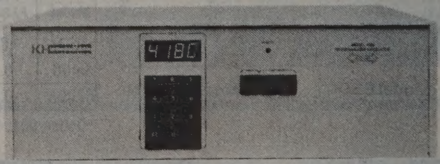
Arbitrary/Function Generator



Model 5910

- **Frequency Range:** .0001Hz to 5MHz
- **Sine, Square, Triangle, Pulse, Sawtooth, and Arbitrary Waveforms**
- **Unique, Self-Contained AUTO-PROGRAMMER**
- **IEEE-488 Bus (GPIB) Compatible**
- **Define Points Directly as Voltage Levels**
- **Full Waveform Editing Capabilities**
- **Store 1024 Points in 1024 x 4000 RAM**
- **EAPROM Storage of Arbitrary Waveforms**
- **$3,500**

Programmable Oscillator



Model 4180

- **Frequency Range:** 1Hz to 1MHz
- **Harmonic Distortion:** Typically 0.01%
- **Frequency Accuracy:** 0.5%
- **Amplitude Flatness:** 0.05dB
- **IEEE-488 Bus (GPIB) Compatible**
- **Auxiliary Square Wave:** 5Vp-p, 20ns Risetime
- **WAVEGUARD™ Output Protection Circuit**
- **$3,000**

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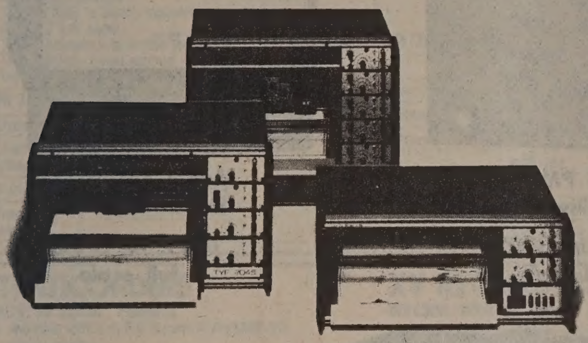
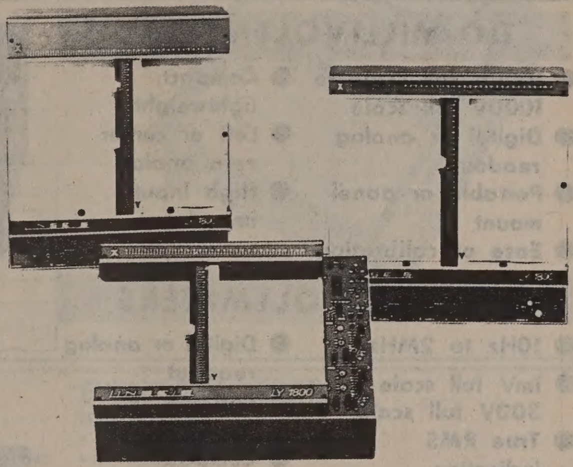
For More Information. Circle No. 236

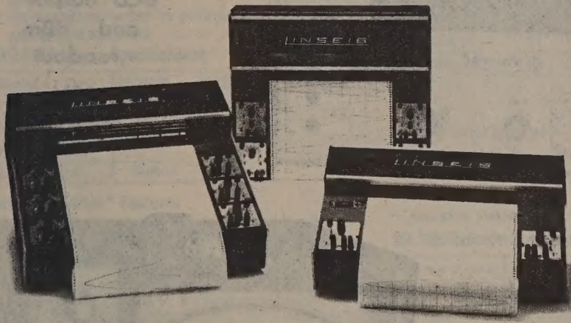
The Recorder Company Presents:



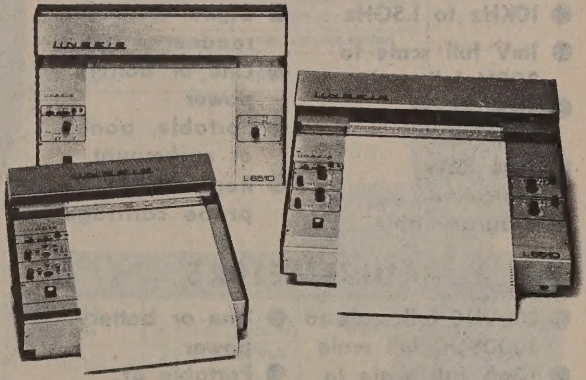
L 2005 1 – 6 Channel Rackmountable Recorders
Microprocessor-controlled data synchronization of the time delay between channels available, 42 different input modules, RS-232/IEEE 488 Interfaces optional



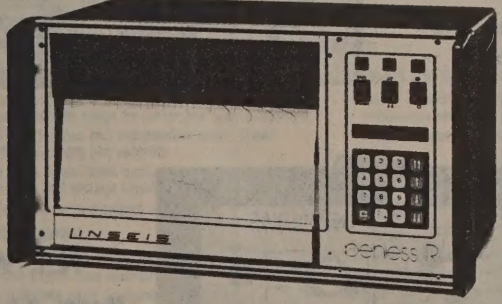
XY Recorders
Two sizes 8 ½ x 11" and 11 x 17", XY and XYY models, optional paper take-up mechanism for continuous paper feed



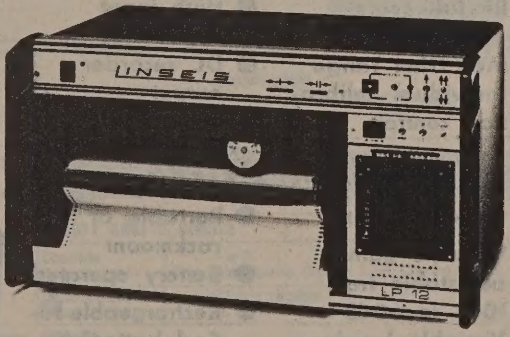
1 – 6 Channel Flat-bed Recorders
Retrofittable due to modular construction, input modules for voltage, current, resistance, and temperature measurements



Compact Flat-bed Recorders
Our economical recorder line, 120, 200 or 250 mm chart widths, voltage and temperature inputs



Linear Array Penless Recorder
Microprocessor-controlled linear array print head, printing without moving parts, 4 analog channels, automatic parameter documentation on chart, no dead band, no overshoot



12 Channel Multiplexing Point-printing Recorder
12 independently programmable input channels, voltage, current, and temperature measurements

LINSEIS
The Recorder Company
"Call Toll Free: 1-800-RECORDER"

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For More Information. Circle No. 237

HIGHLY SENSITIVE
DC AC RF
TEST EQUIPMENT

MILLIVAC INSTRUMENTS

QUALITY, PRECISION AND PERFORMANCE AT COMPETITIVE PRICES

DC MILLIVOLTMETERS

- 100μV full scale to 1000V full scale
- Digital or analog readout
- Portable or panel mount
- Ease of calibration
- Compact, lightweight
- Left or center zero analog
- High input impedance

AC MILLIVOLTMETERS

- 10Hz to 2MHz
- 1mV full scale to 300V full scale
- True RMS indication
- Ease of calibration
- Digital or analog readout
- Portable or panel mount
- Compact, lightweight

RF MILLIVOLTMETERS

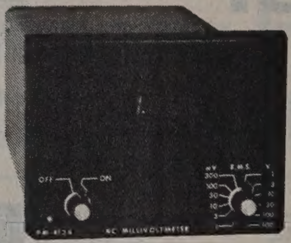
- 10KHz to 1.5GHz
- 1mV full scale to 300V full scale
- True linear response
- True RMS indication
- Programmable
- Digital or analog readout
- Line or battery power
- Portable, panel or rackmount
- Replaceable probe cartridge

MULTIMETERS

- 10μVDC full scale to 1000VDC full scale
- 10pA full scale to 1000mA full scale
- 3mVAC,RF full scale to 300VAC, RF full scale
- .1 Ohm to 5000 Meg Ohm range
- Individual calibration controls
- Line or battery power
- Portable or rackmount
- Left or center zero analog
- High input impedance
- DC recorder output

AC AMPLIFIERS

- Ultra low noise
- Variable gain, adjustable from 10dB to 60dB
- Variable bandpass limits from 5Hz to 500KHz
- Selectable 10K ohm or 10Meg ohm input impedances
- Portable or rackmount
- Battery operated
- Rechargeable Ni-Cad batteries
- BNC input and output connectors
- Detachable input dividers


OFF
ON
PM-412A
AC MILLIVOLTMETER

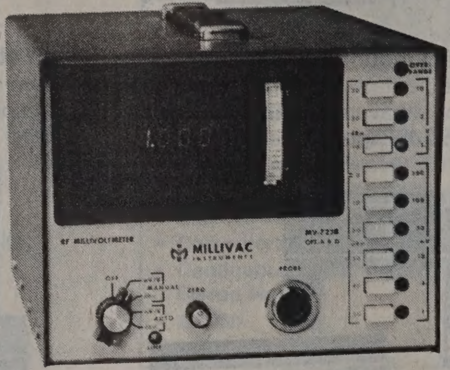
Model PM-412A
AC Millivoltmeter

1mV to 300V full scale

MILLIVAC
ZERO
OFF
VOLTS
DC MILLIVOLTMETER

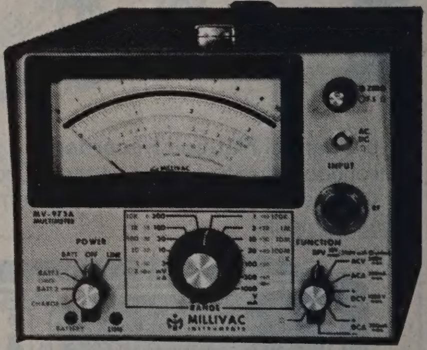
Model PM-502B-C
DC Millivoltmeter

10mV to 1000V full scale


RF MILLIVOLTMETER
MILLIVAC INSTRUMENTS
MV-723B
ZERO
PROBE
MANUAL
AUTO

Model MV-723B
RF Millivoltmeter with options: autoranging, BCD output and dBm readout

1mV to 10V full scale


MILLIVAC
MV-973A MULTIMETER
POWER
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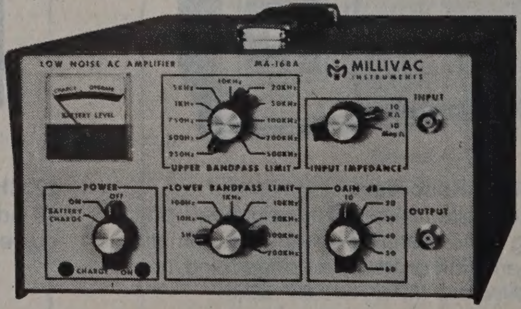
RANGE
MILLIVAC INSTRUMENTS
BATTERY
CHARGE

NEW
Model MV-973A
Multifunction Multimeter

DCV, DCA, ACV, ACA, RFV and Ohms

Battery or line operated


LOW NOISE AC AMPLIFIER
MA-168A
MILLIVAC INSTRUMENTS
BATTERY LEVEL
UPPER BANDPASS LIMIT
INPUT IMPEDANCE
INPUT
POWER
OFF
ON
BATTERY CHARGE
CHARGE
LOWER BANDPASS LIMIT
GAIN dB
OUTPUT

NEW
Model MA-168A
Ultra Low Noise AC Amplifier

The illustrations and highlights shown here are only representative of our complete line. Many additional models, options and accessories are available. Information and detailed specifications are available upon request.

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WESTERN GRAPHTEC

recorders

OSCILLOGRAPHS – WR 3101/WTR771A/781A/751

WR 3101 Features*

- Digital annotator automatically prints year, month, day, hour, minute, second, data number and chart speed from external input (ASCII or RS 232C). Time can be real time, running time, or IRIG-B.
- New stiffer pen motor for higher frequency response and better D.C. linearity.
- 19 inch rack or bench mounting.
- Roll or Z fold paper.
- 10-pin connector provided for standard remote controls: Time marker, Event marker, Chart drive ON/OFF.
- Compact and light weight.

WR 3101 Specifications

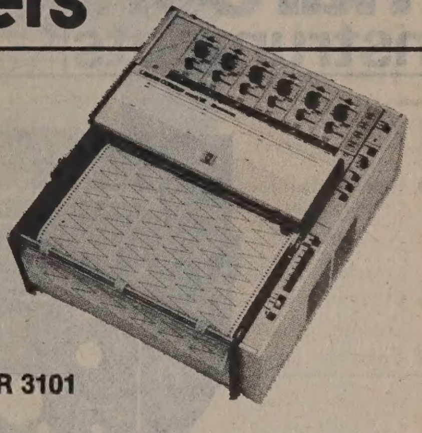
Channels	2•4•6•8•12
Chart drive speeds	5•500mm/sec. & min. and EXT
Accuracy	±0.5% of full scale
Frequency response	0~120Hz (±0.5dB)

WTR 700 Series Features

- Linear-line drawing without arc distortion.
- Inkless heat pen drawing.
- Easy replacement of recording paper.
- Superb frequency characteristics.
- Electronic switch-over of paper feed speed.

WTR 700 Series Specifications

	WTR 771A & WTR 781A
No. of elements	1
Recording width	40 mm full scale
Accuracy	±2% of full scale
	WTR 751
No. of elements	2
Recording width	40 mm full scale
Accuracy	±2% of full scale


WR 3101

MULTICORDERS

MC6700 Series* Features

- Available with 2, 4, 6 or 8 pens in standard and deluxe version.
- 20 push button selectable chart speeds and rewind feature for chart review.
- Wide range of plug-in signal conditioners.
- MC6715 has timer and event markers, remote control chart drive, pen up/down, and roll chart adaptor.
- Each channel is identified by color. Pen travels full 10" recording width.
- Pens overlap by 2.5mm. Compensation system delays signals to all but No. 1 pen so traces have common time base.
- Inside stacking system for recorded data, dust cover are standard equipment.

MC 6700 Series Specifications

Model	MC6715	MC6725
Channel	4•6•8	4•6•8
Recording Pen	Fiber Tip	
Circuit System	DC Servo	
Event Market	Built-in	Optional

MC6620 Series* Features

- Max pen speed and acceleration 1200mm/sec (3G)
- Wide range of plug-in signal conditioners
- Pens can be raised and lowered easily
- Wide range of optional functions: Roll paper feeding, Input polarity switch-over, time and event marker can be optionally incorporated
- Superb pen durability
- Remote control by external signals

MC6620 Series Specifications

Model MC-6621	
No. Channels	4, 6, 8
Recording Pen	Fiber Tip
Event Marker	Optional

XY RECORDERS

WX4300/WX4420 Series* Features

- DIN or inch rack mounts available
- Instant change-over between A3 and A4 size paper
- Suitable pen pressure selection
- Remote control options
- Wide range of plug-in signal conditioners

Basic Recorder Specifications

WX4301 and WX4302	
Effective writing area	381 x 254 mm
Circuit System	DC servo
Recording pens	Fiber-tip
Recording paper	Sheet or roll

WX 1000 Series Features

- Perfect for desk top operation
- Built-in X and Y amplifiers
- Rack mountable
- Conductive plastic feedback potentiometer

WX 1000 Recorder Specifications

Number of pens	one
Recording area	250 x 180 mm
Pen type	disposable fiber-tip
Circuit system Input circuit Input resistance	DC servo floating 1 megohm

Common mode rejection ratio	AC 120 dB (50/60 Hz)
Accuracy	±0.5% of full scale
Dead zone	within ±0.2% of full scale
Max pen speed.	500 mm/sec (both X and Y axes)

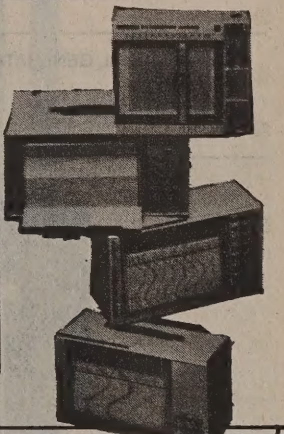
EVENT RECORDERS

EO-3413 Features

- Thermal recording response time 20 ms
- Roll recording paper
- Rack mounting available
- Suited for extended recordings
- Equipped with plastic cover

Model EO-3413 Specifications

No. Channels	30•20•10
Recording Method	Heat sensitive method
Recording Response Time	Within 20 ms



SERVOCORDER/MICROSERVO

SR6340 Features*

- High accuracy and fast response (1000 mm/sec) for wide performance range for general or specialized use.
- Model SR6342 has two independent pens; Model SR6341 is a single pen recorder.
- Z-fold chart paper loads easily, allows for convenient data review and storage capability.
- Dust proof cover is standard equipment.

SR6402 Features

- Ultra-compact True Servo recorder.
- Conforms to DIN case standards.
- Easily built into other equipment for use as a recording meter.
- Records continuously for 30 days.
- Uses disposable fiber-tip pens.
- Uses Z-fold paper for easy data processing and handling.
- Chart speed can be easily changed without motor change.
- Selection of 2 chart speeds from front panel.
- Sturdy steel case is easily panel mounted.
- Spans from 10 millivolts to 1 Volt can be selected by single resistor.

SR6411 / SR6421 Features

- Power-conserving design makes long-term continuous recording possible.
- Portability achieved through compact, light-weight design.
- Many functions to enable easy operation and a wide range of applications.
- Dust cover designed for use on site included.

SR6511 (150) Features

- Remote functions
- Start/stop of paper feed
- Output of signals synchronized with recording paper
- Recording paper feed synchronized with external signals
- Servo On/Off
- Recording signal input terminal
- Event marker
- Small, lightweight design
- Dust cover

Specifications

	SR6341 (1 pen)	SR6342 (2 pen)
Channels	1	2
Recording pens Recording paper	Fiber-tip Z-fold standard: Roll paper (optional)	
Circuit Type Accuracy	DC Servo ±0.25% of full scale	

SR6511, SR6512, SR6513

Channels Recording pen	1 or 2 Disposable fiber-tip Channel 1 red, Channel 2 black
Recording paper Circuit System	Z-fold or roll paper DC Servo

SR6402

Configuration Recording method Circuit System	Desk top or panel-mounted Disposable fiber-tip pen DC Servo

SR6411 and SR6421

Configuration Recording method Circuit System	Portable vertical face models (with handle) Disposable fiber-tip pen DC Servo

WESTERN GRAPHTEC

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Outside Calif. (800) 854-8385
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marconi instruments

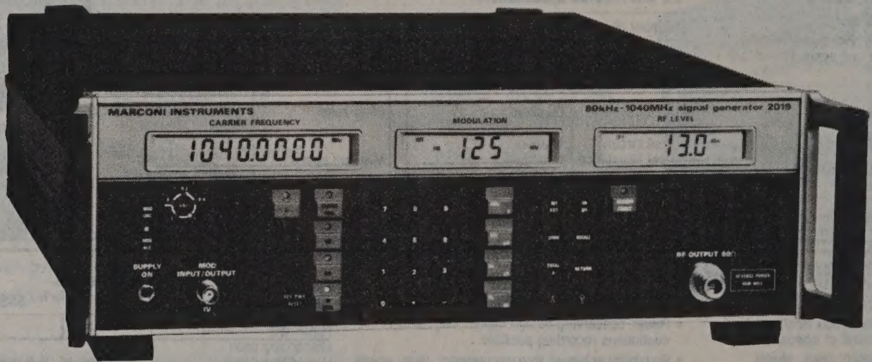
PRODUCT DIRECTORY

MARCONI INSTRUMENTS
FREQUENCY
FM DEVIATION
AM DEPTH
RF LEVEL
MODULATION OSCILLATOR
PULSE MOD
RF OUTPUT

Model 2017
Programmable Cavity-tuned Signal Generator

SIGNAL GENERATORS

FM/AM SIGNAL GENERATOR Model 2017	10kHz to 1024MHz GPIB	Spurious free, low noise, cavity-tuned signal generator with keyboard/GPIB entry of all functions. Typical SSB noise −144 dBc/Hz, 20kHz from carrier. Output level to +19dBm, with ±1dB level accuracy down to 1μV, and integral reverse power protection. Facilities include slow analog sweep, FM/AM/Pulse, internal modulation oscillator, and GPIB counter function.
FM/AM SIGNAL GENERATOR Model 2018 Model 2019	 80kHz to 520MHz 80kHz to 1040MHz GPIB	Synthesized generators with very low close-in phase noise. Microprocessor control provides simple and rapid operation by direct keyboard or GPIB entry of all functions. Includes comprehensive frequency and amplitude modulation, ±1dB level accuracy down to 1μV and integral reverse power protection. Calibration and fault finding performed from keyboard or GPIB to dramatically cut downtime.

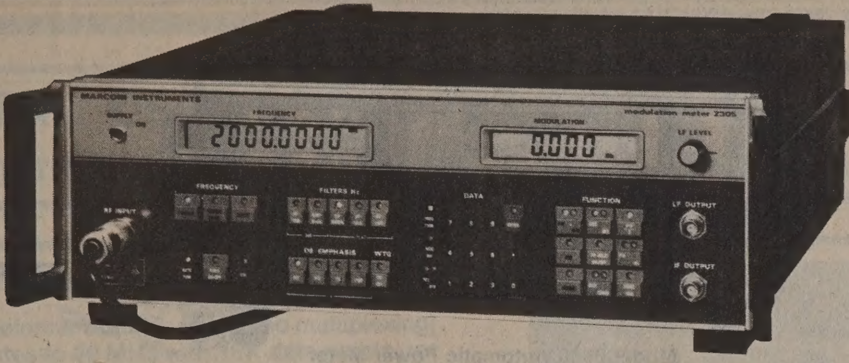

MARCONI INSTRUMENTS
CARRIER FREQUENCY
MODULATION
80kHz - 1040MHz signal generator 2019
RF LEVEL
1040.0000
- 125 -
13.0
SUPPLY ON
MOD INPUT/OUTPUT
RF OUTPUT

Model 2019 Synthesized Signal Generator – Available on GSA
Now with 4 Special Purpose Variants

SPECIAL PURPOSE VARIANTS *NEW*

EXPANDED FM BANDWIDTH Option −01	80kHz to 1040MHz GPIB	The FM bandwidth is extended down to 1Hz to improve ability to handle digital signaling information on pagers and transceivers. Stereo separation is also improved to better than 56dB at 10MHz in this version.
AVIONICS Option −02	1.5MHz to 1040MHz	Variant designed to handle VOR/ILS signals used in aircraft navigation and landing equipment. Difference in depth of modulation better than 0.045% for ILS tones.
10kHz CARRIER FREQUENCY Option −04	10kHz to 1040MHz GPIB	This generator has extended carrier frequency to cover VLF communication bands between 10kHz and 80kHz used in maritime applications.
PULSE MODULATION Option −08	80kHz to 1040MHz	A pulse modulation facility allows testing of radar R.F. and I.F. stages. Rise and fall time less than 100ns, with on/off ratio better than 65dB at 70MHz.

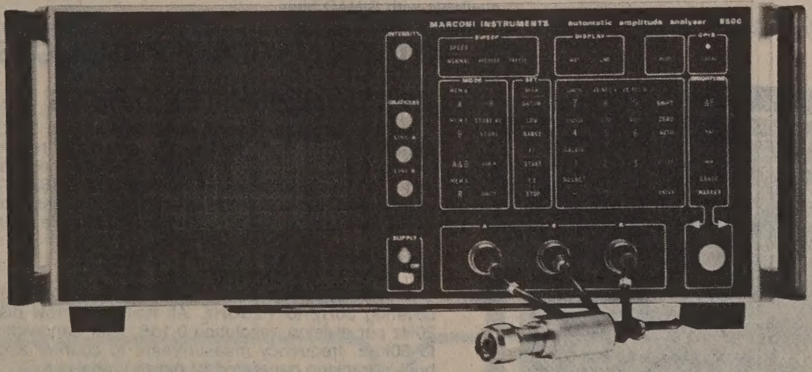
For More Information. Circle No. 240


MARCONI INSTRUMENTS
modulation meter 2305
FREQUENCY
2000.0000
MODULATION
0.000
LF LEVEL
FILTERS Hz
DATA
FUNCTION
DE-EMPHASIS
LF OUTPUT
IF OUTPUT
RF INPUT
SUPPLY

Model 2305 2GHz Modulation Meter – Available on GSA

MODULATION METERS

AM/FM MODULATION METER Model 2305 (6625-01-154-4844)	500kHz to 2GHz GPIB	Measures FM to 500kHz, AM to 99%, ϕ M to 500 radians with modulating frequencies up to 300kHz. Selectable automatic or manual tuning including display of carrier or modulation frequency. Choice of band limiting filters to optimize measurement of residual noise, S/N ratio, and frequency response. Power measured from 10mW to 1W. Design includes non-volatile memory and full GPIB programming facilities. Optional direct measurement of distortion.
AM/FM MODULATION METER Model 2304 (6625-01-033-5835)	25MHz to 1000MHz	Completely automatic tuning and level setting. Measures FM on ranges 1.5kHz to 150kHz, AM 30% and 100% for modulating frequency 50Hz to 9kHz. Accuracy 3%. Optional internal rechargeable battery.


MARCONI INSTRUMENTS
automatic amplitude analyser 6500
SWEEP
DISPLAY
GPIB
MODE
SET
SUPPLY

Model 6500 Automatic Amplitude Analyzer

MICROWAVE PRODUCTS

AUTOMATIC AMPLITUDE ANALYZER Model 6500 *NEW*	10MHz to 126GHz GPIB	Provides versatile and accurate scalar measurements with on screen graphics. Includes direct display of transmission loss/gain, return loss, VSWR and absolute power. Dynamic range of at least 66dB, 71dB with noise reduction. Designed to be used with any sweeper. All functions keyboard/GPIB controlled with comprehensive memory system.
MICROWAVE COUNTER Model 2440 *NEW*	10Hz to 20GHz GPIB	Three channel automatic frequency measurement with resolution down to 0.1Hz. Acquisition rate is a fast 200ms. High FM and AM tolerance. Compact design.
MICROWAVE POWER METER Model 6900 Series *NEW*	10MHz to 20GHz GPIB	Fast response power meters with choice of analog or digital read-out models. Include built-in calibrator and nonlinearity corrections for sensors. See power meter section for further details.

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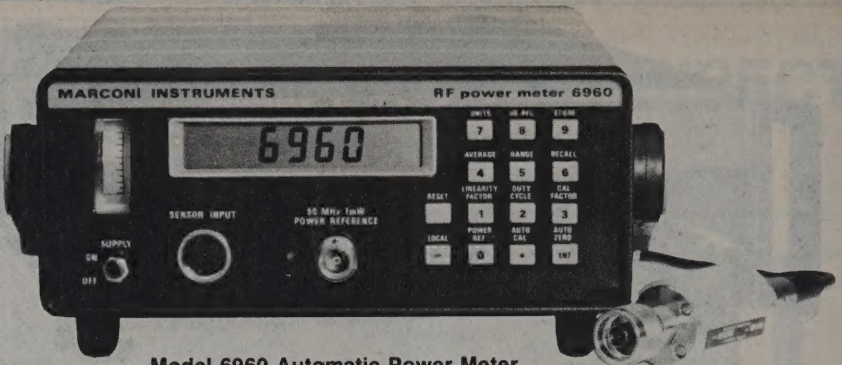
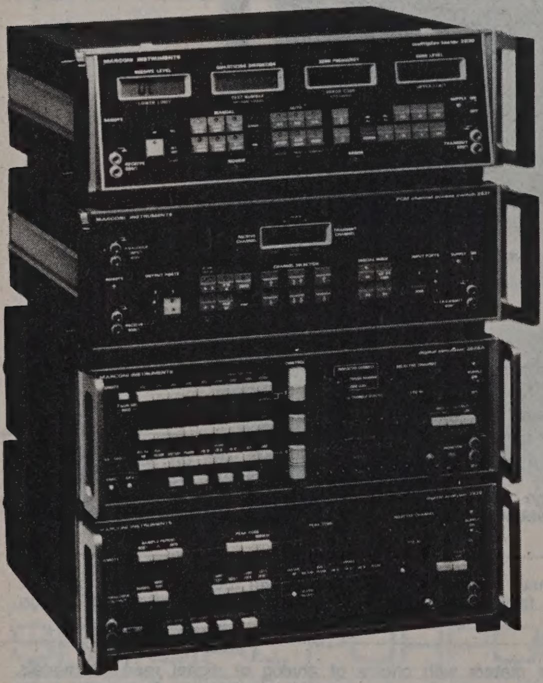


Model 6960 Automatic Power Meter

POWER METERS

AUTOMATIC RF POWER METER Model 6960 ***NEW***	10MHz to 20GHz GPIB	Microprocessor controlled, fast response Power Meter with auto-range, auto-calibration, and auto-zero facilities. Under GPIB control, measurements can be made in less than 25ms. Includes non-volatile memory, self-test capability, and corrections for duty-cycle and power meter nonlinearity. Choice of sensors to meet desired sensitivity and frequency range.
PORTABLE RF POWER METER Model 6950 ***NEW***	10MHz to 20GHz	Lightweight analog power meter designed for applications where portability is essential. Indications in dB and mW with meter accuracy of ±2%. Response time continuously adjustable from 50ms to 15s. This fast response time makes the unit ideal for power meter leveling applications using the recorder output. An optional rechargeable battery pack can be fitted internally. Sensors available to meet desired sensitivity and frequency range.
AF POWER METER Model 893B	20Hz to 35kHz	Covers power range from 300μW to 10W full scale. Impedance 2.5Ω to 20kΩ in 48 steps. Balanced or unbalanced input, calibrated in volts and dBm. Version available with SINAD filter.



PCM Multiplex Test System

OTHER MARCONI PRODUCTS INCLUDE:

WHITE NOISE TEST SETS

Noise Loading Test Sets Models 2090B and 2090C are designed to meet both manual and automatic requirements of testing FDM multichannel systems. Units meet latest CCIR and CCITT accuracy requirements (399-3 & 482-1). Both units are suitable for use with either A or B series filters. Model 2090C is programmable via GPIB with suitable interface.

SPECTRUM ANALYZERS

Choice of Spectrum Analyzers Systems 2370, 2371 and 2373 covering 30Hz to 1.25GHz. All feature narrow dispersion of 20Hz per division, resolution 0.1dB, filter bandwidth from 5Hz to 50kHz, frequency measurement to counter accuracy and built-in tracking generator for network analysis.

BROADCAST TEST SYSTEMS

Systems to analyze and display all essential television transmission parameters associated with the vertical interval test signal and timing of horizontal and vertical blanking intervals. Audio test system automatically performs 17 parameter measurements on mono and stereo sound broadcast systems in seconds.

PCM & DIGITAL TEST SETS

Instruments to measure and analyze performance parameters of digital communications links and their associated channel banks.

EDDYSTONE RECEIVERS

Communications receivers covering 10kHz through 1GHz, suitable for primary or back-up receiver requirements.

COMING SOON...

Complete the Marconi Action Card to receive details of all new products being announced in 1984, including Signal Generators, Microwave Counters, Data Test Sets, and a Mobile Radio Test Set.

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DIGITAL OSCILLOSCOPES FROM NORLAND

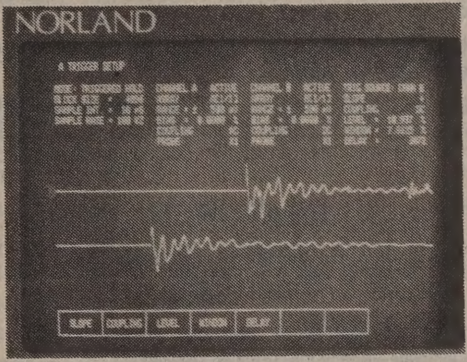
ACQUISITION, ANALYSIS, AND OUTPUT-ALL IN ONE INSTRUMENT

CAPTURE TRANSIENT AND REPETITIVE WAVEFORMS

Acquire waveforms simultaneously (no multiplexing) at sample rates to 20 MHz with 16K data points per channel (500 kHz with 128K data points per channel). Select the number of channels to meet your acquisition needs. Call us for your special frequency requirements.

PRE- AND POST-TRIGGER DELAY FOR TRANSIENTS

Pre-trigger delay allows you to view the waveform prior to the trigger event. Post-trigger delay lets you view the signal after the trigger.



Special to digital scopes, pre-trigger delay gives you the ability to view the waveform prior to the trigger event.

BUILT-IN WAVEFORM PROCESSING AND DATA ANALYSIS AT YOUR FINGERTIPS

Norland Digital Scopes provide you with a full range of built-in waveform processing and data analysis functions.

MATHEMATICAL:	addition, subtraction, multiplication, division, exponential, logarithm, square root.
TRIGONOMETRIC:	sine, cosine, tangent, and the three inverse functions.
STATISTIC:	linear fit, mean, standard deviation.
CALCULUS:	integral, derivative, peak area, loop area, total area.
WAVEFORM ANALYSIS:	RMS, peak-peak, 1/Δt, rise time, rescale, smooth, shift.

TOTAL REMOTE CONTROL

OPERATIONAL INSTRUCTIONS
WAVEFORM DATA
AUTO-PROGRAMS
REGISTER VALUES

COMPUTER ⟷ IEEE-488 / RS-232C ⟷ NORLAND DIGITAL SCOPES

AUTO-PROGRAMMING

Automate your data acquisition, data analysis, data output commands with Auto-Programming. Auto-Programming allows you to combine sequences of manual commands and store these sequences in a separate, independent program memory for recall and execution when desired.

CALL NORLAND TODAY AT (800) 558-0158 AND DISCOVER HOW NORLAND DIGITAL SCOPES CAN REDUCE YOUR TEST COSTS AND TEST TIME.

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ENERGY MONITORING INSTRUMENTS

The O.S.I. Watt-hour and Amp-hour Meters provide a convenient and highly accurate way to characterize, monitor and control critical manufacturing processes where product quality and cost are related to electrical energy output.

These solid-state units utilize low loss transducers and are especially suited for watt-hour or amp-hour totalization, power or current monitoring and observation of waveforms in applications where SCR chopped, or other non-sinusoidal waveforms are involved.

In addition to the display of totalized watt-hours or amp-hours since last reset, these units provide a panel meter indication of average watts or amps.

CATALOG 983 LISTS MANY MODELS AVAILABLE FOR ENERGY MONITORING SURVEYS ELECTRIC VEHICLES, SOLAR ELECTRIC SYSTEMS, AND COMMERCIAL BUILDING POWER APPLICATIONS.

FEATURES

0 to 10 volt output proportional to watts or amps.
Pulse output for watt *or* amp-hours.
LED METER, 6 LCD DIGIT COUNTER
±0.5% f.s. accuracy.
Convenient Rack Mount—5¼″ high.
Complete—Ready for customer installation.
For complete specifications, contact O.S.I.

OPTIONS

BCD Output
Split Transducers
Balance Control
Mechanical Counters
Instrumental Enclosure
Analog Panel Meter

A.C. WATT-HOUR METERS

***102 MODELS AVAILABLE**

SINGLE PHASE 60 Hz MODELS

MODEL	INPUT VOLTS	INPUT CURRENT AMPERES	METER FULL SCALE WATTS	W-H PER COUNT
WH30-1	120	5	600	1
WH30-2	240	5	1.2K	1
WH30-31	120	100	12K	10

D.C. AMPERE-HOUR METERS

***12 MODELS AVAILABLE**

MODEL	INPUT CURRENT AMPERES	METER FULL SCALE CURRENT	AH PER COUNT
AH70-5	5	5	.001
AH70-100	100	100	.01
AH70-1K	1K	1K	.1

D.C. WATT-HOUR METERS

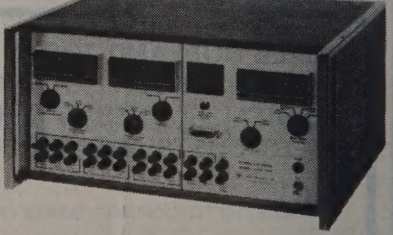
***30 MODELS AVAILABLE**

MODEL	INPUT VOLTS	INPUT CURRENT AMPERES	METER FULL SCALE WATTS	W-H PER COUNT
WH70-1	120	5	600	1
WH70-2	240	5	1.2K	1
WH70-3	480	5	2.5K	1
WH70-46	120	2000	250K	100

POWER TEST PANEL

The Model PTP-948 is a custom designed panel to operate on a single phase, 3 phase 3 wire, or 3 phase 4 wire. The display includes voltage and current on each phase, total kilowatts and an electromechanical counter to display watt-hours.

OSI will custom design equipment for a.c., d.c., and variable frequency applications. Readouts interface features are supplied as required.



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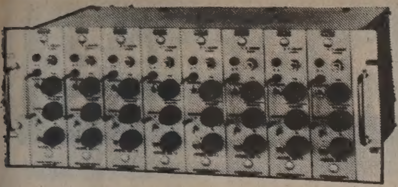

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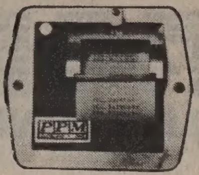


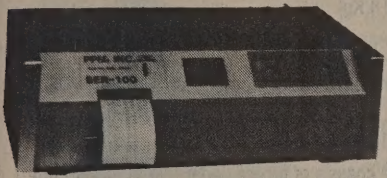
SIGNAL CONDITIONERS

PPM SIGNAL CONDITIONERS PROVIDE ULTRA-STABLE EXCITATION, BRIDGE BALANCE, AND MONITORING CIRCUITS FOR USE WITH STRAIN-GAGE AND RTD TRANSDUCERS.

MODEL SG-11 (ILLUSTRATED ABOVE, EIGHT UNITS IN ENCLOSURE) HAS AN INDIVIDUAL POWER SUPPLY PER CHANNEL FOR MAXIMUM ISOLATION (APPROACHING BATTERY OPERATION). THOUSANDS OF SG-11 UNITS ARE IN OPERATION AT N.A.S.A. AND INDUSTRIAL LABORATORIES THROUGHOUT THE WORLD.

MODEL SG-16 (NOT ILLUSTRATED) PROVIDES LOWEST-COST QUANTITY SIGNAL CONDITIONING. A 20-CHANNEL SYSTEM WITH COMMON POWER SUPPLY IS AVAILABLE AT $100/CHANNEL WITHOUT AMPLIFIERS. AMPLIFIER OPTIONS RANGE FROM $15/CHANNEL FOR 10 MA GALVO DRIVERS TO $150/CHANNEL FOR LOW-DRIFT DIFFERENTIAL AMPLIFIERS.

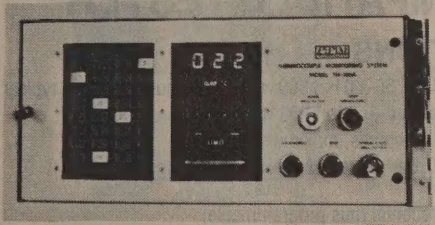
MODEL SG-11 PLUG-IN UNIT:	$249.50
MODEL SG-11-R (SOLDER-TERMINALS) ENCLOSURE:	199.00
MODEL SG-11-RC (MS-CONNECTORS) ENCLOSURE:	595.00



SEQUENTIAL EVENT RECORDERS

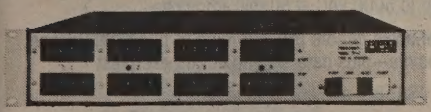
THE MODEL SER-100 SERIES OF SEQUENTIAL EVENTS RECORDERS PROVIDE A PRINTED RECORD OF THE TIME AND SEQUENCE OF INDEPENDENT ON/OFF EVENTS OCCURRING AT A NUMBER OF POINTS. THE SER-100 MAY BE SET TO RECORD EITHER THE TURN-ON TIME OR THE TURN-OFF TIME, OR BOTH, ALONG WITH THE POINT IDENTIFICATION.

MODEL SER-100 WITH 16 INPUTS:	$3,500.00
EACH ADDITIONAL 16 INPUTS:	300.00



THERMOCOUPLE MONITOR

THE MODEL TM-100A SCANS UP TO 100 THERMOCOUPLES, DISPLAYING TEMPERATURE DIGITALLY. A HIGH-LOW LIMIT CIRCUIT COMPARES THE TEMPERATURE WITH PRESET THUMBWHEEL SWITCH SETTINGS; A LAMP MATRIX DISPLAYS ALL OUT-OF-LIMIT CHANNELS. INTERFACES PROVIDE FOR PRINTOUT OR COMPUTER ENTRY OF DATA.



DIGITAL TIMERS-PROGRAMMERS

THE EP- SERIES OF DIGITAL ELECTRONIC PROGRAMMERS PROVIDE RELAY OR SOLID-STATE SWITCH OPERATION AT DIGITALLY-PRESET START AND STOP TIMES. EACH CHANNEL OPERATES INDEPENDENTLY. UNITS ARE AVAILABLE FROM 1 TO 1000 CHANNELS, WITH TIMING FROM MICROSECONDS TO HOURS.

FOR PRICING, CONSULT FACTORY OR SALES REP.

THERMAL PRINTERS

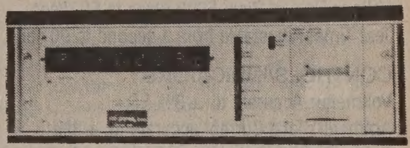
THE TP-100 SERIES IS A LINE OF SILENT ALPHA-NUMERIC THERMAL PRINTERS. QUIET, RELIABLE OPERATION, LONG LIFE, AND MODERATE COST RESULT FROM THE USE OF A SIMPLE MECHANISM WHOSE ONLY FUNCTION IS TO ADVANCE PAPER. EASE OF LOADING AND LOW MAINTENANCE MAKE THESE UNITS IDEAL FOR MEDICAL USE.

STANDARD MODELS ARE 12 (TP-112), 20 (TP-120), AND 40 (TP-140) COLUMNS. AVAILABLE TO OEM'S ARE 80 OR 120 COLUMN UNITS, AS WELL AS GRAPHIC STRIP-CHART RECORDERS WITH RESOLUTION TO 200 DOTS/INCH.

MODEL TP-112 (ILLUSTRATED) FITS INTO A PANEL CUTOUT 3 INCHES HIGH BY 3.5 INCHES WIDE. IT INCLUDES DRIVE ELECTRONICS AND REQUIRES 8-BIT PARELLEL INPUT DATA. RS-232 OPTION IS AVAILABLE.

MODEL TP-112 (AS SHOWN):	$595.00
MODEL TP-112 WITH CABINET & POWER SUPPLY:	895.00

SUBSTANTIAL DISCOUNTS ON VOLUME OEM ORDERS.

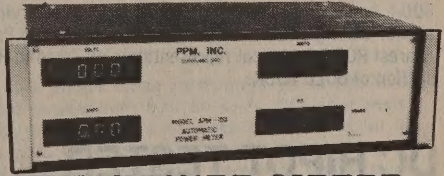


DATA LOGGERS

THE MODEL DL-3 IS A COMPLETE DATA ACQUISITION SYSTEM IN A COMPACT, PORTABLE PACKAGE. IT SCANS UP TO 256 INPUTS, DIGITIZES THEM, AND PRINTS OUT THE VALUES BY MEANS OF A BUILT-IN THERMAL PRINTER.

OPTIONS INCLUDE: FLOATING DECIMAL POINT, INTERNAL CALENDAR-CLOCK, STRAIN-GAGE OT THERMOCOUPLE CONDITIONING, COMPUTER INTERFACE, LIMIT COMPARATOR, AND ENGINEERING UNITS CONVERSION.

MODEL DL-3 WITH 16 CHANNELS:	$2,500.00
MODEL DL-3 WITH 256 CHANNELS:	5,000.00



AUTOMATIC POWER METER

THE MODEL APM-100 AUTOMATIC POWER METER DISPLAYS "TRUE RMS" VOLTS, AMPERES, KW, AND POWER FACTOR SIMULTANEOUSLY ON FOUR 3.5 DIGIT DISPLAYS. FULL-SCALE RANGES ARE: 1000 OR 199.9 VOLTS, 19.99 AMPERES, 19.99 OR 1.999 KW, AND 1.000 POWER FACTOR. RANGE-CHANGING IS AUTOMATIC. ACCURACY IS ± 0.3% OF FULL-SCALE FROM DC TO 1000 HZ.

THE MODEL APM-10 PROVIDES THE SAME READINGS AS ABOVE ON A SINGLE READOUT UNIT WITH MANUAL SWITCHING. ACCURACY IS ± 0.5% OF FULL-SCALE.

MODEL APM-100 (ILLUSTRATED):	$2,500.00
MODEL APM-10 (NOT ILLUSTRATED):	1,000.00

PROM PROGRAMMERS

PPM OFFERS A LINE OF PROM PROGRAMMERS TO PROGRAM EPROMS, BI-POLAR PROMS, AND PLA'S. THESE PROGRAMMERS ARE LOW-COST DEDICATED UNITS, EACH HANDLING A FAMILY OF SIMILAR DEVICES. OUR SPECIALTY IS OEM VOLUME CUSTOM REQUIREMENTS, BUT SINGLE UNITS ARE AVAILABLE.

MODEL EPROM 2700 (PROGRAMS 2716 SERIES):$1,000.00

For More Information. Circle No. 243

ROD-L
ELECTRONICS, INC.
1098 Hamilton Ct., Menlo Park, CA 94025 • (415) 322-0711 • Telex 296210

AC HIPOT TESTERS

SPECIFICATIONS

Input: 115/230 VAC, 50/60 Hz: 500 watt maximum
Output: Voltage 0-5000 VAC (user specified)
Voltage Rate of Rise: 5000 V/sec to 50 V/sec
Test Time: Adjustable from 1 second to 90 secs.

CONTROLS/INDICATORS

Voltmeter: Accurate to ±3% F.S.
Ammeter: Total Current accurate to ±3%
Safety Ground: Reject level .5 ohm or .1 ohm (user specified)
Dimensions: 16¾″ × 5¼″ × 13¼″ (43 × 13 × 34 cm) rack mountable
Weight: 30-35 lbs. (13.6-15.9 Kg)

FEATURES

All models can be specified with or without the adjustable "Real Current Trip Point" feature on the rear panel. "Total Current Trip Point" (Adjustable) is standard on all models. The adjustable voltage models feature rugged variable transformers with precision adjustment features for easy resetting to preselected ranges.

A full range of options is available with all models.

ROD-L can provide custom designed testers to fit virtually any hipot or similar testing situation. Call the factory in Menlo Park or contact your nearest ROD-L technical representative as listed in Representatives section of GOLD BOOK.

DC HIPOT TESTER

SPECIFICATIONS

Input: 115/230 VAC, 50/60 Hz
Output: Zero to 5.5kV @ 5 mA (Adj.)
Voltage Rate of Rise: 5000 V/sec—50 V/sec. (Adj.)
Test Time: 1-90 seconds (Adj.)
Dimensions: 16¾″ × 5¼″ × 13¼″ (43 × 13 × 34 cm)
Weight: 24 lbs. (11 Kg) net

FEATURES

Ammeter: Reads total output current
The new M100DC Hipot Tester is completely automatic and safe to use. It enables quality assurance and production test personnel to fully comply with worldwide testing standards such as: UL, BSI, VDE, IEC and others.

The M100DC performs both high voltage leakage tests and the usual hipot tests. As a special feature, the M100DC performs a one Ampere, AC ground continuity test before and during the hipot test. This continuous test ensures an established ground path between the M100DC and the device under test.

25 AMP GROUND TESTER

SPECIFICATIONS

Input: 115/230 VAC, 50-60 Hz
Output: 2.5 Volts (fixed), 25 Amps (40 Amps max available)
Voltage Risetime: Instant ON at zero crossing
Test Time: 5-7 seconds recommended, internally controlled

CONTROLS

Ammeter: Indicates actual ground current 0-30 Amps. Accurate to ±5% F.S.
Ohm Meter: 0-0.15 ohms. Accurate to ±5% F.S.
Dimensions: 16¾″ × 5¼″ × 13¼″ (43 × 13 × 34 cm). Rack mountable.
Weight: 20-23 lbs. (9.1 to 10.4 Kg)

FEATURES

Performs 25 amp ground continuity tests in compliance with BSI, VDE and similar standards

Test time is adjustable from 1 second to 90 seconds

Measures AC resistance from chassis of device under test to power-cord ground lead—zero to 0.15 ohm

Audible and visual alarms identify resistance limit exceeded

Hipot interface enables interconnecting to any ROD-L Hipot Test Instrument to form an automatic test system

IEEE-488 BUS-COMPATIBLE TESTER

SPECIFICATIONS

Input Power: 115/230 VAC, 50-60 Hz, 300 watts, maximum, 30 watts typical
Test Voltage: User specified—up to 5000 VAC
Output Current: 50 Milliamperes, maximum
Voltage Rate of Rise: Three preset rates—each can range from 1 to 30 seconds
Test Interval: 1 to 90 seconds (bus programmable)
Shutdown: Within 2 milliseconds after any test—pass or fail—without voltage-transient generation
Dimensions: 13½″ × 11″ × 16¾″ (34 cm × 26 cm × 43 cm)
Weight: 45 lbs. (20.5 Kg)

FEATURES

Performs A-C insulation breakdown and ground continuity tests

Applies a test potential up to 5000 VAC at 50 milliamperes

M488 Bus-compatible—enables remote programming of test time, voltage rate of rise, current trip points—plus data logging during each test

Complies with UL, VDE, CSA, BSI and IEC Standards

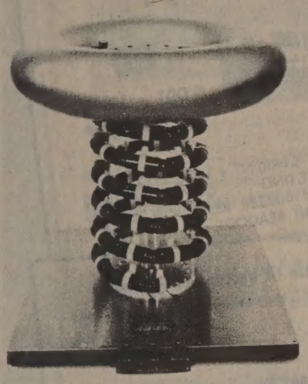
The M488 Hipot Test system is a self-contained, rugged instrument that can be operated either manually, or via a 488-bus interface. The bus feature is particulary valuable in fast, efficient testing of electronic and electrical products—hipot testing of power supplies and components such as transformers, line filters and cables.

ROD-L ELECTRONICS, INC. 1098 HAMILTON CT., MENLO PARK, CA 94024 • (415) 322-0711 • Telex 296210

Sensitive Research*

*A TRADEMARK OF EIS

HIGH VOLTAGE MEASUREMENT


PARK

High Voltage Divider

Model PARK Voltage Divider is constructed to a design by J. H. Park. (Ref: "Journal of Research" of National Bureau of Standards, Engineering and Instrumentation Vol. 66C, No. 1, Jan.—Mar., 1962. Reprints available upon request.) It is similar to the NBS standard employed in their calibration of high voltage instruments. Each 100 kv divider consists of 100 individually shielded one-megohm resistors, matched to each other to achieve an approximate temperature coefficient of less than 1 ppm/°C, and connected in series to form a vertical helix between a ground plate and a high voltage electrode. Uniquely shielded, testing indicates that corona, heating and leakage errors are less than 10 ppm at less than 10 ppm at 50 kv and 50 ppm at 100 kv.

The divider's special "hat" is designed to give uniform gradients from the high voltage electrode to ground and allows stacking of additional 100 kv units for higher voltage measurements. Each unit is only 22¼" high! DC Ratio Accuracy: ±.05%, 100 kv to 1 v; ±.5%, 100 kv to 1 kv. AC Ratio Accuracy: ±.5%, 50 kv (max.) to 500 v. (60 cps only). Recommended readout instrument at 1 v output tap is a precision DC potentiometer, at 1 kv tap (.5 kv on AC) recommended instrument is a ±.5% accurate electrostatic voltmeter (**Sensitive Research** Model ESD described below).

Special High Voltage Dividers

Based on experience with the many Park Dividers already manufactured and their proved reliability, special designs have been constructed and proposed. These special dividers are essentially the same as the Park except for such criteria as sensitivity and size. Designs up to 600 KV DC at ±1% accuracy have been constructed and successfully used by our customers. Dividers for use up to 1,000,000 volts are under consideration. Although most designs considered so far have been for single ranges, there is no particular objection to building a divider with several ranges. Present certification by NBS is limited to 100 KV but higher ranges can be calibrated by "bootstrapping" methods.

DCHI

DC Kilovoltmeter (multirange)

Model DCHI is a multirange permanent magnet moving coil, DC kilovoltmeter. Available at 50,000 ohms/v, ±1% fs accuracy, ranges of 1.5/3/7.5/15 kv or 3/7.5/15/30 kv, and at 75,000 ohms/v, ±.5% fs accuracy, ranges of 2/5/10/20 kv. The indicator is a University Model ±.5% accurate microammeter with a 4" scale length. It is self-contained in a moulded bakelite case and internally bracketed to the instrument panel. Size: 13¾" x 7½" x 8" h.

ELECTROSTATIC VOLTMETER
ESH

Electrostatic Voltmeter (high voltage)

Model ESH AC/DC electrostatic voltmeter is available as a single range instrument up to 100 kv fs (140 kv DC only), or with as many as 4 switch-controlled ranges from 5 to 50 kv fs. DC input resistances to 5 x 10^{15} ohms. Capacitance varies from approx. 30 mmfd on 5 kv range to 10 mmfd on 50-100 kv ranges. Reads true RMS. Accuracy is ±1% fs (±.5% up to 30 kv on special order). 6" scale length. Transit lock and brackets for panel mounting available. Maximum frequency usage is expressed as follows: $f \leq 2$ fCE, where f = max. allowable operating frequency, C = capacitance of instrument in farads, E = voltage in volts.

Electrostatic Voltmeter (portable)

Model ESD portable AC/DC electrostatic voltmeter is available as a single or multirange instrument to measure from 120 to 6 kv fs. Insulation resistance is 1 x 10^{15} ohms. Capacitance varies from approx. 225 mmfd for a 120 v range to 20 mmfd for a 6 kv range. Multirange instruments are designed for AC/DC measurements on first range, AC only on higher ranges. ±.5% to 1% fs accuracy (±1.5% for ranges of 150 v and less). 5.2" scale length. Size: 7¾" x 7½" x 6⁵⁄₁₆". Available as edgewise panel instrument with the same performance characteristics except insulation resistance approx. 1 x 10^{13} ohms.

ESD

Electrostatic Voltmeter (small portable)

University Model is a smaller, more economical version of the portable Model ESD. Single and multirange instruments available from 300 v to 5 kv fs. ±1% fs accuracy. 4" scale length. Moulded bakelite case. Size 5¼" x 5" x 4⅜".

ELECTRICAL INSTRUMENT SERVICE, INC. ***25G DOCK STREET, MT. VERNON, N.Y. 10550***

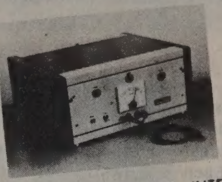
Coil & Winding Testers

WRITE FOR DATA SHEETS ON THE UNITS SHOWN. ALL ARE STANDARD PR-ff-OD-f1-UCTION ITEMS, AVAILABLE FOR EARLY DELIVERY . . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER COMPANY

P.O. BOX 1805 ARDMORE, OKLAHOMA 73402
TELEPHONE (405) 223-4773

Ground Lead Tester
checks resistance at high current



SERIES **204**

0/.25 ohms

TESTS GROUND LEAD INTEGRITY UNDER HIGH CURRENT—RESPONDS TO POOR CONNECTIONS AND FAULTY STRIPPING—MEASURES ACTUAL AC RESISTANCE—GO/NO-GO OPERATION FOR HIGH PRODUCTION.

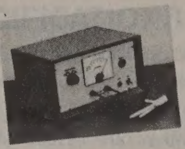
Precision Digital Ohmmeter
. . . for accurate resistance testing

SERIES **203**

0.001 — 19.99K Ohms Range

CONSTANT CURRENT 4 WIRE SYSTEM . . . SELF PROTECTING . . . GO/NO-GO LIMIT STYLE WITH BUZZER REJECTION SIGNAL . . . 3½ DIGIT READOUT.

Adjustable Limit Megohmmeter
. . . with buzzer signal on rejections

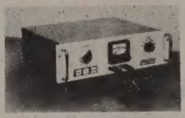


SERIES **205**

1 to 20,000 Megohms

DRIFT FREE . . . NO WARM-UP . . . RUGGED TAUT BAND MOVEMENT . . . ADJUSTABLE REJECTION LIMIT WITH BUZZER SIGNAL.

Resistance Deviation Bridge
. . . for precision high speed testing

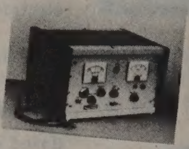


SERIES **223**

0.01/10,000 Ohms

LESS THAN 0.2 SEC. RESPONSE . . . SOLID STATE . . . SELF CALIBRATING INDICATES PERCENT DEVIATION . . . ADJUSTABLE HIGH/LOW LIMITS WITH BUZZER SIGNAL FOR GO/NO-GO TESTING.

Adjustable Hi Voltage Surge Tester
. . . tests coils and windings for shorts
. . . grounds
. . . opens

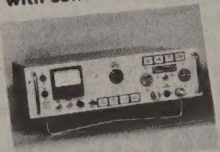


SERIES **648**

Ratings to 10,000 Volts

DIRECT READING PULSE-SURGE TESTER . . . REQUIRES NO ACTIVE MASTER . . . PRECISE ENERGY CONTROL . . . GO/NO-GO OPERATION FOR UNSKILLED PERSONNEL.

Combination Dielectric Tester
with continuity test for
ground lead
line shorts
line opens
breakdowns



SERIES **116**

SERIES 116 BREAKDOWN TEST CIRCUITRY COMBINED WITH GROUND LEAD CONTINUITY TEST SECTION AUTOMATICALLY PERFORMS GROUND LEAD AND DIELECTRIC TESTS IN SEQUENCE IDEAL FINAL TEST STATION FOR SIMPLE APPLIANCES.

Automatic Coil & Winding Test Station
micro-processor controlled . . . coils
. . . armatures
. . . stators
. . . fields

SERIES **720**

Test Rates to 1000 Parts per Hour

READY-TO-GO PACKAGE HANDLES 90% OF COIL WINDING TEST APPLICATIONS . . . QUICK CHANGE TEST FIXTURES . . . FULLY AUTOMATIC GO/NO-GO CYCLE.

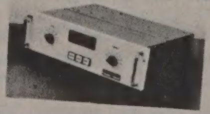
Automatic Test Equipment

WRITE FOR DETAILS ON THE EQUIPMENT SHOWN. THESE THESE ARE FULLY ENGINEERED, PROVEN, STANDARD DESIGNS AVAILABLE ON A REASONABLE DELIVERY SCHEDULE . . . LET US QUOTE ON YOUR REQUIREMENTS.

SLAUGHTER COMPANY

P.O. BOX 1805 ARDMORE, OKLAHOMA 73402
TELEPHONE (405) 223-4773

High Speed Circuit Tester
. . . for accuracy and integrity



SERIES **703**

3000 Tests per Minute

SELF PROGRAMMING FOR TESTING UP TO 500 POINTS . . . MICRO PROCESSOR CONTROLLED . . . GO/NO-GO OPERATION DIGITAL READOUT OF FAULT AND LOCATION.

Automatic Cable & Harness Tester
. . . for continuity . . . breakdowns
. . . megohms

SERIES **707**

Expandable to 500 Points

Micro-Processor Controlled

SELF PROGRAMMING WITH MAGNETIC TAPE CASSETTE STORAGE AND RECOVERY OF PROGRAMS . . . MODULAR CONSTRUCTION . . . TESTING RATES TO 3000 CIRCUITS PER MINUTE . . . GO/NO-GO OPERATION . . . DIGITAL READOUT.

Automatic Test System GPIB Configuration
Micro-computer Controlled

SERIES **727**

MOST SOPHISTICATED AVAILABLE . . STANDARD GPIB BUS . . FULLY PROGRAMMABLE COMPONENT TEST PANELS AND OTHER SYSTEM ELEMENTS . . . TURN KEY (INCLUDING SOFT WARE) OR COMPONENT ELEMENT FORM . . .

For More Information. Circle No. 246

NEW - Design To Meet Advanced Agency Requirements
High Voltage Dielectric Strength Tester

Model **306-3.0**

Variable Voltage to 3 Kilovolts AC
Variable Sensitivity to 120 Kilohm or Better

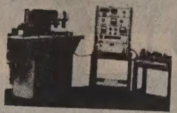
THIS ADVANCED TESTER OFFERS GREATER SENSITIVITY AND MEETS NEWLY ESTABLISHED AGENCY REQUIREMENTS. **ENGINEERED FOR MAXIMUM OPERATOR CONVENIENCE AND SAFETY.**

PROGRAMMABLE INSULATION LEAKAGE TESTERS
PROGRAMMABLE ON IEEE-488 GPIB

SERIES **727**

VOLTAGE AMPLITUDE ... VOLTAGE RATE OF RISE/FALL ... CURRENT LIMIT THRESHOLD ... REAL/TOTAL I SELECT (AC UNIT) ... DWELL TIME ... CHARGE TIME (DC UNIT)
- ARC DETECTION CIRCUITRY
- ZERO CROSSING H.V. ENABLE
- COMBINATION CABINET (EIA OR BENCH-TOP)

Time Sharing ATE Package
For High Speed Testing
Of Wound Armatures



SERIES **720 ES**

MICRO-PROCESSOR BASED CONTROL . . . FLEXIBLE TIME SHARING OF MODULAR INSTRUMENTATION EQUIPMENT BETWEEN AUTOMATED IN-LINE TEST STATION AND OFF-LINE MANUAL REPAIR TEST FIXTURE. TURN KEY PACKAGE PROVIDES A COMPLETE ELECTRICAL SCAN TESTING SCHEDULE.

SLAUGHTER COMPANY

TURN-KEY TEST SYSTEMS ARE CREATED BY COMBINING OUR STANDARD FIELD TESTED AND REFINED UNITS AS NECESSARY TO DO THE JOB AT HAND. WHEN YOU COME TO US FOR A TEST SYSTEM, YOU DO NOT HAVE TO PAY FOR ENGINEERING THE JOB FROM THE BOTTOM UP, NOR DO YOU HAVE TO LIVE THROUGH AN EXTENSIVE DEBUGGING PERIOD.

STANDARD PRACTICE IS TO SUPPLY ALL SYSTEMS IN SOLID STATE MICRO-PROCESSOR CONTROL CONFIGURATION.

Test With Confidence

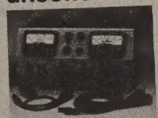
New Products for 1984

WRITE FOR DATA SHEETS ON THE INSTRUMENTS SHOWN . . . ALL ARE STANDARD PRODUCTION MODELS, AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER COMPANY

P.O. BOX 1805 ARDMORE, OKLAHOMA 73402
TELEPHONE (405) 223-4773

INSULATION LEAKAGE TESTER WITH GROUNG LEAD VERIFICATION



MODEL **303**

MEETS
120 KILOHM
REQUIREMENTS

ADJUSTABLE 3 KVAC PRESETTABLE LIMIT TO 10MA
REDUNDANT SAFETY CUT-OFF

THREE WIRE GROUNDED OR UNGROUNDED WORKPIECES ARE AUTOMATICALLY CHECKED FOR GROUND LEAD CONTINUITY THROUGH SWITCHABLE DEAD METAL RETURN LEAD AS A PREREQUISITE TO HIGH VOLTAGE INSULATION LEAKAGE TEST. MULTIPLE HIGH VOLTAGE OUTPUTS INCLUDE NEMA RECEPTACLES FOR 120 VAC AND 240 VAC PRODUCTS PLUS RECESSED HIGH VOLTAGE SOCKETS FOR UTILITY CLIP-ON LEADS.

Insulation Testers

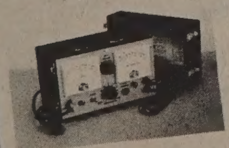
WRITE FOR DATA SHEETS ON THE INSTRUMENTS SHOWN . . . ALL ARE STANDARD PRODUCTION MODELS, AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK . . LET US QUOTE ON YOUR REQUIREMENTS FOR MODIFIED UNITS OR SPECIAL TEST EQUIPMENT.

SLAUGHTER COMPANY

P.O. BOX 1805 ARDMORE, OKLAHOMA 73402
TELEPHONE (405) 223-4773

High-voltage Leakage Tester
checks insulation for...leakage
...grounds
.....arcing

MODEL **122**



16 lb. Portable for lab and field work

VARIABLE VOLTAGE RATINGS TO 2.5 KV AC & DC. DUAL RANGE LEAKAGE METER 0/100/1000 μa . . . CAPACITY COMPENSATION . . . MEASURES INSULATION RESISTANCE, CAPACITY, POWER FACTOR.

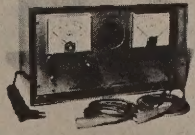
High-voltage Insulation Tester
with buzzer signal on breakdowns
...grounds
....shorts

MODEL **101**

Watch what you are doing . . . not the tester

SIX TEST VOLTAGES . . . 500 TO 2500 V.A.C. PRICED SO YOU CAN AFFORD TO SPOT A FEW ALONG YOUR ASSEMBLY LINES.

High-voltage Leakage Tester
audibly signals excess leakage
...grounds
.....arcing

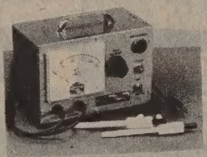


MODEL **103**

Measures Leakage . . . not capacity current

TEST VOLTAGE CONTINUOUSLY VARIABLE ADJUSTABLE LEAKAGE LIMIT . . . CAPACITY COMPENSATION ON AC TESTS . . . RATINGS TO 10,000 VOLTS AC & DC . . . LIMITED ENERGY . . . NON-DESTRUCTIVE . . . FOR LAB AND PRODUCTION LINE SERVICE.

Adjustable High-voltage Tester
with buzzer signal on breakdowns
...grounds
....shorts

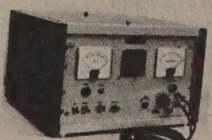


MODEL **106**

Voltmeter shows actual Test Voltage

CONTINUOUSLY VARIABLE TEST VOLTAGE RATINGS TO 10,000 VOLTS AC & DC . . . RECOMMENDED FOR BREAKDOWN TESTING AT FINAL ASSEMBLY AND INSPECTION

Automatic H-V Insulation Tester
for precision checking...breakdowns
...leakage
...grounds



MODEL **103-MP**

Automatic Test Cycle

FULLY AUTOMATIC TEST CYCLE . . . CONTROLLED RATE-OF-RISE . . . ADJUSTABLE TEST VOLTAGE, DWELL TIME, & LEAKAGE LIMIT . . . CAPACITY COMPENSATION ON AC TEST . . . FOR PRECISION TEST OF CRITICAL PARTS & ASSEMBLIES . . .

For More Information. Circle No. 246

AMERICA'S BEST PROM PROGRAMMERS

Two series of high tech instruments for EPROM/PROM/PAL/MPU programming.

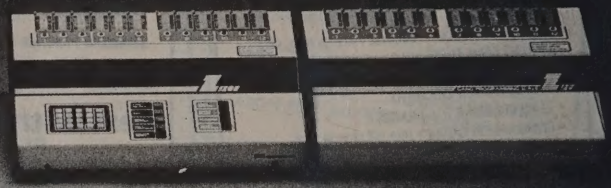
Z SERIES programming units give you two independent RS-232 ports, 16 character alphanumeric displays, up to 128K x 8 of static RAM, full RAM editors, and prompted device selection. You can slave expand our universal or gang programmers for even greater production throughput of EPROMs, EEPROMs or Intel MPUs. These smart Z80A based units even calibrate themselves to save you time and ensure the best production lot yield.

For development applications or high volume programming, you can choose units with integral dual 8 inch DS/DD disk drives and CP/M* operating system.

ZAP SERIES of EPROM/MPU programmers are portable, easy to use and nicad battery operated. These compact, superbly engineered instruments give you many of the features of larger units plus PROM simulation. Use ZAP programmers for your engineering, low volume production and field service applications.

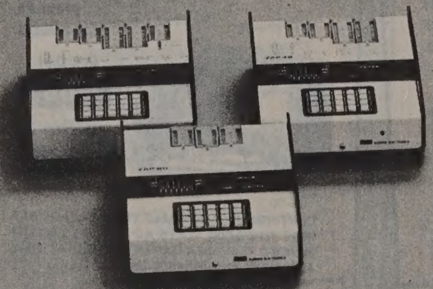
Z-2000B Disk Based Programmer

The Z-2000B universal programmer has all the features of the Z-1000B plus built-in dual 8 inch disk drives. Up to 2 megabytes of disk storage, 64K x 8 static RAM, CP/M* operating system, cross assemblers, two RS-232 ports and optional IEEE 488 interface makes this our premier programmer.



Z-1200/Z-1248 Gang Programmers

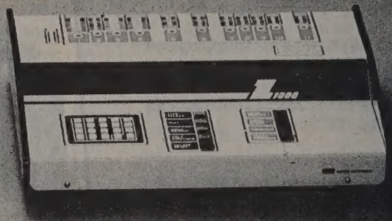
Z-1200s are designed to program 12 EPROMs/EEPROMs simultaneously in sets or all the same. You can add Z-120 gang programming slaves to multiply your throughput and you can gang program Intel's 87XX family of microcomputers with our Z-1248 programmer or Z-148 slave.



Zap Series EPROM/EEPROM/MPU Programmers

The ZAP SERIES of portable, battery operated programmers are designed for your development and field service needs.

These handy units program EPROMs and EEPROMs thru 27128, Intel and Motorola MPUs, use fast algorithms and have built-in PROM simulators. They also feature keystroke device selection, 16K x 8 DATA RAM, a sophisticated editor, 110 to 19.2K baud RS-232 ports and terminal control.



Z-1000/1000B Universal Programmers

The Z-1000 and 1000B program your EPROMs, bipolar PROMs, PALs, FPLAs and Intel microcomputers. Prompted device selection, fast algorithms and easily upgraded software let you program almost any device available now or in the future. These units are slave expandable for EPROM and MPU gang programming.

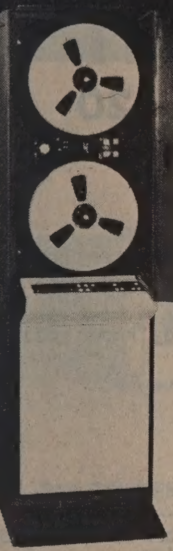
SUNRISE ELECTRONICS, INC.

524 South Vermont Avenue
Glendora, California 91740
(213) 914-1926 • TWX 910-584-3847

*Registered trademark of Digital Research, Inc.

For More Information. Circle No. 247

THORN EMI Instrumentation Recorders



SE9000 16 inch Laboratory Recorders

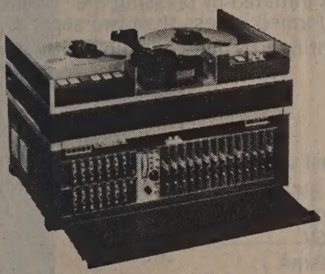
Full 42 track record/reproduce in single 6 foot rack. 7, 14, 28, 32, and 42 track, field convertible. 9 electronically switchable speeds, 15/16 -240 ips. IRIG Intermediate and Wideband; 4 MHz direct, 1 MHz FM, 40 kbpi HDDR; modular for any mix. Built-in calibrator for performance verification. Built-in tape cleaner. Optional IEEE-488 interface.

New SE9000HD High Density Digital Recording Systems

Packing density over 40 kbpi using standard headstacks and tape. Auto-ranging bit synchronization, microprocessor selection of tape speed for optimum packing density. Fully bi-directional operation, including error correction. Serial/parallel conversion, or individual synchronous or asynchronous parallel inputs. Rates to 150 Mbps.

New "Wrap Around" HDDR Conversion

Converts your present wideband direct recorder to HDDR capability. Includes encoding, auto-ranging bit synchronization, error correction, serial/parallel conversion, bidirectional operation. Capabilities to 40 kbpi with your standard IRIG headstacks.



SE7000A, C, and D Field Portable Recorders

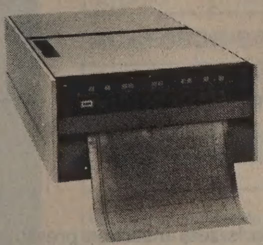
IRIG Intermediate and Wideband Group 1 recorders. 7 to 42 tracks. FM, direct, and HDDR in any mix, plus voice log. ½ and 1 inch tape, field convertible. 15/16 to 120 ips, tachometer or tape controlled. Built-in calibrator. Hand held or rack mounted remote controls. Optional 20-39 Vdc power, and IEEE-488 interface.

SE7000M Wideband

IRIG Wideband capabilities in the SE7000 chassis. 2MHz direct, 500 kHz FM, 30 kbpi HDDR. 7 or 14 track. Built-in calibrator. Optional 20-39 Vdc power, and IEEE-488 interface.

Lightweight SE3000 Series

offers heavyweight features. ¼ inch or ½ inch tape, field convertible. 4, 8, or 14 modular channels in any mix of FM, direct, or HDDR. Buy and carry only the channels you need. 8 speeds, 15/32 to 60 ips. Record up to 34 hours continuously. Built-in calibrator. Operates on 11-30 Vdc or 100-250 Vac (48-420 Hz). Optional IEEE-488 interface.



SE6300 Direct Writing UV Oscillographic Recorder

Up to 24 channels with either 8" or 12" wide paper. Frequency response to 8500 Hz. Chart speeds from 0.02 ips to 200 ips.

SE2550 Transient Recorder

4 or 8 channels with up to 32k memory per channel. Microprocessor controlled. 1MHz sampling rate with 10 bit resolution.

THORN EMI Technology Inc.

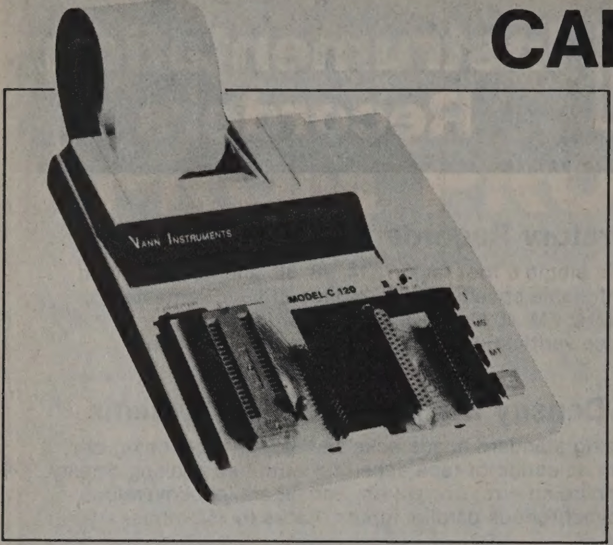
8601 Dunwoody Place, Atlanta, GA 30338 Tel: (404) 587-0017
TWX: 810-766-2267 Toll Free: 800-243-2572
A THORN EMI company

Sales Offices:

- Irvine, CA 92714
  Telephone: (714) 261-0141
- Reston, VA 22091
  Telephone: (703) 620-6056
- Sunnyvale, CA 94086
  Telephone: (408) 732-9027
- Framingham, MA 01701
  Telephone: (617) 875-5858
- Albuquerque, NM 87110
  Telephone: (505) 884-0541

International:

THORN EMI Datatech Ltd.
Spur Road, Feltham, Middlesex
TW14 OTD, England
Telephone: 01-890-1477 Telex: 23995



CABLE TESTING INSTRUMENT

Model C 120

GENERAL DESCRIPTION

- Self programming
- Adaptable to a variety of cable connectors
- Checks continuity as well as for shorts, opens and miswires
- Rapid pass/fail testing
- Point to point wire listing
- Signature analysis eliminates keeping "known good" cable on hand

FUNCTIONS AND FEATURES

- Tests cables up to 60 conductors.
- Configured to different connector styles by plugging in cable adaptor boards.
- Programmed by pressing the "Memorize Signature" key when a good cable is connected.
- Point to point hard copy wiring list can be obtained by pressing the "Module Terminations" key.
- Pass/fail test for a cable is initiated by pressing the "Check cable" key. The test is performed in less than two seconds.
- Individual conductors identified by just touching with the probe lead.

SPECIFICATIONS

Dimensions: 8 x 7.3 x 1.6″
Power: Four AA batteries or
AC wall adaptor 110V ±10%
Test Socket: Two 60 pin sockets into which cable adaptors (optional) are inserted
Probe Option: Identifies conductors plugged into socket A by touching with probe lead
Switches: Power on/off
Printer on/off
Paper feed
Memorize signature
Module terminations
Check cable
Printer: 18 characters/line max
Paper plain — 2¼″ width
Character printer — impact

Self Test: Performs self test upon powering up
Sensitivity: Short circuit < 3K ohms
Open circuit > 10K ohms
Test voltage < 6V
Test current < 2 mA
Interwire Capacitance: 10,000 pF max
Indicators: Flashing red LED indicates fail
Flashing green LED indicates pass
Operating Temperature: 32°F to 105°F (0°C to 40°C)
Storage Temperature: −40°F to 165°F (−40°C to 74°C)

CABLE ADAPTORS

PART NUMBER ORDERING SYSTEM

CA XX Y/Z

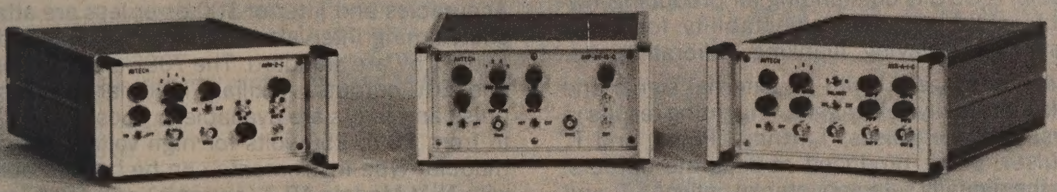
Cable Adaptor — CA
Number of positions (9 to 60) — XX
Y/Z: P — Pin (Plug)
S — Socket
R — Receptacle

CE — Card Edge .1″ center to center fingers on .062″ PCB
D — Subminiature 'D' Example: EIA RS232; RS449
DIP — Dual Inline Package 14, 16 pin row spacing is .3″; 24, 40 pin row spacing is .6″. Socket version is zero insertion pressure.
FC — Flat Cable 12″ of color coded 28AWG cable stripped and tinned. Utilized in wiring special connector types.
H — Header universal dual row .1″ center to center spacing plug has .025″ posts.
RC — Ribbon Connector Example: Telco 25 pair; Centronics type; Champ; Series 57; IEEE488; GPIB/HPIB.

Should you have any questions regarding our company or products, please contact us. Also if you require assistance in the design of a custom cable adaptor we will be very happy to work with you. When you do have a need for a cable tester it is available for immediate delivery, and we will consider it a pleasure to supply you.

VI Vann Instruments
1200 Schofield Lane, Farmington, New Mexico 87401 • (505) 326-7557

PICOSECOND-NANOSECOND PULSE GENERATORS & ACCESSORIES



PULSE GENERATORS AND PULSE DRIVERS

MODEL	V OUT (MAX)	t_r (nsec)	t_f (nsec)	PW (nsec)	PRF	PRICE (USA)	OTHER
AVN-1-C	5	0.1	0.13	0.2-1.5	50-250 MHz	$2412.00	Over 80 models available with a wide range of options including electronic control of output pulse parameters and DC powered OEM modules.
AVM-1-C	5	0.1	0.13	0.2-6.0	0-25 MHz	$2434.00	
AVM-2-C	15	0.1	0.13	0.2-2.0	0-25 MHz	$2434.00	
AVP-AV-HV3-C	40	0.15	0.25	0.2-2.0	0-1 MHz	$2236.00	
AVMR-2-C	20	0.3	0.3	20-200	0-5 MHz	$1706.00	
AVK-AV-C	15	0.1	2.0	1-50	0-50 KHz	$1646.00	
AVI-V-C	50	0.3	2.0	2-100	0-20 KHz	$1614.00	
AVI-V-HV3-C	100	0.2	2.0	2-100	0-5 KHz	$2714.00	
AVL-2-C	350	1.5	3.0	5-100	0-5 KHz	$2394.00	
AVR-1-PW-C	200	10	10	0.1-5 usec	0-1 KHz	$1851.00	
AVR-B3-C	100	3	3	0.1-10 usec	0-20 KHz	$2014.00	

LASER DIODE PULSE GENERATORS AND DRIVERS

MODEL	I OUT (AMPS)	t_r (nsec)	t_f (nsec)	PW (nsec)	PRF	PRICE (USA)	OTHER
AVO-2A-C	0-5	1	1	2-50	0-20 KHz	$1949.00	12 basic models. For lower currents use Avtech 50 ohm pulse generators.
AVO-5-C	0-28	3	4	6-100	0-5 KHz	$2775.00	
AVO-5B-C	0-48	10	10	25-500	0-1 KHz	$2280.00	
AVO-C	25-100	8	30	25	0-1 KHz	$1687.00	

IMPULSE GENERATORS

MODEL	V OUT	PW (nsec)	PRF (MHz)	PRICE (USA)
AVH-S-1-C	0-10	0.130	0-1.0	$2115.00
AVH-C	0-30	1.0	0-1.0	$1388.00
AVH-HV1-C	0-100	1.0	0-0.1	$2214.00
AVG-1-C	0-250	4.0	0-0.02	$2025.00

PULSE AND CW AMPLIFIERS

MODEL	GAIN (db)	BW (MHz)	t_r (nsec)	PRICE (USA)
AV-131	40	1-500	1.0	$410.00
AV-132	20	1-500	1.0	$310.00
AV-133	10	5-1000	0.5	$410.00

ACCESSORIES

SAMPLE AND HOLD AMPLIFIERS
- 0.2-4.0 nsec aperture
- Unity gain

DELAY GENERATORS
- Delays to 100 nsec and to 100 usec
- 3 models

TRANSFORMERS
- Rise times as low as 60 psec
- Inverting & matching types

POWER SPLITTERS
- Inverting & non-inverting
- 100 psec rise times

BIAS INSERTION UNIT
- For CW and baseband pulses
- PW from 0.2 to 100 nsec

SCOPE PROBES
- 5 GHz bandwidth
- 100 psec rise time

Over 100 all solid state models for optical communications, laser, GHz logic, radar, SAW, ATE, TDR, nuclear and other OEM and lab applications are listed in our free 60 page catalog. Call, TELEX or write today for your copy. For your special requirements, we excel at fast turn around special orders at near stock item prices.

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Japan: MEISHO ELECTRONICS Tokyo (03) 816 6581 2

BNC Digital Delay Generators

Digital Delay Generators provide accurate, repeatable control of time. DDGs are a precision source of stable intervals, pulses and gates. They're easy to manually set up and operate, as well as BCD and IEEE-488 GPIB programmable. A DDG is outstanding for producing low-jitter outputs with precision selectability for exact triggering, sync'ing, delaying, blanking, calibrating, etc.

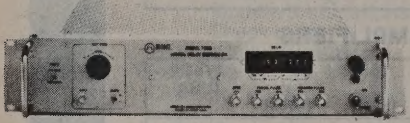
All DDGs can be triggered with an external signal and some can also internally self-trigger. Triggering results in a pair of fast risetime pulses, T_0 (Initial Pulse) and T_1 (Delayed Pulse), being produced at separate outputs. The delay is the digitally selected interval between T_0 and T_1. By adding the insertion delay, T_1 can be timed from the external trigger event. An independent Gate output also provides a third pulse equal in width to the delay time. With Model 7085, both T_1's delay and its width are digitally variable. The 7010 optionally offers counted burst outputs.

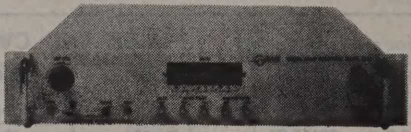
Accuracies and jitter of 100 ps or less are attainable for short timing intervals. Output pulse amplitudes of +5V and −1.5V are standard. The 7085 also has complement and ECL outputs. Auxiliary modular-type fast risetime pulse amplifiers are available to boost T_0 and T_1 outputs to from 20 to 250 volts for high voltage triggering. The modular-type instruments can be housed and powered with NIM Models AP-3 (portable) and TB-4 (rack) power supplies. Key DDG specifications are listed below.

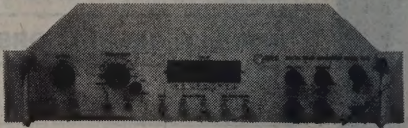
MODEL	Time Increments	Basic Time Range	Optional Time Range	Insertion Delay	Indeterminacy	Basic Jitter (RMS)	Trigger Rate	Input Sens'ty	Oper. Modes	Power	Base Price (USA)
7030A	1 ns	0-100 µs	—	80 ns	None	50 ps	0-10 MHz	250mV	D,G	±6, ±12, -24V	$3295
7065	1 ns	0-1 ms	0-1s[1]	85 ns	None	50 ps	0-5 MHz	200mV	D,G	115/230 VAC	$4460
7075	1 ns	0-1 ms	0-1s[1]	85 ns	None	50 ps	0-5 MHz	200mV	D,G	115/230 VAC	$5100
7085	1 ns	0-100 ms[2]	—	150 ns	None	50 ps	0-5 MHz	200mV	D/W	115/230 VAC	$6735
7050	10 ns	0-10 ms	0-1s[1]	55 ns	±5 ns	100 ps	0-5 MHz	200mV	D,G,P	±6V	$2300
7055	10 ns	0-10 ms	0-1s[1]	55ns	±5 ns	100 ps	0-5 MHz	200mV	D,G,P	115/230 VAC	$2920
7020	100 ns	0-10 ms	0-10s[1]	110 ns	±50 ns	100 ps	0-1 MHz	100mV	D,G	±6, ±12 V	$1555
7010	100ns to 1ms	0-10 ms to 0-100s[3]	—	120 ns	±50 ns	500 ps	0-1 MHz	2V	D,G,P E,B[4]	115/230 VAC	$1105

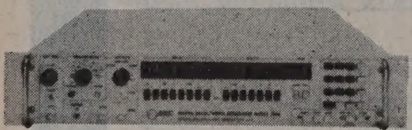
Operating Modes: D — Delay; G — Gate, D/W — Delay/Width, P — Period, E — Events, B — Burst.

Notes: [1]With Option A. [2]Width of Delayed Pulse also digitally variable in 1 ns increments from 5 ns to 10 ms. [3]Selectable in 5 decade steps. [4]With Option B.

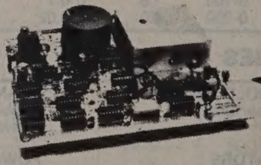

MODEL 7055


MODEL 7065

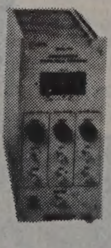

MODEL 7075

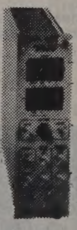

MODEL 7085

MODEL 7010


MODEL C-1000

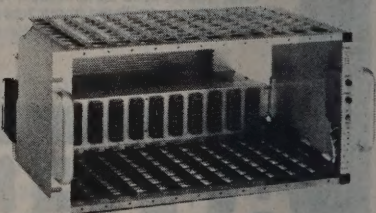
◄ Unique trigger-sync'd frequency source you can **randomly** trigger to 25 MHz, yet its output always coherently locks to the latest trigger with only 100 ps phase error! Fixed clock outputs from 75 to 150 MHz are available.


MODEL 7030A


MODEL 7020

MODEL 7050

AP-3 POWER SUPPLY


TB-4 POWER SUPPLY

For detailed data sheets phone (415) 527-1121 or write:

BERKELEY NUCLEONICS CORPORATION
1198 Tenth St., Berkeley, California 94710

ELECTRONIC
DEVELOPMENT
CORPORATION

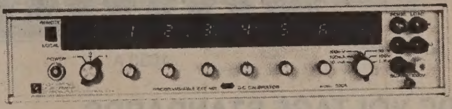
Digitally Programmable Standards AC and DC Voltage and Current

NOTICE: All instruments are traceable to the U.S. Bureau of Standards. Certification is supplied with all applicable instruments at time of delivery.
Line (mains) Power: 117 Vac and 230 Vac; from 50 Hz to 400 Hz.
All instruments are available under G.S.A. CONTRACT to authorized organizations. (Request Bulletin 4).

D.C. VOLTAGE & CURRENT STANDARD — MODEL 520 A (See Page A-3)

PROGRAMMABLE IEEE-488 GP-IB

- IEEE-488 interface is included. No extra charge.
- Floating output. Optically isolated from the logic.
- True bipolar, balanced zero.
- "Crowbar" zero reference.
- 100 Volts COMPLIANCE in the current mode.
- ±1000V range is optional.
- Complete output terminal sets on both front and rear panels. No extra charge.
- Bench or rack mountable. No extra charge.
- Weight 14 lbs., 6.35 kg.



D.C. VOLTAGE MODE					D.C. CURRENT MODE	
Model 520 A	**100 mV range**	**10 V range**	**100 V range**	**1000V range OPTION RA-5**	**10 mA range**	**100 mA range**
Output, d.c.	±100.0000 mV	±10.000 00 V	±100.000 0 V	±1000.000 V	±10.000 00 mA	±100.000 0 mA
Resolution (1 ppm)	±0.1μV	±10μV	±1μV	±1 mV	±10 nA	±100 nA
Accuracy	±0.002%	±0.002%	±0.002%	±0.002%	±0.005%	±0.005%
	Accuracies stated are of setting plus range residual, "worst case" method, valid for 12 months.					
Noise	±0.0005% of range +2μV in a band pass of 0.1 Hz to 100 kHz.					
Compliance	emf into 400Ω	100 mA	100 mA	1 mA	100 V	100 V
Price	$2,450.00 Complete			$525.00	$2,450.00 Complete	

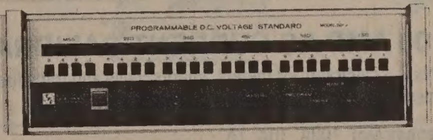
DIGITALLY PROGRAMMABLE D.C. STANDARDS, MODEL 501 J (See Page A-7)

"Building Block" Concept: Purchase only what you need.
Switching and setting time: 50μS
Program Formats: BCD or BINARY; **Entry:** Serial or Parallel or IEEE 488 (GP/IB).
Certification: NBS traceability.

	MAIN FRAME Model (501 J)	**100 mV RANGE Option: D**	**AMPLIFIER RA-3**	**AMPLIFIER RA-4**	**DC CURRENT PCS-1**	**AC & DC CURRENT PCS-2**
See Page	A-7	A-9	A-12	A-14	A-11	B-2
Output d.c.	10.0000Vdc	100.000mVdc	100 & 200Vdc	100V & 1000Vdc	10 & 100mAdc	1Ma, 10mA, 100mA, 1A, 10A ac/dc
Resolution	100μV (10 ppm)	1μV (10 ppm)	1 & 2mV (10 ppm)	1mV & 10mV	0.1 & 100mA	10nA, 100nA, 1mA, 10mA, 100mA
w/opt. B	10μV (1 ppm)	0.1μV (1 ppm)	100 & 200μV	100μV & 1mV	0.01 & 0.1μA	1nA, 10nA, 100nA, 1mA, 10mA
Accuracy	±0.002%	±0.002%	±0.01%	±0.01%	0.01%	DC: ±0.01%; AC: ±0.05%
Noise	0.0005%	0.0005%	0.0005%	0.0005%	0.0005%	0.15% to 0.00375%
Compliance	50mA	in to 400Ωload	15mA	15mA-50mA	100V	1.5V-5Vdc
Prices	$1995	$240	$1295	$1595	$1625	$1995

ACCESSORIES (May be field installed)

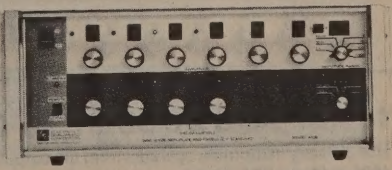
MR-1	Memory register or buffer storage
AK-1	Negative programming logic.
AM-1	Front panel display and control (for BCD).
AM-2	Front panel display and control (for BINARY).
IS-40	Opto-Isolation.
KT-488	IEEE 488 interface (Kit)



PROGRAMMABLE AC CALIBRATOR, MODEL 4500 (See Page A-14)

Completely Solid State. 60 Second warm up. Light Weight — 20 lbs. (9.1 kg)

Programming Format: BCD; **Entry:** Parallel or Serial or IEEE-488. GP/IB



6 Output Ranges	100μV to 111 Vac	**Resolution**	1 ppm
Accuracy (Amplitude)	0.04%	**Distortion**	0.1%
4 Frequency Ranges	10 Hz to 111 kHz	**Resolution**	100 ppm
Accuracy (Frequency)	0.001%	**AC Current**	See Model PCS-2 (Page B-2)
Price	$5495		

SEE FOLLOWING PAGES

ELECTRONIC
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TEL: (617) 268-9696; TLX: 951596 (ELECDEVCO BSN); CABLE: ELECDEVCO BOS

ELECTRONIC
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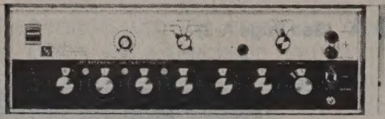
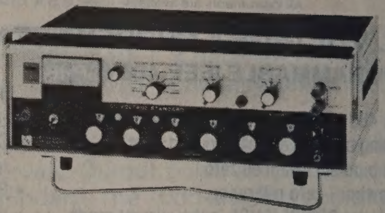
Manually Operated AC & DC Voltage and Current Standards, Sources, References, Calibrators.

NOTICE: All instruments are traceable to the U.S. Bureau of Standards. Certification is supplied with all applicable instruments at time of delivery.
Line (mains) Power: 117 Vac and 230 Vac; from 50 Hz to 400 Hz.
All instruments are available under G.S.A. CONTRACT to authorized organizations. (Request Bulletin 4).


1030 A


MV 116 J
with option G-1

DC VOLTAGE STANDARDS

Applications for Production Line QC, Field Service Calibration Laboratories. Ideal as a Reference/Source/Supply for design and development labs. Simulator for thermocouples and transducers.

MODELS	**E 100E**	**MV 106/J**	**MV 116/J**	**330J**	**1030A**
See Page	**C-2**	**C-5**	**C-5**	**D-2**	**D-3**
DC Volts (ranges)	± 11V ±100mV	± 11V ±100mV ± 10mv	± 11V ± 1V ±100mV	±311V ± 31V ± 3V ±300mV	±1111V ± 111V ± 11V ± 100mV
Resolution (1 ppm)	100µV 1µV	10µV 100nV 10nV	10µV 1µV 100nV	100µV 10µV 1µV 0.1µV	100µV 10µV 1µV 0.1µV
I out	75mA	50mA	50mA	100mA	50mA
Accuracy	±0.005% of setting	±0.002% of setting	±0.002% of setting	±0.002% of setting	±0.003% of setting
Price	$995	$1595	$1595	$2095	$2450

DIFFERENTIAL VOLTMETER (ΔVM) Option G-1 (See Page H-2) — Price $395
with RECORDER OUTPUT Option G-2 (See Page H-2) — Price $495

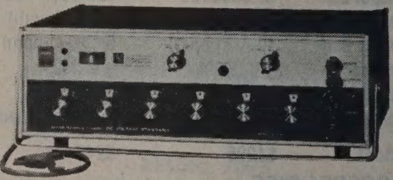
Available in Models MV 106, MV 116 and 1030. For potentiometric and differential measurements from 0.5µV to 1000 Vdc. Factory installed. **Accuracies:** from ±0.005% to ±0.002%.

BATTERY/EXTERNAL POWERED DC VOLTAGE STANDARD/SOURCE — MODEL MV 216 A

Internal, re-chargeable battery operation and 117 Vac, 12 Vdc and 24 Vdc external power. Absolute isolation from line. **(See Page C-3)**
High voltage accuracy and stability. Compliance current. Very low source impedance.

Ranges (dc)	±10V	±1V	±100mV
Resolution (1 ppm)	10µV	1µV	100NV
I out	10mA		
Accuracy	±0.003% of setting		

Zout	0.01Ω	0.001Ω	20Ω
Power	Internal re-chargeable Batteries also 117 Vac, 12V and 24 Vdc		
Price	$1975		

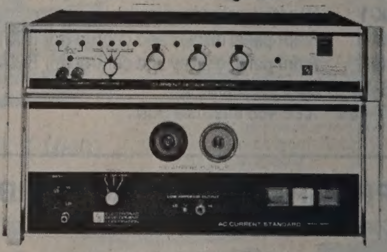


100 AMP AC CURRENT CALIBRATOR MODEL 3210

This is a calibrator for meters, shunts, coils and transducers when used in this stand-alone configuration. **(See Page E-6)**

Ranges (ac)	100A, 10A, 1A
Compliance	0.1V, 2.0V, 20V
Accuracy	± (0.05% of setting + 0.02% of range)
Price	(3210A=$2250+CDC-32=$795) CDC 32/10=$2995

Stand-alone Configuration



(For watt-hour meter configuration, see WMC-32)

10 AMP AC & DC CURRENT CALIBRATOR (Source), MODEL 3200B (See Page E-4)

This auxiliary instrument operates from the output of a stable, accurate AC or DC Voltage Calibrator, such as: EDC Model MV 116 J (for d.c.), and EDC Model 4600 or Model CDC-32 (for a.c.).

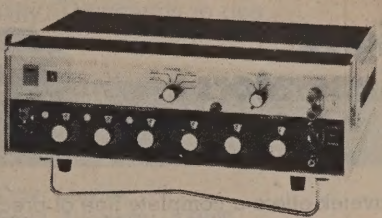
Ranges (ac & dc)	10A, 1A, 100mA, 10mA, and 1mA
Accuracy: (dc)	±(0.01% of setting+0.01% of range+10µA)
(ac)	±(0.05% of setting+0.001% of range+20µA)
Voltage Compliance	1.5V (min) to 5V (max)
Price	$1750

For More Information. Circle No. 252

DC CURRENT AND VOLTAGE STANDARD — MODEL CR 103 J (See Page E-2)

Short-circuit and open-circuit protected. 30 second warm-up. Automatic zero.

	Current Mode	Voltage Mode
DC Ranges	±110mA ± 11mA	±11V ±1V ±110mV
Resolution (1 ppm)	100nA 10nA	10μV 1μV 0.1μV
Compliance	100V	50mA
Accuracy	±0.005% of setting	±0.003% of setting
Price	$1995	

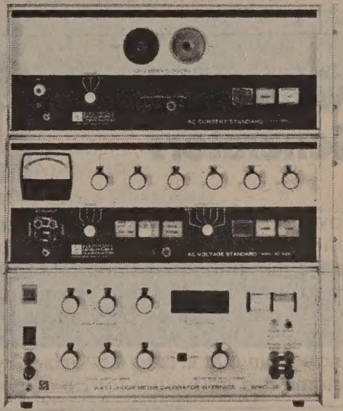


AC WATT-HOUR METER CALIBRATION SYSTEM (See Page E-6)

System WMC-32/10 and WMC-32/00

This is a completely flexible system comprised of three independently useable instruments:

Model 4600	AC Voltages up to 1000 Vac
Model WMC-32	Interface, Power-factor (Phase angle control), and time measurements.
Model 3210	100 Ampere a.c. Calibrator
Price	System WMC-32/10 $9945
	— or —
Model 3200	10 Ampere a.c. and d.c. Calibrator
Total System Accuracy	0.1%
Frequency	50 Hz to 400 Hz.
Price	System WMC-32/00 $9290



Model 3210
AC Current

Model 4600
AC Voltage

Model WMC-32 Interface
Power Factor, Time

AC VOLTAGE STANDARD — MODEL 4600 (See Page F-2)

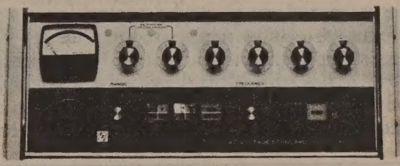
Completely solid state. Highly stable. 60 second warm-up. Low output impedance.

Vac rms Ranges	1000V, 100V, 10V, 1V, 100mV
Accuracy	±0.05%
Burden	50 VA (2A max.)
Frequency Range	50 Hz to 5 kHz

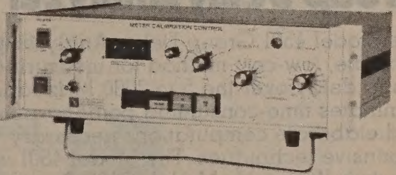
5 internal frequencies 50 Hz, 60 Hz, 400 Hz, 1 kHz plus optional frequency and unlimited number of frequencies attained by use of external oscillator via front panel terminals.

Distortion	0.5%
Weight	48 lbs.
Price	$4750

Auxiliary Instruments: **Model IC-20** Meter Increment Calibrator
Model PAS-300 Phase Shifter
Model WMC-32 Watt Hour Meter Calibrator



Model 4600

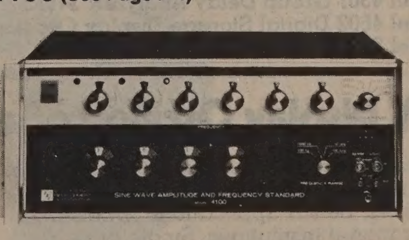


Model IC-20

SINE WAVE FREQUENCY & AMPLITUDE STANDARD Model 4100 (See Page F-4)

Completely Solid State. Light weight — 20 lbs. (9.1 kg).

6 Output Ranges	100μV to 111 Vac	**Resolution**	1 ppm
Accuracy (Amplitude)	0.04%	**Distortion**	<0.1%
4 Frequency Ranges	10 Hz to 111 kHz	**Resolution**	100 ppm
Accuracy (Frequency)	0.001%		
Price	$4350		



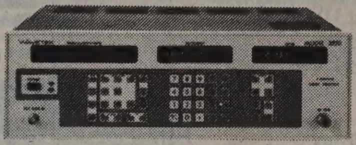
ELECTRONIC
DEVELOPMENT
CORPORATION

11 Hamlin Street, Boston, Mass. 02127-4198, U.S.A.
TEL: (617) 268-9696; TLX: 951596 (ELECDEVCO BSN); CABLE: ELECDEVCO BOS

WAVETEK

P.O. Box 190, Beech Grove, IN 46107. Phone (317) 788-5960

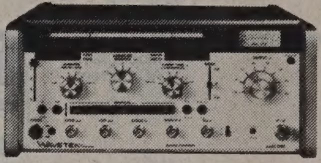
Signal Generators



Wavetek offers a complete line of precision, synthesized signal generators. Models 3510 and 3520 are microprocessor-based, fully GPIB programmable 1 GHz and 2 GHz instruments. Nine other signal generator models, plus a long list of options and accessories, allow you to select an instrument that will meet your exact needs.

Frequency Range	Model	Price ($)	RF Output Range	Frequency Accuracy	Resolution	Mod. Modes	Frequency Programmability
1-520 MHz	3000	$3795	+ 13 to −137 dBm	±0.001% (Typical: 0.0002%)	1 kHz	AM, FM	BCD standard. GPIB optional.
	3000-200	5385					
	3001	4545					
1 kHz-520 MHz	3002	5495					
1-520 MHz	3003	5495			100 Hz	AM, FM Also sim. AM/FM	
1 kHz-520 MHz	3004	5495					
1-520 MHz	3005	5495					
1 kHz-520 MHz	3006	5495					
1-1000 MHz	3010	5495					
1-1040 MHz	3510	6195					GPIB standard.
1-2080 MHz	3520	7995	+10 to −137 dBm				

Sweep/Signal Generators



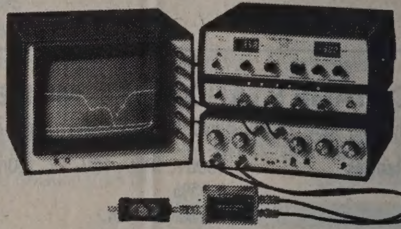
Wavetek's complete line of precision, sweep/signal generators allows you to meet your sweep requirements with a minimum investment. Model 2005 is an extremely broadband 1 to 4500 MHz sweep generator that offers a level of performance previously only available in UHF sweepers. Other Wavetek models cover the frequency range from 500 kHz to 4.5 GHz. Crystal-controlled marker systems are available for all Wavetek sweepers.

Frequency Range Single Band	Model	Price ($)	Maximum Sweep Width	RF Output Range
1.0 MHz-400 MHz	1062	$1285	Full band.	+ 10 to −60 dBm
1.0 MHz-1000 MHz	1080	2995	Full band.	+ 13 to −70 dBm
1.0 MHz-1000 MHz	1081	2995	Full band.	75 ohm version
2.5 GHz-3.5 GHz	1083	3495	Full band.	+ 13 to −60 dBm
3.5 GHz-4.5 GHz	1084	3495	Full band.	+ 13 to −60 dBm
Multiband				
1 MHz-1400 MHz	2000	3475	500 MHz	+ 10 to −80 dBm
1 MHz-1400 MHz	2001	3475	500 MHz	+ 10 to −80 dBm
1 MHz-2500 MHz	2002A	5675	Full band.	+ 13 to −77 dBm
1 MHz-2500 MHz	2002B	5675	Full band.	+ 13 to −77 dBm
1 MHz-4500 MHz	2005	7775	Full band.	+ 13 to −57 dBm

Scalar Analyzer System

Wavetek's Scalar Analyzer System permits active or passive components to be tested for insertion gain or loss, as well as return loss. Our Model 1080 Sweep Generator combines with the Model 1077 Sweep Comparator, the Model 1905 X-Y Display Oscilloscope, and the FB-40-50 Return Loss Bridge to create an ideal system for testing in the 1 to 1,000 MHz range.

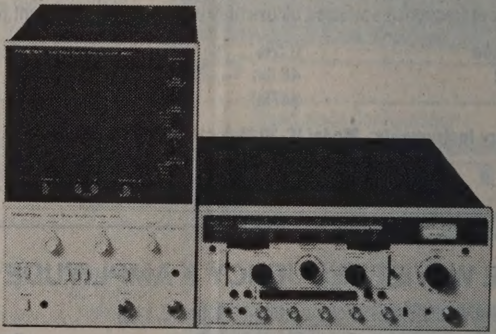
Total System: $5590



Group Delay Analyzer

The Model 4501 Group Delay Analyzer provides a fast, accurate, low-cost method for measuring variations in group delay over the 5 to 2000 MHz range. The analyzer eliminates time-consuming point-by-point measurements and elaborate computations necessary with other more expensive techniques. The Model 4501 is designed for use with Wavetek's Model 2002B Sweep Generator and Model 4602 Digital Storage Display Oscilloscope. The Model 4501 is also compatible with a variety of Wavetek's other sweep generators and display oscilloscopes.

Model 4501 Group Delay Analyzer: $4975
Model 4602 Digital Storage Display Oscilloscope: $2395
Model 2002B Sweep Generator: $5675



X-Y Display Oscilloscopes

Wavetek oscilloscopes satisfy the needs of engineering laboratories, production facilities, bench applications, OEMs and educational institutions. Single or dual-trace models are available in 12-inch or 9-inch CRTs with electromagnetic deflection. The large, bright, focused trace ensures easy viewing from several feet away.

Model	Price ($)	CRT Size
1901C	$ 925	12-inch
1903	1375	12-inch
1905	775	9-inch
1910	1295	12-inch
1951 (OEM)	745	12-inch
1955 (OEM)	645	9-inch

Wavetek also manufactures products for the CATV, TV and Two-Way Communications industries, as well as a variety of microwave components. For information, phone TOLL FREE 1-800-428-4424.

For More Information. Circle No. 253

PTS
FREQUENCY SYNTHESIZERS

HIGH-PERFORMANCE DIRECT SYNTHESIZERS

Accurate, stable, quiet frequencies on command, fast. For NMR, imaging, SATCOM, surveillance, ATE. Sources adapting to your needs with options. High demonstrated reliability. Thousands in use.

PTS 040

Range: 0.1-40MHz
Resolution: 0.1Hz-100KHz (opt.)
Switching: 5-20μs
Output: +3 to +13dBm: 50 ohm
Spurious Outputs: −75dB

Phase Noise: −75dBc, (0-15KHz)
Freq. St'd: Oven, TCXO, Ext.
Interface: BCD par. or GPIB
Size: 19"W, 5¼"H, 18"D
Price: $4,175.00*

Other Options:
Progr. Attenuator, 0-90dB
(or 0-99dB with GPIB)
nx10MHz output 20-140MHz
or any 10MHz multiple
from 20-140MHz.

PTS 160

Range: 0.1-160MHz
Resolution: 0.1Hz-100KHz (opt.)
Switching: 5-20μs
Output: +3 to +13dBm: 50 ohm
Spurious Outputs: −75dB

Phase Noise: −70dBc, (0-15KHz)
Freq. St'd: Oven, TCXO, Ext.
Interface: BCD par. or GPIB
Size: 19"W, 5¼"H, 18"D
Price: $5,400.00*

Other Options:
Progr. Attenuator, 0-90dB
(or 0-99dB with GPIB)
nx10MHz output 20-140MHz
or any 10MHz multiple
from 20-140MHz.

PTS 200

Range: 1-200MHz
Resolution: 0.1Hz-100KHz (opt.)
Switching: 5-20μs
Output: +3 to +13dBm: 50 ohm
Spurious Outputs: −70dB

Phase Noise: −70dBc, (0-15KHz)
Freq. St'd: Oven, TCXO, Ext.
Interface: BCD par. or GPIB
Size: 19"W, 5¼"H, 18"D
Price: $6,150.00*

Other Options:
Progr. Attenuator, 0-90dB
(or 0-99dB with GPIB)
nx10MHz output 20-140MHz
or any 10MHz multiple
from 20-140MHz.

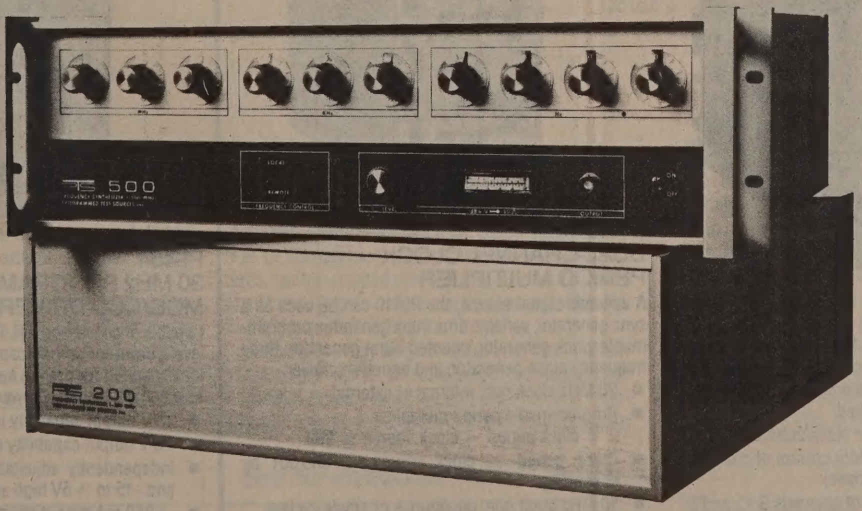
PTS 500

Range: 1-500MHz
Resolution: 0.2Hz-100KHz (opt.)
Switching: 5-20μs
Output: +3 to +13dBm: 50 ohm
Spurious Outputs: −70dB

Phase Noise: −63dBc, (0-15KHz)
Freq. St'd: Oven, TCXO, Ext.
Interface: BCD par. or GPIB
Size: 19"W, 5¼"H, 18"D
Price: $7,250.00*

Other Options:
nx10MHz output, 20-140MHz,
or any 10MHz multiple
from 20-140MHz.

*Prices are US only, manual & remote, 1Hz res. with oven std.



PROGRAMMED TEST SOURCES, INC.
Beaver Brook Rd. Littleton, MA 01460 617-486-3008

APO-61

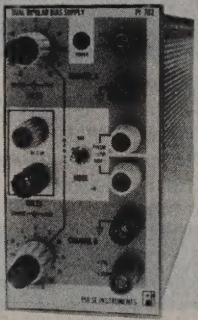
IEEE-488 BUS MODULAR INSTRUMENTS

Satisfying your automatic and manual testing needs, Pulse Instruments PI-Series consists of plug-in signal sources and power supplies that operate in the Tektronix TM-500 Series power modules. Most instruments provide digital programming options and can be connected to the IEEE-488 Bus using the Pulse Instruments' PI-952 Instrument Coupler.

Plug-in units with the digital programming option and rear input/output option 002 or 003, require the Tektronix TM-506 Power Module with option 2. In addition, the installation requires Pulse Instruments' TM-500-MOD-DP custom inter-plug-in wiring. However, these PI-Series plugs-ins will operate as standard plug-in units, without optional features, in non-modified TM-500 power modules. The PI-210 Word Generator must be driven by the PI-100A Clock Generator via Pulse Instruments' TM-500-MOD-200 custom inter-plug-in wiring that is installed in the power module.

Programmable instruments operating in properly modified TM-500 power modules can be made IEEE-488 Bus compatible by employing the Pulse Instruments' PI-952 Instrument Coupler. Each PI-952 can interface up to eight TM-506-MOD-DP power modules.

PROGRAMMABLE POWER SUPPLIES



PI-702
PROGRAMMABLE BIPOLAR DUAL BIAS SUPPLY

The PI-702 provides manual and voltage-programmable output voltage control from each of its two channels. Typical applications include the biasing of CCD devices and programming other voltage-programmable instruments.

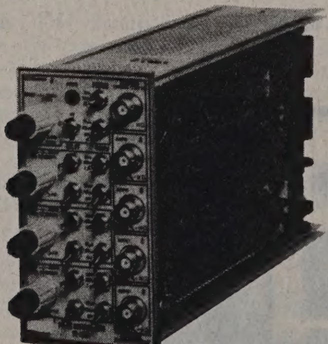
- Dual ±25 V bipolar outputs @ ±50 mA
- 0.75 ohm output resistance
- Voltage or digital programming
- Unity gain power booster
- Low ripple and noise
- Fixed +5 V @ 0.5 A supply to power TTL and CMOS devices

PI-720
IEEE-488 PROGRAMMABLE DC VOLTAGE SOURCE/DVM

A general purpose, two-channel, programmable dc voltage source with integral current and voltage measurement capability. It may be controlled manually, or by a host computer via the IEEE-488 Bus.

- Two channels: ±25 V @ ±150 mA
- IEEE-488 Bus compatible
- Current/voltage measurement: two 4½-digit LED displays
- Voltage programming resolution: 0.5 mV single channel; 12 mV dual channel
- Digital programming capability
- Autoranging in digital programming mode
- Two DVM inputs to measure external voltage

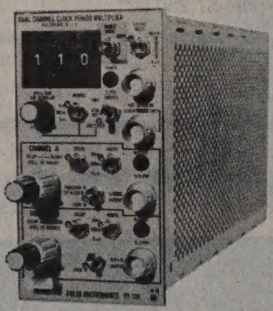
CLOCK/WORD GENERATORS



PI-100A
4-CHANNEL 50 MHz CLOCK GENERATOR

The PI-100A is well-suited for SSI/MSI device testing and characterization, four-phase clock generation, and other critical timing applications where multichannel synchronized signals are required.

- Four synchronized, 50 MHz clock outputs
- Independent delay with width control of channels B, C, and D (10 nsec to 1 msec)
- Normal to inverted output of channels B, C, and D
- External triggering or synchronous gating of Master Clock A

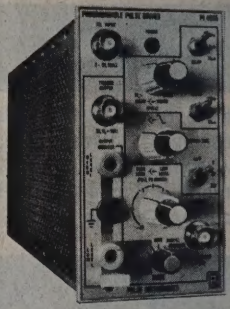


PI-110
DUAL-CHANNEL CLOCK PERIOD MULTIPLIER

A versatile signal source, the PI-110 can be used as a sync generator, variable time mark generator, programmable clock generator, counted burst generator, three frequency pulse generator, and period multiplier.

- 20 MHz clock rate, internal or external
- Programmable period multiplier: $2 < \text{clock period} \div \text{clock source} \leq 999$
- Clock period ÷ clock source = 998,001 by cascading
- 10 MHz burst rate, continuous or single cycle
- Delay and width control of multiplied outputs
- Internal crystal reference option

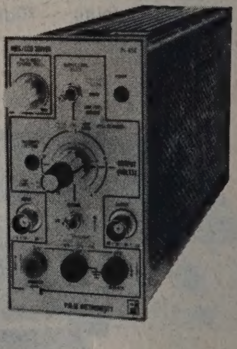
PULSE DRIVERS



PI-451A
PROGRAMMABLE PULSE DRIVER

Its compactness and versatility allow the PI-451A to be used in a variety of applications, ranging from device characterization in the research lab to automatic testing in production.

- Independently adjustable ±25 V output levels from a 50 ohm source
- 30 V maximum output swing into capacitive loads
- Normal or inverted outputs
- Variable transition times: 2nsec/V to 2 μ sec/V
- Variable output delay and width: 100 nsec to 100 μ sec
- Voltage or digital programming of output levels



PI-454
30 MHz PROGRAMMABLE MOS/CCD DRIVER

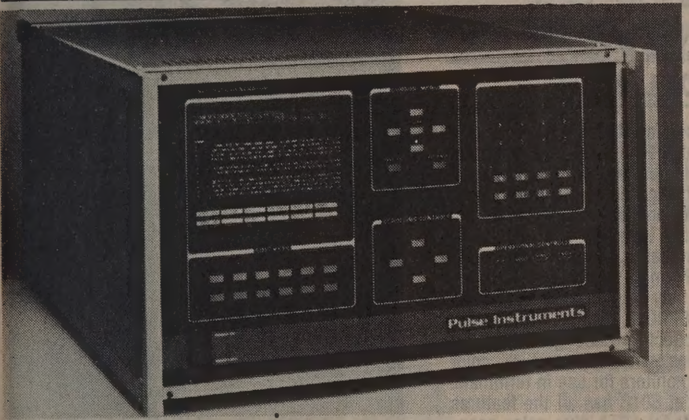
Capable of converting TTL Inputs to a high speed, high level output for driving capacitive loads, the PI-454 is ideally suited for driving second generation CCDs and as a general purpose power driver.

- 15 V output capability into 40 pf @ 30 MHz
- 7.5 V output capability into a 50 ohm load
- Independently adjustable outputs: +15 to -5 V and -15 to +5V high and low levels
- ±250 mA output short circuit currents
- Selectable output pulse polarity and width control
- Voltage or digital programming of output levels

Pulse Instruments Company • Dept. GB • 1234 Francisco St., Torrance, CA. 90502 • (213) 515-5330

For More Information. Circle No. 255

50-MHz DATA GENERATOR IS VERSATILE, PROGRAMMABLE



PI-5800 DATA GENERATOR

FEATURES:

- Easy to use — no programming skill required
- DC to 50 MHz output clock rate
- 4K bits memory per channel with 8K cascade expansion
- All channels can be RZ (return-to-zero)
- Dynamic pattern update during "RUN"
- Three-state output on one-half of all channels
- Primary and secondary looping greatly expands word depth
- Sub-patterns can be repeated up to 1,024
- IEEE-488 compatible
- RS-232C interface
- Optional non-volatile program storage (EEPROM)
- Optional 1 nsec increment programmable delay

PI-5800 DATA GENERATOR SPECIFICATIONS

OUTPUT CHARACTERISTICS[1]

Output Resistance:	50 ? ± 10%
Pulse Duration:	20ns minimum NRZ mode, 10ns mode
Fan Out:	4 TTL loads minimum for duration ≥ 20ns 2 TTL loads minimum for duration < 20ns
Skew:	3ns maximum between any 2 channels on the same 16 channel card 4ns maximum between any 2 channels within the same 64 channel unit
Rise and Fall Time:	tr ≤ 8ns tf ≤ 6ns
High Level:	3.5V minimum 15ns after rising edge has reached 1.5V 3V minimum for duration < 20ns
Low Level:	0.45V maximum for duration ≥ 20ns 0.6V maximum for duration < 20ns
High Impedance:	Disable Time:[2] .^{t} phz ≤ 16ns .^{t} plh ≤ 16ns Enable Time:[2] .^{t} pzh ≤ 23 ns .^{t} pzi ≤ ns

INPUT CHARACTERISTICS

External Clock A	TTL compatible, 2.4V, 10ns pulse width minimum required
External Clock B	TTL compatible, to be driven by cascading clock output only
External Halt	TTL compatible, 2.4V, 20ns pulse width minimum required. Positive going or negative going slope selectable by rear panel mounted switch

GENERAL

Instruction memory depth:	1000 lines
Display:	7 inch CRT. 80 characters per line
Memory:	4,096 bits per channel
Compatibility:	IEEE-488 GPIB, RS-232-C
Power PI-5800/	110 vac ± 10% 8 amps max. 47/63 Hz
PI-5810:	220 vac ± 10% 4 amps max. 47/63 Hz
Dimensions:	10.5"H x 17.5"W x 23.75"D
Weight:	49-55 lbs. net
Operating Temperature:	0°C to 50°C

With true 50-MHz operation in all modes and a memory depth of 4 kbits for each of 256 channels, the PI-5800 data generator from Pulse Instruments not only is a versatile digital signal source, but can generate extremely long patterns as well. The instrument is also easy to program.

A dozen program-controlled soft keys call a selection of menus on the unit's 7-in. CRT display. The menus cover such topics as entry and editing of patterns and instructions, output format and channel status, clock and interface setups, and output wave form displays.

Enhancing the instrument's versatility are the selective output formats, which allow the choice of RZ (return-to-zero) or NRZ (nonreturn-to-zero) operation; high-impedance or 50-Ω output; and true or complement signals. Moreover, since patterns can be updated dynamically, as much as 90% of a channel's data output can be changed while the PI-5800 is in its run mode.

Subpatterns may be generated, with each pattern consisting of a different word length, repeating itself 1 to 1024 times. Using second-level looping, subpatterns can be repeated within the main program to produce patterns exceeding 250 Tbits in length.

Up to four mainframes, each containing four 16-channel data output cards, can expand the system to a maximum of 256 channels. Other features of the instrument include output levels of 0 to 2.5 V, back-terminated by 50 Ω; an external clock input of dc to 50 MHz; IEEE-488 or RS-232-C compatibility; and optional EEPROM program storage. In addition, the instrument accepts optional 16-channel cards, whose delay is programmable in 1-ns increments.

Pulse Instruments Co., 1536 W. 25th St., San Pedro, Calif. 90732; (213) 548-1327.

See our Immediate Action Card Vol. 4

Pulse Instruments

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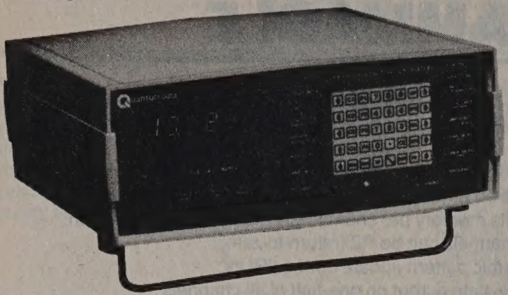
For More Information. Circle No. 255

QUANTUM DATA



COLOR CHARACTER GENERATOR

MODEL 801C

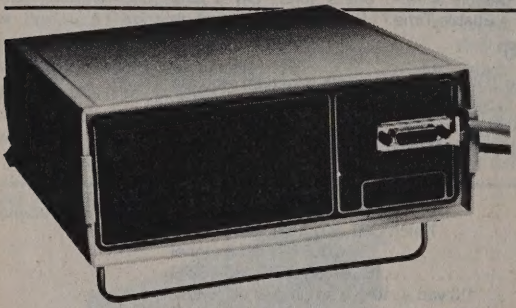
The Quantum Model 801C is a programmable RGB video test generator for use in development and manufacture of color monitors and terminals. The unit can be programmed to duplicate the video signals of a given CRT terminal or specific video application. Formats for many CRT applications may be stored in the Model 801C's EPROM, making it an excellent production test generator for companies who manufacture color display monitors for use in terminals. The Model 801C has all the features of the Model 801A plus color capabilities with sixteen selectable color patterns. These patterns allow testing for purity, convergence, gun tracking, geometry, bandwidth, focus, and brightness. Video amplifier characteristics may be accurately determined as color is switched on a dot basis.

FEATURES

- Sixteen selectable color patterns.
- Programmable dot clock range of 1.024-32.768 MHz color, 1.024-65.520 MHz monochrome.
- Internal frequency synthesizer for variable dot clocks with crystal accuracy.
- Auto-sequencing-color-pattern changes character and background colors to assure equal phosphor usage for life test applications.
- Five selectable monochrome patterns (including crosshatch).
- Lockout switch inhibits unauthorized format tampering.
- 64 character library or make your own characters.
- Up to 256 characters/row by 128 character row/frame (including blanking).
- Custom characters programmable from the keypad.
- Interlace and non-interlace modes.
- Negative video capability.
- Non-volatile CMOS memory stores and recalls four color or monochrome formats.
- EPROM storage of up to 141 user formats.
- Both video and sync timing are entirely programmable by the user.
- Automatic frequency calculation from entered parameters.
- Coded error messages to help identify invalid formats.
- Resident performance check formats.

APPLICATIONS

- Production testing of CRT displays.
- Aids in testing of newly designed CRT displays.
- Incoming inspection of OEM CRT displays.



COLOR SYSTEMS GENERATOR

MODEL 801CE

Now you can bring all of the signal generating power of our Model 801C under direct computer control.

APPLICATIONS

- Computer controlled testing of O.E.M. CRT displays.
- Automatic alignment of CRT displays.
- Mass storage and distribution of test signal formats (in the lab and on the production floor).
- Remotely control custom designed signal buffers and control panels (using the Interflex Bus™).

FEATURES (in addition to those provided by the Model 801C)

- A computer interface to the world standard IEEE-488 General Purpose Interface Bus (GPIB) instead of the 801C's front keypad.
- A computer interface to Quantum Data's Interflex Bus™. Allows the direct attachment of custom-designed devices at very low cost.
- Easy-to-use commands that allow you to program your own custom patterns.
- Thirty-four (34) additional color patterns.

NEW

THE OPIX IMAGER

The OPIX Imager is an extremely flexible test instrument for evaluating raster scanned CRT displays, video DAC's, and video signal formats.

- Full color graphics to 200 MHz dot rate.
- RS232 and IEEE-488 GPIB interfaces.
- Simultaneous video channels.
- Video distribution capabilities for an entire production line.
- Video and sync timing variable on a dot and line basis.
- All timing and color mapping user programmable.

COMPUTERIZED ADJUSTMENT TOOL

CAT 2000

The CAT 2000 allows you to adjust pots, coils and trimmers under direct computer control which interfaces easily through the IEEE-488 GPIB and has accuracy greater than .03 degrees.

APPLICATIONS

- Automating operator based electronic adjustments.
- Perfect tool for addition to adjustment robotics systems.
- Verification of trimmer range.
- Automatic calibration or adjustment.

FEATURES

- A very simple program instruction set.
- Programmable torque of 0-15 ounce inches.
- Velocities up to 5 revolutions per second under program control.
- Rack mountable.
- An increasing family of tools aimed toward the automated industry needs.

BENEFITS

- Saves time by adjusting multi-turn controls stop to stop in just seconds.
- Consistently accurate due to computer control.
- Payback is usually within 6 months.
- Precision unmatched by manual methods of the past.
- Eliminates operator error.
- Reduced operator fatigue.
- Increased product quality.
- Drastically reduces finished product reject rate by having accurate adjustment.

QUANTUM DATA

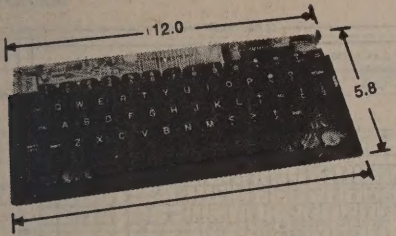
455 E. KEHOE CAROL STREAM, IL 60188 • (312) 668-3301 • TELEX 206725

For More Information. Circle No. 256

GEORGE RISK INDUSTRIES, INC.

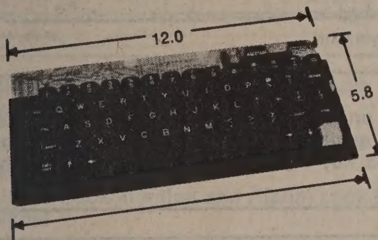
G.R.I. PLAZA / KIMBALL, NEBRASKA 69145 / TELEPHONE (308) 235-4645 / TWX 910-620-9040

KEYBOARDS



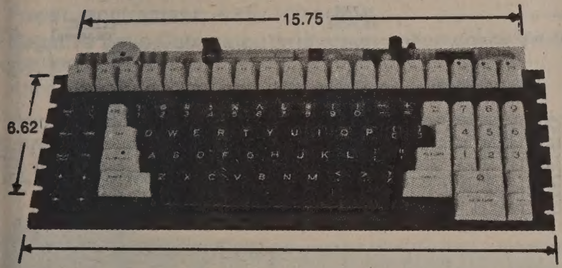
MODEL 7056

• 56 keys — full 128 character ASCII encoding • Two-key rollover • Buffered parallel output • TTL/CMOS compatible • Easy mounting provisions • Non-glare double-shot molded keycaps • Expandable for additional features.



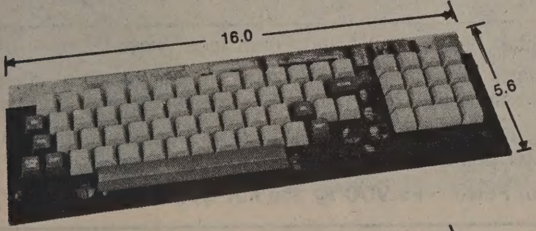
MODEL 7062

• 62 keys — same features as 7056 PLUS separate cursor control keys • User defined key with relegendable keycap or custom engraved • Auto-repeat on all keys • Four mode operating including CAPS LOCK.



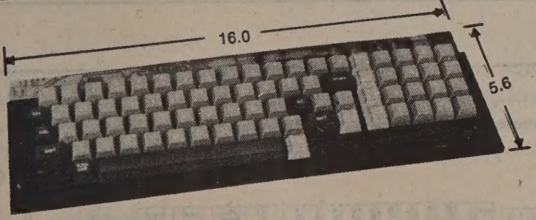
8000 SERIES

• State-of-the-art, microcomputer controlled keyboard, 95 keys, including 19 special function keys • High reliability performance • Four-wire serial interface, 300 or 1200 baud • Unique variable key rollover with phantom key lockout • High speed operation with NO input errors • Ergonomic design.



MODEL 7071

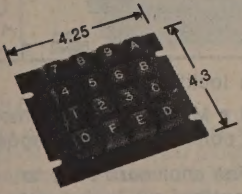
• 71 keys — full 128 character ASCII encoding • Integral 15 key numeric and cursor pad • Four mode operation including ALPHA LOCK • User selectable data and strobe signals • Buffered parallel output • Interface with APPLE II (with slight modifications) special instructions included.



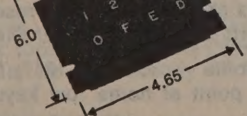
MODEL 7078

• 78 keys — identical to 7071 with the addition of 7 relegendable keycaps or custom engraved.

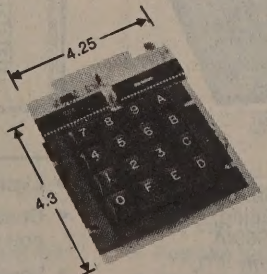
KEYPAD MODELS 10, 12 or 16 keys



• 4 bit hex encoded • Full CMOS design • Outputs compatible with LS and standard TTL logic.



• Parallel or serial RS232 output
• Custom keyboard encoder
• Full 7-bit ASCII characters.

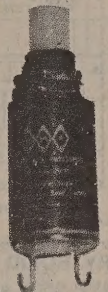


• Unencoded wiring, 1 of 16 or X-Y matrix • One side of each keyswitch is common • Design to be used with custom-supplied encoding.

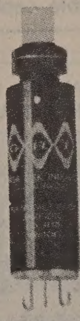
PUSHBUTTON SWITCHES

DRY CIRCUIT & LOGIC SWITCHING

"B" SWITCH
1.125 H x .420 W

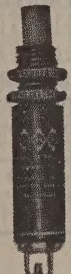


"G" SWITCH
1.745 H x .625 dia.



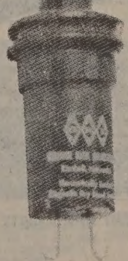
"W" SWITCH
2.525 H x .625 dia.

"KB" SERIES
1.550 H x .705 dia.



"D" SWITCH
1.470 H x .350 dia.

"R" SWITCH
.940 H x .375 dia.



"V" SWITCH
1.320 H x .590 case dia.
.675 bezel dia.

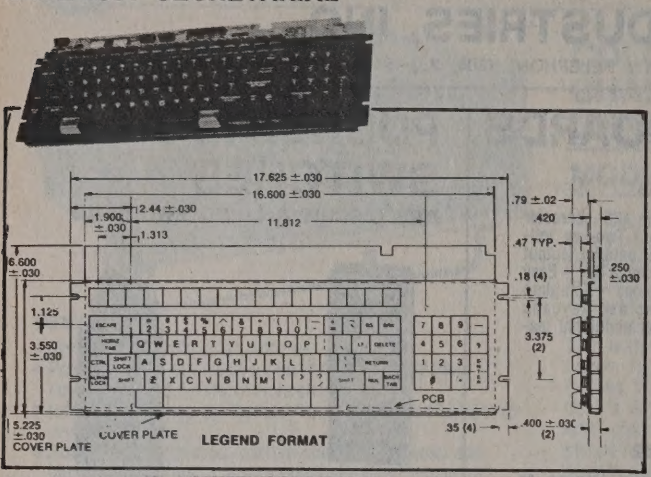
"KBLP" SERIES
1.125 x .750 sq.

SPST-NO, NC; DPST — NO, NC
Available in 4 form A or B
Illuminated and non-illuminated
Hi rel — 50 million
Mounting collars and buttons available
Mercury wetted reed switches available

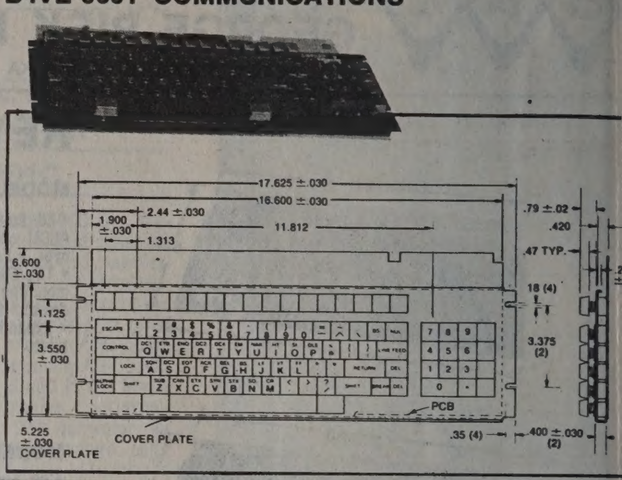
For More Information. Circle No. 257

CHERRY Keyboards

B4VE-9501 SECRETARIAL


17.625 ±.030
16.600 ±.030
12.44 ±.030
1.900 ±.030
1.313
11.812
6.600 ±.030
1.125
3.550 ±.030
5.225 ±.030 COVER PLATE
COVER PLATE
LEGEND FORMAT
PCB
.79 ±.02
.420
.47 TYP.
.18 (4)
250 ±.030
3.375 (2)
.35 (4)
.400 ±.030 (2)

B4VE-9601 COMMUNICATIONS

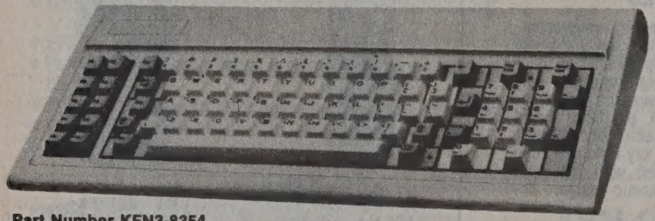

17.625 ±.030
16.600 ±.030
2.44 ±.030
1.900 ±.030
1.313
11.812
6.600 ±.030
1.125
3.550 ±.030
5.225 ±.030 COVER PLATE
COVER PLATE
PCB
.79 ±.02
.420
.47 TYP.
18 (4)
3.375 (2)
.35 (4)
.400 ±.030 (2)

CHERRY SOLID STATE KEYBOARDS

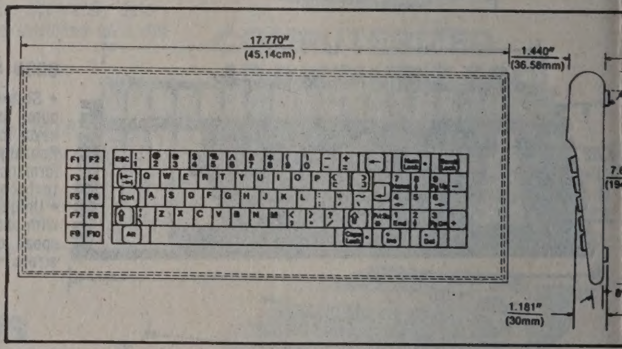
The B4VE-9501 and B4VE-9601 keyboards are comprised of 95 and 96 capacitive encoded keys respectively. Both include the full ASCII alphanumeric typing array, a right hand pad, and a top row of 17 keys with re-legendable caps. Both have two user labeled keys on either side of the space bar. The B4VE-950 has a 14 key auxiliary right hand numeric pad and the B4VE 9601 has a 15 key right hand numeric pad of which four ar user labeled.

KFN3-8354

83 KEY IBM*PERSONAL COMPUTER COMPATIBLE KEYBOARD IN A 30mm DIN ENCLOSURE



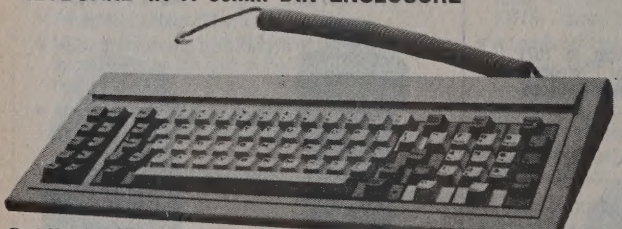
Part Number KFN3-8354
(Without housing specify **Part Number BFN3-8354**)


17.770" (45.14cm)
1.440" (36.58mm)
1.181" (30mm)

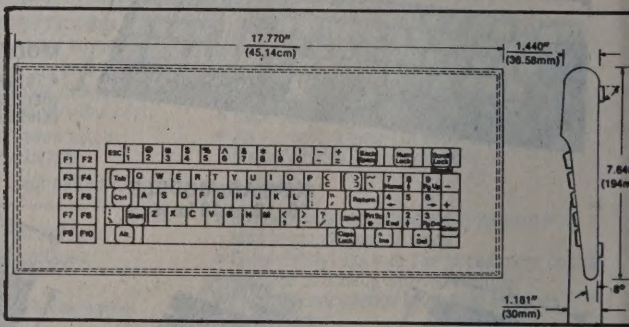
- Selectable output formats:
  1. IBM* compatible interface at 18K Baud serial output with UP/DOWN codes and special handshaking.
  2. ASCII jumpers allow conversion to serial with TTL differential output. (Baud rates 300, 1200 or 9600)
- 2-shot molded keycaps with matte finish
- Full N-key rollover
- Lighted "alpha lock" and "num lock" keys
- Chassis ground • External reset • Matching color, shielde coil cord with 5-pin circular DIN connector. • Auto-repeat
- Low profile — 30mm (1.181") from enclosure base to center point at home row keycap top
- Input Power: +5 VDC @ 250 mA typ., 360 mA max.

KFN3-8451

84 KEY IBM*PERSONAL COMPUTER COMPATIBLE KEYBOARD IN A 30mm DIN ENCLOSURE



Part Number KFN3-8451
(Wthout housing specify **Part Number BFN3-8451**)


17.770" (45.14cm)
1.440" (36.58mm)
1.181" (30mm)

- Selectable output formats
  1. IBM* compatible interface at 18K Baud serial output with UP/DOWN codes and special handshaking. differential output. (Baud rates 300, 1200 or 9600)
  2. ASCII jumpers allow conversion to serial with TTL
- 2-shot molded keycaps with matte finish
- Full N-key rollover
- Lighted "alpha lock" and "num lock" keys
- Chassis ground • External reset • Matching color, shielded coil cord with 5-pin circular DIN connector • Auto-repeat
- Low profile — 30mm (1.181") from enclosure base to center point at home row keycap top
- Input Power: +5 VDC @ 250 mA typ., 360 mA max.

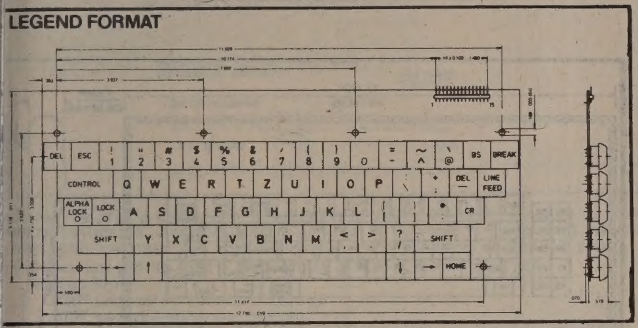
* IBM is the registered trademark of the International Business Machines Corp.

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

For More Information. Circle No. 258

CHERRY Keyboards

80-0316


LEGEND FORMAT

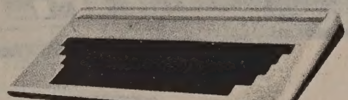
- Serial ASCII Coded • 1200 Baud • Super Low Profile
- M8 Type Key Module
- DIN Compatible • Gold wire crossbar contacts
- 65 key array • 3 Modes
- Electronic Shift/Lock function and Alpha/Lock function with LED signal
- Automatic Power On/Reset function
- Power requirement: +5V/100 mA
- Negative logic Data output with open collectors or Tri-State (optional)
- Attractive brown keycaps with contrasting legends

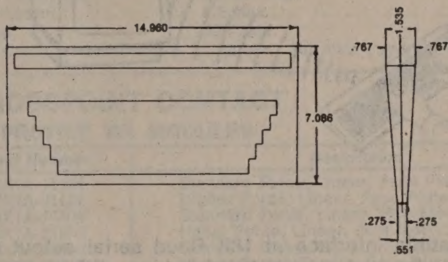
MECHANICAL SPECIFICATIONS

Rest Height Uncovered (spherical) — .426″ ±.015″ (11.68 ±0.38 mm)
Total Travel — .100 Nom. (2.54 mm)
Operating Force — 2½ oz. typical (70 grams)
Life — 20 x 10^6
Feel — Linear — positive stop

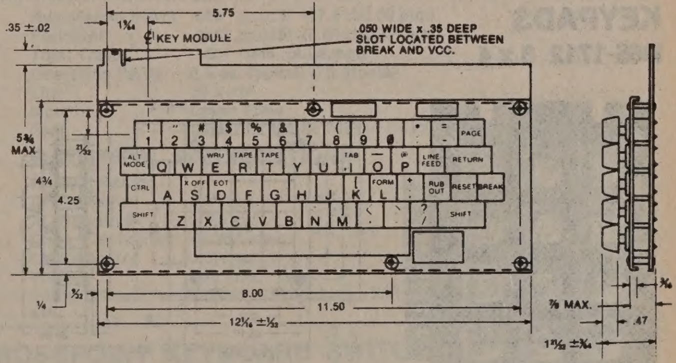
OPTIONAL G99-0056 HOUSING

- Modern Design
- Compatible with DIN requirements
- Attractive brown/beige color



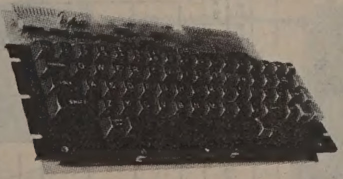

14.960
7.086
1.535
.767
.767
.275
.275
.551

70-4753 KEYBOARD FOR ELETYPEWRITERS

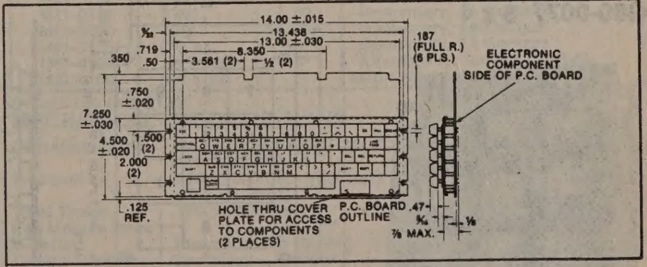

5.75
.35 ±.02
KEY MODULE
.050 WIDE x .35 DEEP SLOT LOCATED BETWEEN BREAK AND VCC.
5¾ MAX
4¾
4.25
8.00
11.50
⅞ MAX.
.47

- 53 keymodules • Key Module Layout according to ASR 33
- 4 Modes (Alpha-Field only letters) • Code according to ASCII

B 70-05AB UNIVERSAL-KEYBOARD WITH ALPHA-LOCK



- Full 67 key array
- Five user-definable spare keys with keycaps that have "quick change" clear plastic tops. These keyswitches are not connected electrically, but can be conveniently hard-wired so as to output any code.
- TTL and DTL compatible output circuitry.


14.00 ±.015
13.438
13.00 ±.030
8.350
3.581 (2)
.187 (FULL R.) (6 PLS.)
ELECTRONIC COMPONENT SIDE OF P.C. BOARD
.350
.719
.50
.750 ±.020
7.250 ±.030
4.500 ±.020
1.500 (2)
2.000 (2)
.125 REF.
HOLE THRU COVER PLATE FOR ACCESS TO COMPONENTS (2 PLACES)
P.C. BOARD OUTLINE
.47
⅞ MAX.

- Only one power supply voltage required: +5 volts at 325 ma. max.
- Positive logic with outputs resting low.
- Four mode keyboard offers (1) lower case mode, (2) upper case mode, (3) control case mode and (4) teletypewriter alpha lock configuration (alpha lock depressed).

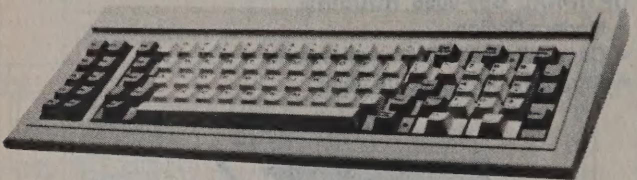
CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

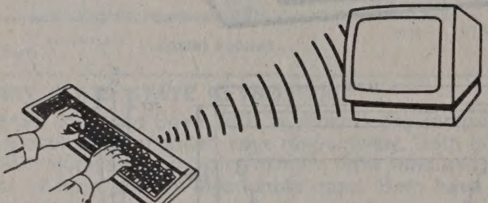
For More Information. Circle No. 258

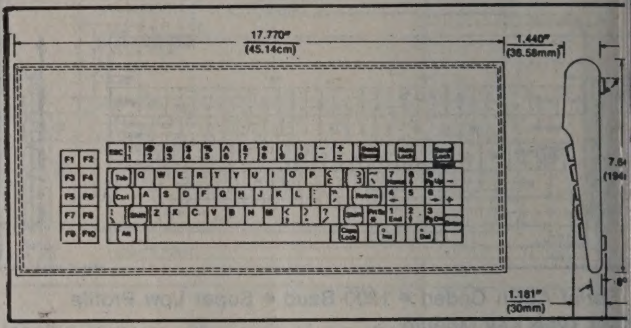
CHERRY Keyboards

KXN3-8451 CHERRY IR WIRELESS KEYBOARD — 84 KEY, COMPATIBLE WITH IBM PC JR.*

Comes in DIN enclosure. This state-of-the art keyboard is equipped with CMOS electronic components and special power circuitry which requires power only when a key is depressed. This extends life of 4 AA alkaline batteries. May be used in a wireless, simplex mode at distances of 20 feet (line-of-site) with IBM PC jr. For use with IBM PC use the same Cherry IR Wireless Keyboard KXN3-8451 plus IR Receiver Pa No. 0B99-I3AL which may be plugged into the keyboard ja on the IBM PC. This IR Receiver converts the PC jr code si nals to IBM PC code.






17.770″
(45.14cm)
1.440″
(36.58mm)
7.6
(19
1.181″
(30mm)
8°

IBM Compatible interface at 18K Baud serial output with Up/Down codes and special handshaking, differential output. (Baud rates 300, 1200, 9000)

- ASCII jumpers allow conversion to serial with TTL
- 2-shot molded keycap matté finish
- Full N Key rollover
- Lighted "alpha lock" and "num lock" keys
- Chassis ground. External reset. Matching color shielded coil cord with 5 pin circular DIP connector. Auto repeat
- Low profile-30mm (1.181″) from enclosure base to center point of home row key cap top

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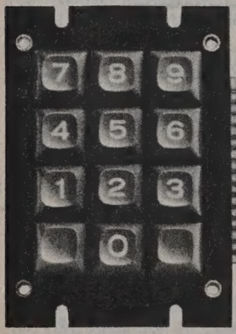
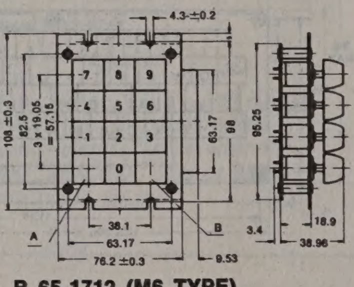
* IBM is the registered trademark of the International Business Machines Corp.

KEYPADS

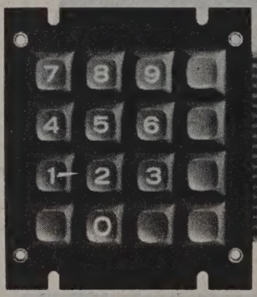
B65-1712 3 x 4

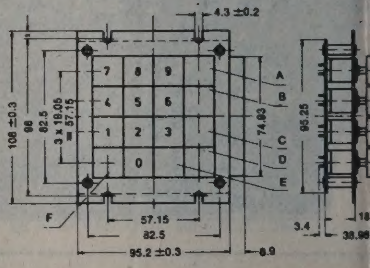



4.3-±0.2
108 ±0.3
82.5
3 x 19.05 = 57.15
63.17
98
95.25
38.1
63.17
76.2 ±0.3
9.53
A
B
3.4
18.9
38.96

B 65-1712 (M6 TYPE)
12 Keymodules
Standard keycap-color: grey
Non-encoded

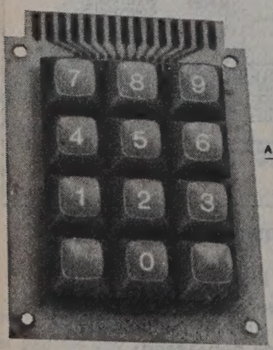
B65-1716 4 x 4

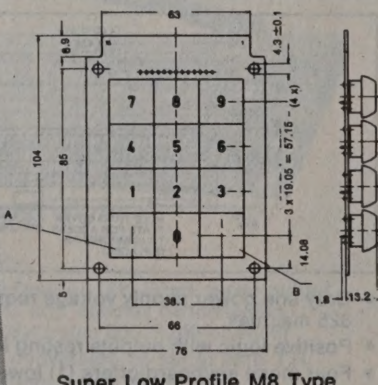



4.3 ±0.2
108 ±0.3
98
82.5
3 x 19.05 = 57.15
74.93
95.25
A
B
C
D
E
F
57.15
82.5
95.2 ±0.3
6.9
3.4
38.9

B65-1716 (M6 TYPE)
16 Keymodules
Non-encoded

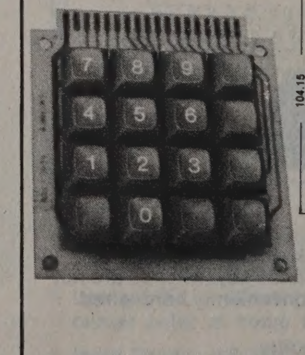
G80-0077 3 x 4

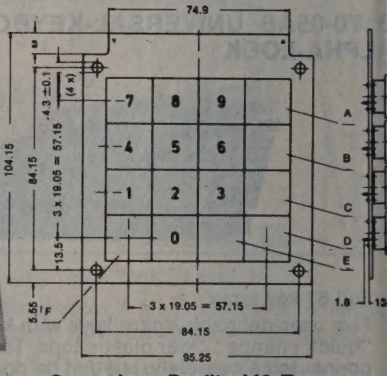



63
4.3 ±0.1
8.9
104
85
3 x 19.05 = 57.15 - (4 x)
14.08
A
B
5
38.1
66
76
1.8
13.2

Super Low Profile M8 Type
Keypad of 12 Keymodules
Non-encoded

G80-0084 4 x 4




74.9
4.3 ±0.1
(4 x)
104.15
84.15
3 x 19.05 = 57.15
13.5
5.55
F
A
B
C
D
E
3 x 19.05 = 57.15
84.15
95.25
1.8
13

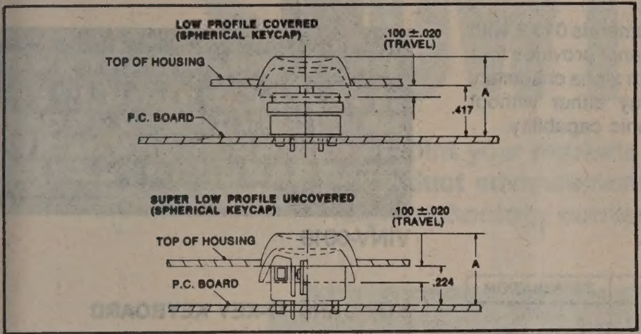
Super Low Profile M8 Type
Keypad of 16 Keymodules
Non-encoded

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

For More Information. Circle No. 258

CHERRY Keyboard Switches

M8 SERIES — SUPER LOW PROFILE DIN-COMPATIBLE GOLD CROSSPOINT CONTACT



Super low profile technology is available in individual keymodules or as complete keyboards. Keymodules are offered in covered or uncovered version with spherical caps and covered version with cylindrical sculptured caps.

- Super low profile from P.C. board to center point of home row keycap top—
  .426″ uncovered spherical keycap
  .619″ covered spherical keycap
- Linear feel with positive stop
- New ergonomic cylindrical button set
- Gold Crosspoint Contact switching

SUPER LOW PROFILE M8 MODULES

Part Number	Description
M81A-0100	Standard Force, Uncovered, Very Low Profile.
M81A-01R0	Standard Force, Uncovered, Very Low Profile, Red LED.
M81G-0100	Higher Force, Uncovered, Very Low Profile.
M81E-0500	Standard Force With Cover.
M81E-05R0	Standard Force With Cover With Red LED.
M81H-0500	Higher Force With Cover.

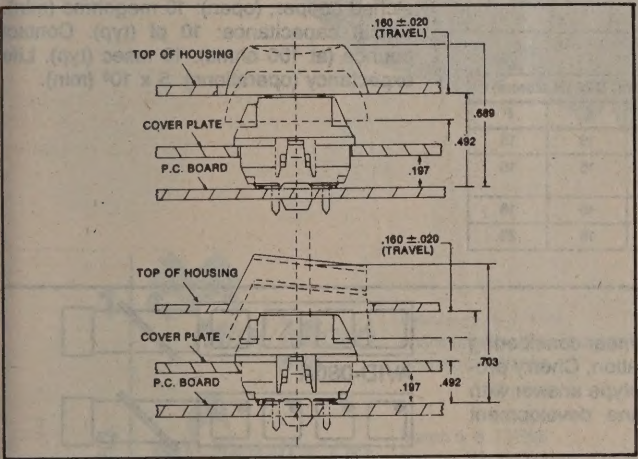
MECHANICAL SPECIFICATIONS

Rest Height (A)	.426″ ±.015″ (10.82 ±0.38mm) — Type I
Pretravel	.063″ ±.024″ (1.60 ±0.61mm)
Total Travel	.100 Nom. (2.54mm)
Operating Force	2½ oz. typical (70 grams)
Life	10 x 10⁶
Mounting	Printed Circuit Board (no coverplate)
Feel	Linear — positive stop

ELECTRICAL SPECIFICATIONS

Contact Rating:	
DC Resistive	3W max.
AC Resistive	3 VA max.
Current switching	0.125A max.
Current carry	0.5 max.
Voltage	28V max.
Initial Contact Resistance — milliohms	200 max. (typically 25m)

MX SERIES — LOW PROFILE DIN-COMPATIBLE GOLD CROSSPOINT CONTACT



- Low profile — .689″ from PC board to the center point of home row keycap top with lo-pro spherical cylindrical sculptured keycaps.
- Linear or tactile feel — positve stop.
- Full Travel — .160″.

LOW PROFILE MX MODULES

Part Number	Description
MX1A-11NN	Standard Force, Linear, Face Plate Mount.
MX1A-21NN	Higher Force, Linear, Face Plate Mount.
MX1A-11NW	Standard Force, Linear, PCB Mount.
MX1A-21NW	Hgher Force, Linear, PCB Mount.
MX1A-A1NN	Standard Force, Tactile, Face Plate Mount.
MX1A-B1NN	Higher Force, Tactile, Face Plate Mount.
MX1A-A1NW	Standard Force, Tactile, PCB Mount.
MX1A-B1NW	Higher Force, Tactile, PCB Mount.
MX1A-31NN	Alternate Action, Face Plate Mount.
MX1A-31NW	Alternate Action, PCB Mount.

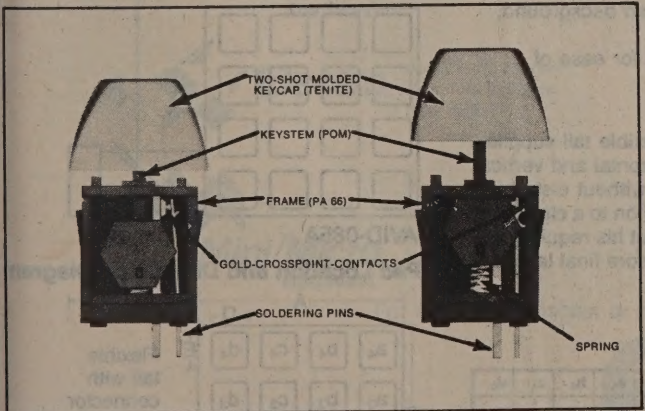
MECHANICAL SPECIFICATIONS

Rest Height ("A")	.689″ ±.015″ (17.5 ±0.38 mm)
Pretravel	.080″ ±.025″ (2.03 ±0.64 mm)
Total Travel	.160″ Nom. (4.06 mm)
Operating Force	2.5 oz. typical (70 grams)
Life	20 x 10⁶
Mounting	Cover Plate
Feel	Linear or tactile feel — positive stop

ELECTRICAL SPECIFICATIONS

Contact Ratng:	
DC Resistive	3W max.
AC Resistive	3 VA max.
Current switching	0.125A max.
Current carry	0.5A max.
Voltage	28V max.
Initial Contact Resistance — milliohms	200 max. (typically 25m)

M4/M5/M6 SERIES — REGULAR PROFILE GOLD CROSSPOINT KEYBOARD SWITCHES



The proven design concept — crossed knife edge contact configuration — provides high force per unit of contact area and virtually eliminates contact closure interference by contaminates. Precious metal contact material (W/E Alloy #1) consists of 69% gold, 25% silver and 6% platinum. Contact interfaces are inert to chemical action with resultant low contact resistance (typically 25 milliohms).

REGULAR PROFILE KEYSWITCH

Part Number	Operating Force	Stem Angle	Action
M41-0100	6 oz.	0°	Momentary, Lighted, 1A Contact
M41-0103	2½ oz.	0°	Momentary, Lighted, 1A Contact
M51-0182	2½ oz.	10°	Momentary, 1A Contact
M51-0143	6 oz.	0°	Momentary, 1A Contact
M51-0229	4 oz.	0°	Momentary, 1A Contact
M61-0120*	2½ oz.	0°	Momentary, 1A Contact
M61-0800	2-4½ oz.	0°	Alternate Action, 1A Contact
M62-0100	2-4½ oz.	0°	Momentary, 2A Contact

* Replaces M61-0100

MECHANICAL SPECIFICATIONS

Operating Force	2½ oz. ±½ oz. Std. (Also available in forces from 2 oz. and higher)
Pretravel	.085 ±.030 Std. (Alternate action version pretravel .030″ to .065″)
Total Travel	.160 ±.020 Std.
Key Module Case Material:	Thermoplastic (Nylon)
Temperature	Operating — 0°/60°C Storage — −35°C/65°C

ELECTRICAL SPECIFICATIONS

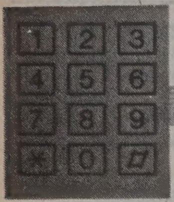
Contact Rating (Form A contacts)

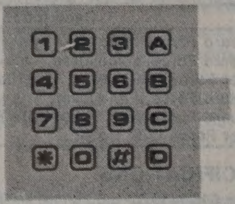
DC Resistive	3W max.
AC Resistive	3 VA max.
Current	0.125 amp. max. switching 0.5 amp. max. carry
Voltage	28V max.
Initial Contact Resistance	200 milliohms max. (typically 24 milliohms)

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

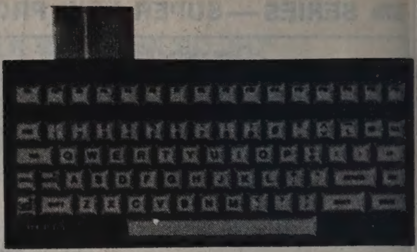
CHERRY Flat Panel Membranes

STANDARD MEMBRANES — FLAT PANELS





The 4 x 3 panel has the numerals 0 to 9, with * and #, while the 4 x 4 panel provides four additional key positions with alpha characters A — D. Or, you can buy either without graphics for custom graphic capability.



VINV-0019

STANDARD 77-KEY KEYBOARD

Flexible adhesive backer; Contact factory for other versions, including full-logic, and in housing.

MEMBRANE ELECTRICAL SPECIFICATIONS

Maximum ratings: 100 ma @ 30 VDC 1.5 watts. Circuit resistance (closed): 100 ohms (max) for screened silver; 50 ohms (max) for etched copper; (open): 10 megohms (min). Circuit capacitance: 10 pf (typ). Contact bounce (at 100 ohms): 10 msec (typ). Life expectancy (operations): 5 x 10^6 (min).

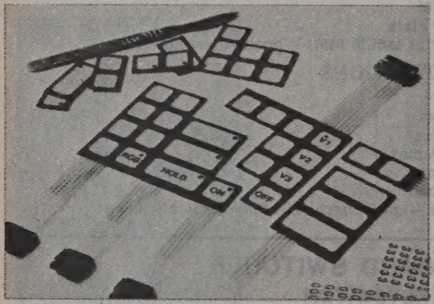
STANDARD MEMBRANES

PART NUMBER	KEY ARRAY	DESCRIPTION	CONSTRUCTION	GRAPHICS	TERMINATION
V1G1-0019	77 Key	Alphanumeric with Graphic Layer	Flex-Circuit W/ADH Backer	Brown/Tan Embossed	Flex-Tail 4.46 in. Long
V2G1-0019	77 Key	Keyboard without Graphic Layer	Flex-Circuit W/ADH Backer	None	Flex-Tail 4.50 in. Long
V1G1-0071	3 x 4	With Graphic Layer	Flex-Circuit W/ADH Backer	Gray/Black Velvet Text	Flex-Tail 2.62 in. Long
V2G1-0071	3 x 4	Without Graphic Layer	Flex-Circuit W/ADH Backer	None	Flex-Tail 2.66 in. Long
V1G1-0075	4 x 4	With Graphic Layer	Flex-Circuit W/ADH Backer	Gray/Black Velvet Text	Flex-Tail 2.62 in. Long
V2G1-0075	4 x 4	Without Graphic Layer	Flex-Circuit W/ADH Backer	None	Flex-Tail 2.66 in. Long
V1NV-0112	ASCII	Encoded 77/Key Keyboard in Housing with Cable		Brown/Tan Embossed	Parallel & Serial Headers

PROTO PAD MEMBRANE PANELS

PART NUMBER	KEY ARRAY	DESCRIPTION	DIMENSIONS IN mm (PAD PITCH 19mm, DEPTH 0.8mm)					
			A	B	C	D	E	F
*AVID-080A	1 x 4	Protopad Strip	79	19	79	15	15	15
*AVID-081A	1 x 4	Protopad Strip with LED Window	79	19	79	15	15	15
*AVID-084A	2 x 4	Protopad Strip	79	38	79	15	15	18
*AVID-085A	4 x 4	Protopad Strip	79	76	79	15	15	23

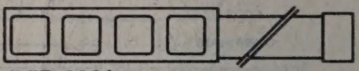
PROTOPAD MEMBRANE PANELS



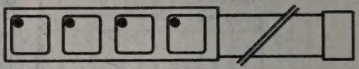
As a design aid to the Engineer considering a membrane panel application, Cherry provides a cost effective prototype answer with their 'Protopad' membrane development series.

Features

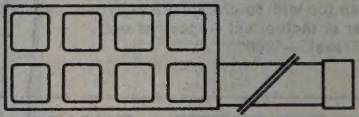
- Key pad configurations of 1 x 4, 2 x 4 and 4 x 4 for economic grouping.
- Modular design provides layout matching in both the horizontal and vertical axis.
- Colour co-ordinated graphics, beige key pads on dark brown background, for balanced contrast.
- Self adhesive backing for ease of mounting.



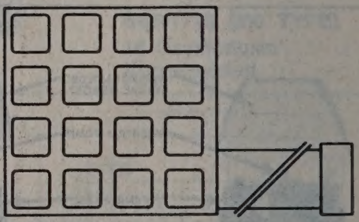
AVID-080A



AVID-081A



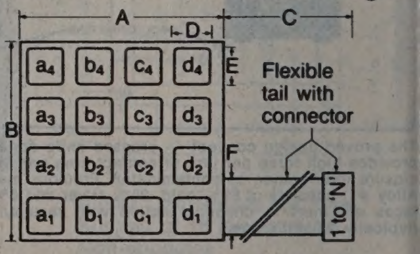
AVID-084A



AVID-085A

CHERRY PROTOPAD MEMBRANE PANELS (*) Each having a single flexible tail supplied without connector. Modular design provides layout matching in both horizontal and vertical axis. Unwanted key pads may be progressively cut away toward flex tail without disturbing the circuit continuity to the remaining pads. Protopads should be mounted on to a clean, flat surface using the self adhesive layer provided. The user should first lay out his requirement with the backing intact to prevent premature attachment to the surface before final layout is decided upon.

Pad Location and Dimension Diagram



FLEXIBLE TAIL CONNECTION MATRIX

Pad Locations	a_1	b_1	c_1	d_1	a_2	b_2	c_2	d_2	a_3	b_3	c_3	d_3	a_4	b_4	c_4	d_4
Connections for all 4 Pad Modules	1 5	2 5	3 5	4 5	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
Connections for all 8 Pad Modules	1 5	2 5	3 5	4 5	1 6	2 6	3 6	4 6	— —	— —	— —	— —	— —	— —	— —	— —
Connections for all 16 Pad Modules	1 5	2 5	3 5	4 5	1 6	2 6	3 6	4 6	1 7	2 7	3 7	4 7	1 8	2 8	3 8	4 8

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

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SHOWTIME '85

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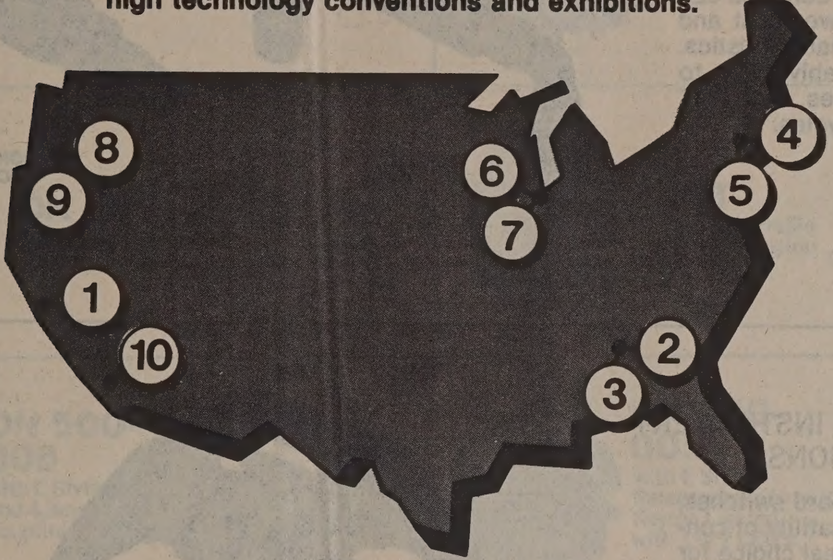

1	**Mini/Micro West**	February 5, 6, 7, 1985 Anaheim Hilton Exposition Center Anaheim, California
2	**Southcon**	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
3	**Mini/Micro Southeast**	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
4	**Electro**	April 23, 24, 25, 1985 New York Coliseum New York
5	**Mini/Micro Northeast**	April 23, 24, 25, 1985 Albert Hall New York
6	**Midcon**	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
7	**Mini/Micro Midwest**	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
8	**Northcon**	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
9	**Mini/Micro Northwest**	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
10	**Wescon**	November 19, 20, 21, 22, 1985 Anaheim Convention Center Anaheim, California

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Subsidiary of Electronic Conventions, Inc.
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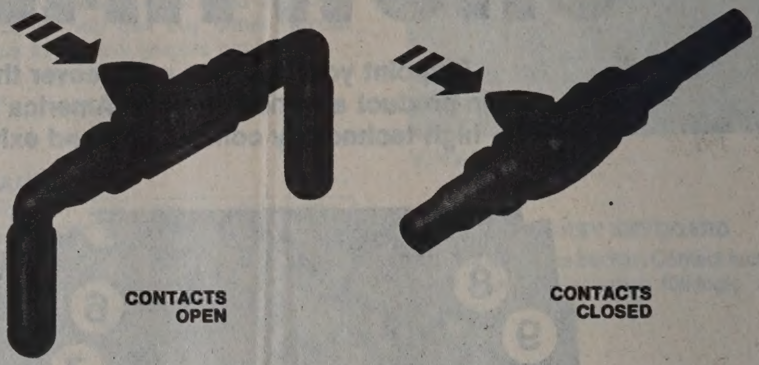
For More Information. Circle No. 21

MEI DN & DNT SERIES KEYSWITCHES

SEALED CONTACTS

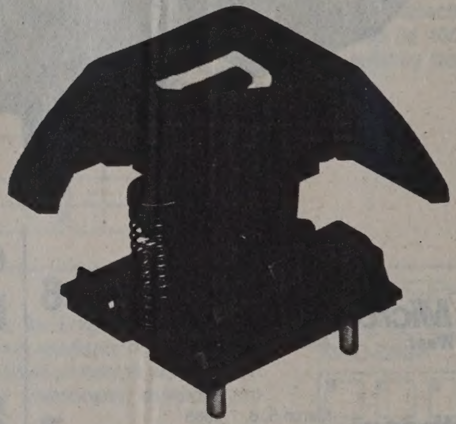
DN and DNT switches work in your product's environment because the contacts are sealed in a silicone rubber tube. And since they are sealed, the contacts can be silver with its lower cost and cleaner electrical characteristics. That's why DN reliably tests to over 15 million cycles, and DNT to over 50 million cycles.



DN SERIES

FOR DEMANDING INSTRUMENT PANEL APPLICATIONS

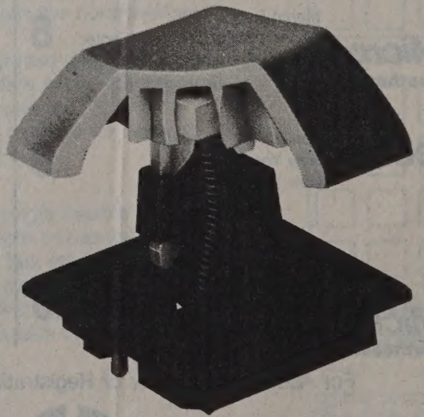
The DN series keyboard switches, because of their versatility of configuration, are the ideal choice for almost any front panel key array. Options include lighting, double pole, alternate action, sub-panel mounting, boot protection and numerous relegendable and double-shot keytops. The very low profile, sealed contact and full key travel features make the DN an excellent "operator friendly" alternative to touch panels.



DNT SERIES

HIGH QUALITY, LOW COST, FULL TRAVEL KEYBOARDS

The DNT series because of its exceptional life and sealed contacts offers a low cost alternative to a solid state keyboard. The long travel and break-away touch are design features providing the maximum operator satisfaction. Profile height, while greater than the DN, is still low enough to allow construction of keyboards meeting the ergonometric standard of 30 mm height of home row keys. DNT switches may be used with or without a metal sub-panel.



See P. 1076 for MEI LIGHTED KEYSWITCHES

MECHANICAL ENTERPRISES INC.

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HERNDON, VA 22070
(703) 435-9496
TWX 710-832-0942

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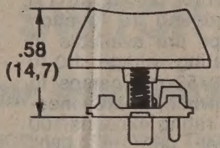
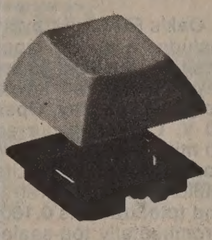
For More Information. Circle No. 259

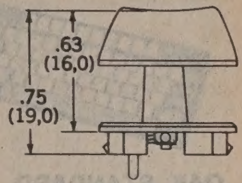
MEI DN & DNT KEYSWITCH STYLES

DN 500
with L Style Keytop

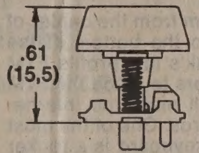


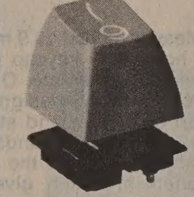


DNT
with Low Profile
Sculpted Keytop

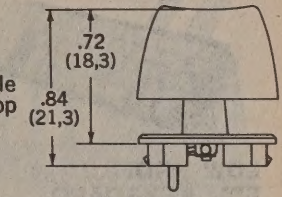

.63
(16,0)
.75
(19,0)

DN 500
with M Style Keytop

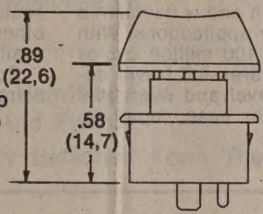


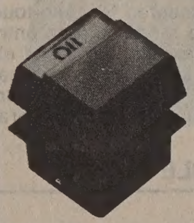


DNT
with High Profile
Sculpted Keytop

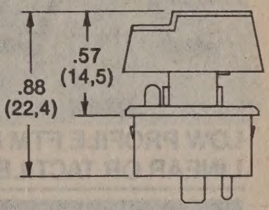

.72
(18,3)
.84
(21,3)

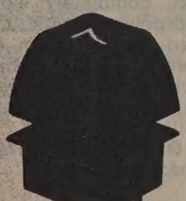
DN 500-005
with L Style Keytop
and 4.3mm Keytop
Coupling


.89
(22,6)
.58
(14,7)

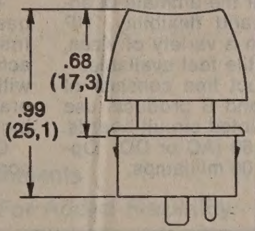


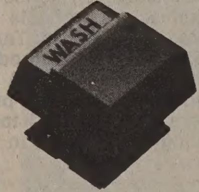
DN 500-005
with E Style
Relegendable Lens
Keytop Lighted
with 1 or 2 LED's.


.88
(22,4)
.57
(14,5)

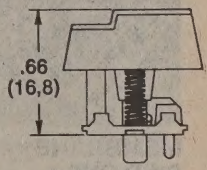


DN 500-005
with C Style Keytop
and 7.8mm Keytop
Coupling

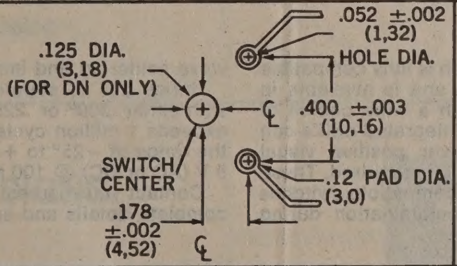

.68
(17,3)
.99
(25,1)



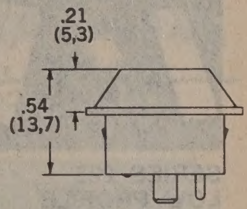
DN 500
with E Style
Relegendable Lens
Keytop Lighted with
LED

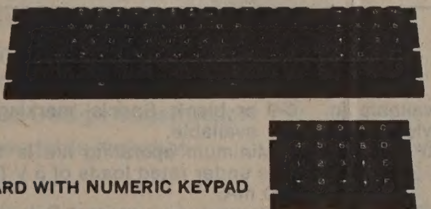


SWITCH
TERMINAL
LAYOUT
(DN & DNT)
NOTE: CHANGE
.052 TO .062
IF USING
SUB PANEL


.125 DIA.
(3,18)
(FOR DN ONLY)
SWITCH
CENTER
.178
±.002
(4,52)
.052 ±.002
(1,32)
HOLE DIA.
.400 ±.003
(10,16)
.12 PAD DIA.
(3,0)

DN 500-005
with Boot and
Legend Plate
Lighted with LED





FULL KEYBOARD WITH NUMERIC KEYPAD

SPECIAL ARRAYS

Both DN and DNT keyboard switches can be delivered configured in a custom array with properly legended keytops in a steel or aluminum sub-panel. Such arrays can simply be placed on the PCB with other components and wave soldered followed by a water wash.

See P. 1076 for MEI LIGHTED KEYSWITCHES

MECHANICAL ENTERPRISES INC.

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HERNDON, VA 22070
(703) 435-9496
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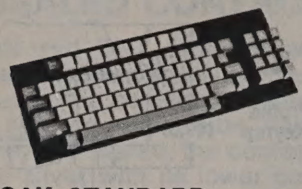
OAK KEYBOARDS, KEYPADS, KEYSWITCHES

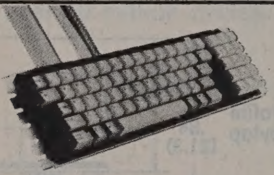


OAK STANDARD 81 POSITION KEYBOARD

Oak's FTM full-travel membrane keyboard includes a 60-key typewriter layout, an 11-position numeric keypad and 10 function keys. Sculptured keycaps are available in beige or flat gray. Operating voltage: 1.0 to 30 V. Operating current: 50 microamps to 20 miliamps per single switch. Interconnection is row/column. Life rating exceeds 100 million per key. Pretravel: .080″ ± 0.020″ and total travel is 0.160″. Keyboards are environmentally top-sealed.

The encoded version features a choice of 2-key rollover of Oak's E^3 (entry-error-elimination) system, a multi-key rollover function with phantom key lockout for all data keys. The encoder debounces all keys and permits selection of auto repeat for all noncontrol keys. The board is 4-mode with ASCCI output codes and parallel transmission with a serial option.

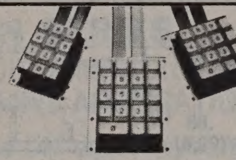
Contact your nearest Oak sales office for complete details and specifications.



LOW PROFILE FTM KEYBOARD

Measuring just 19.9 mm from the center of the home row keycap to the bottom of the aluminum baseplate, Oak's low profile FTM keyboard allows designers to place the FTM in an enclosure and still meet the international 30 mm DIN standards. One of the most notable features of the keyboard is a rocker mechanism which gives a distinct nonfatiguing feel for the keyboard operator. Other features include LED indicators for shift lock and function keys, variable operating force, RFI/EMI/ESD protection, single tail termination and custom encoding electronics.

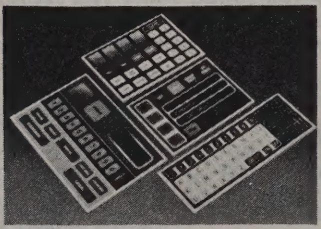
Contact your nearest Oak sales office for complete details and specifications.



LOW PROFILE FTM KEYBOARD— LINEAR OR TACTILE FEEL AVAILABLE

The Oak FTM keypad incorporates human-engineered feel and touch and is useful in a wide range of data entry applications. With life expectancy rated at 100 million cycles per key, the keypad features full travel design (0.160″). The pretravel and overtravel features promote operator ease, input accuracy and low fatigue. The keypad is front sealed to protect against spilled liquids and other contaminants. EMI/RFI shielding is available on all standard keypads.

Contact your nearest Oak sales office for complete details and specifications.



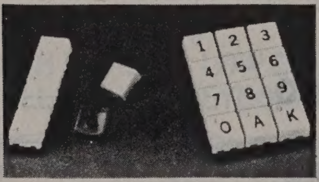
MEMBRANE SWITCHES

Oak TIP switches offer the ultimate in environmental resistance and flexibility. TIP switches are available in a variety of sizes, colors and designs. Tactile feel available.

The TIP switch product line consists of three designs. Type A and B products use rigid single-or double-printed circuit boards. Operating voltage: 1 to 50 (AC or DC). Operating current: 0.05 to 100 milliamps.

Type C products are completely film-based, using a non-rigid polymer substrate instead of a PC board. Termination is achieved via a "tail" which is compatible with standard commercial connectors. Operating voltage: 1 to 30 (AC or DC). Operating current 0.05 to 50 milliamps.

Contact your nearest Oak sales office for complete details and specifications.

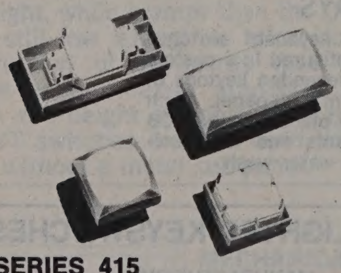


SERIES 225 LOW PROFILE PUSHBUTTON KEYBOARD SWITCH

Oak's series 225 switch is fully compatible with front panel styling and is available in five standard colors with a wide choice of legends. Switches with integrated LED's can be incorporated wherever positive visual confirmation of data entry is required. These unique microprocessor compatible switches are sealed to avoid contamination during wave soldering and immersion cleaning.

Series 225 is supplied in several styles with either .300″ or .225″ profile. Life rating exceeds 1 million cycles for operation over the range of −25° to +75°C. Max. loads are 5 V (AC or DC) @ 100 mA.

Contact your nearest Oak sales office for complete details and specifications.



SERIES 415 KEYBOARD SWITCH

Oak's series 415 switch is available in both single and double station styles. Standard sizes: .610″ square and .720″ square. Double station styles: .610″ x 1.235″ and .720″ x 1.470″.

This series mounts directly to a PC board. Keys are available in white, black, blue, red, and gray. Standard markings are numbers 0-9 or blank. Special markings and colors are available.

Minimum operating life is 10 million cycles under rated loads of 5 V (AC or DC) @ 100 mA.

Contact your nearest Oak sales office for complete details and specifications.

OAK SWITCH SYSTEMS INC. P.O. Box 517, Crystal Lake, IL 60014
(815) 459-5000 • TWX 910-634-3353 • TLX 72-2447

RUGGEDIZED SWITCH PANEL DESIGNS

ORBIT INSTRUMENT CORP.

CORPORATE FACILITIES:
80 CABOT COURT, HAUPPAUGE, L.I., NY 11788, TELEPHONE: (516) 435-8300
6431 GLOBAL DRIVE, CYPRESS, CA 90630, TELEPHONE: (714) 527-0561

MILITARIZED KEYBOARD/ BALL TRACKER ASSEMBLIES

INSTALLED IN CONSOLES AS A REMOVABLE ASSEMBLY FOR EASY ACCESS

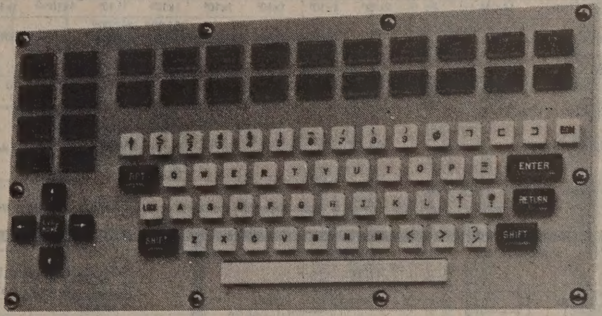
INCLUDES

- 32 Function Switches For Fast Control Action
- Orbit Instrument 2″ Diameter Ball Tracker With 256 Output Pulses Per Revolution Of The Ball
- Bi-Directional Data Bus
- Qualified To MIL-STD-810 For Humidity, Salt Fog, Shock, Vibration, Dust And Fungus
- Ball Tracker Can Be Quickly Detached From The Keyboard

BACK LIGHTED KEYBOARDS

These Custom Keyboards Feature

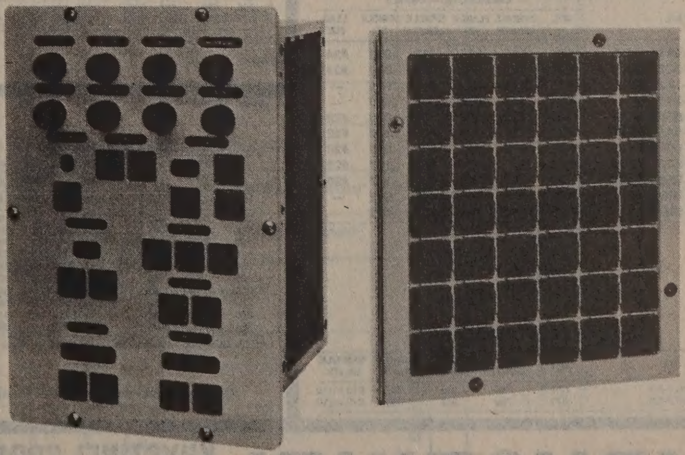
- Low Profile Design
- Sealed For Drip-proof Environments
- Relegendable Function Keys For Added Flexibility
- Any Key Can Be Backlit
- Custom Encoding
- Tactile Feel



CUSTOM PANEL DESIGNS

USING

- Orbit Low Profile Snap Action Switch Technology
- Switches Can Be Split Legend Or TRI Split
- Rugged Design Construction
- Relegendable Keycaps



SEND US YOUR SPECIFICATIONS TELEPHONE (516) 435-8300 OR TWX (510) 221-2122

KRYSTINEL LINEAR FERRITE CORES

SLUGS

COIL FORMS INSERT TUNING CORES

THREADED CORES

CUP CORES

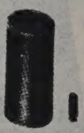
BALUN CORES

BOBBINS

TOROIDS

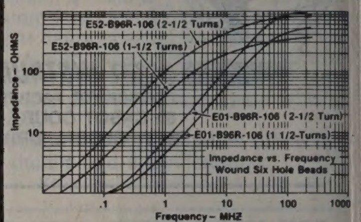
WASHERS

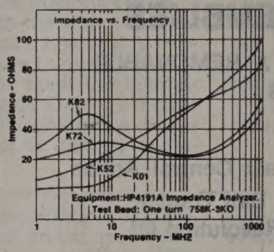
SHIELD BEADS

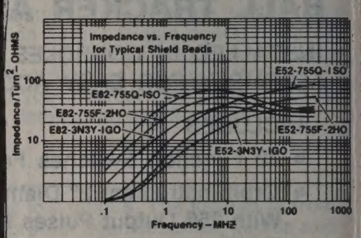

SLEEVES

Krystinel manufactures a comprehensive line of standard and custom made ferrite cores. We maintain an inventory of some of our standard sizes and shapes. Additionally, special parts can be made to your electrical and mechanical specifications should our standard parts not satisfy your requirements.

Technical information, samples, and quotations may be obtained by contacting the sales department at our Paterson, New Jersey office.



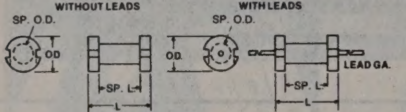




MAGNETIC CHARACTERISTICS

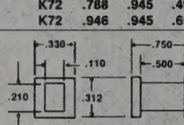
CHARACTERISTIC	UNIT	SYMBOL	MATERIALS																					
MATERIAL			K31	K21	K01	KM1	K41	KA1	K51	K52	K11	K14	K61	K91	K80	K72	K81	K82	K83	K86	K87	K73	K
Initial Permeability		$\mu 0$	15	40	120	200	275	370	400	850	275	800	1500	1800	2250	3500	4400	5000	6000	7500	10,000	3000	4
Maximum Permeability		μMAX	40	100	300	750	1000	1200	1500	2500	700	1900	2500	6000	4100	4500	6300	7000	7500	10000	13,000	4500	6
Coercive Force	Oersted	Hc	23	4	2.5	1.5	1.0	1.0	0.5	0.4	0.8	0.4	0.4	0.15	0.2	0.15	0.13	0.1	0.08	0.1	0.1	0.1	(
Saturation Flux Density	Gauss	B_{SAT}	2200	2100	2800	2300	3100	3100	2100	3000	3000	3800	4750	4750	4800	4200	4200	4300	4400	4300	4300	4100	4
@H (Oersted)	Oersted	(H)	(50)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(20)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(10)	(
Residual Flux Density	Gauss	B_R	1350	1000	1500	1250	1500	1400	1100	1300	1200	1300	1750	1600	1300	1200	1200	1100	900	1500	1200	700	8
Curie Temperature	°C	T_c	500	450	400	275	325	325	150	140	200	175	200	210	200	150	150	150	150	150	150	150	1
Volume Resistivity	Ω-CM	ρ	2x10⁴	1x10⁸	1x10⁷	1x10⁸	1x10⁸	1x10⁸	1x10⁷	1x10⁸	3x10³	4x10	1x10²	5x10	5x10²	2x10	2x10	2x10	2x10	2x10	2x10	2x210	2
Temperature change of initial permeability (0°-60°C)	%	$\frac{\Delta\mu°}{\mu_o @ 25°C}$	±5	±5	±6	±3	25°-60° +50% 25°-0° -25%	25°-60° +50% 25°-0° -25%	±12	±10	±5	±8	±10	±30	±20	±20	±20	±25	±25	±30	±30	±15	±
Loss Factor x10⁻⁶ @Frequency	 MHz	$\frac{Tan\delta}{\mu_o}$	325 100	80 10	25 2	50 1	55 .4	50 .4	20 .1	20 .1	15 .1	20 .1	17 .1	15 .1	13 .1	15 .1	15 .1	15 .1	15 .04	10 .02	10 .02	NOT APPLIC Pulse Materi	
Preferred Core Shapes			All	All	All	All	Coil Forms Sleeves Threads Slugs	Beads Baluns Toroids	Coil Forms Sleeves Threads Slugs	All	Slugs Threaded Cores Cups	Toroids Beads	Toroids	Toroids Threaded Cores Bobbins	Beads Baluns Toroids <.5 in. OD-	All	All Except Coil Forms Threaded Cores Large Bobbins			← Restricted to Toroids <.5 in OD –			

NOTES: 1. Normal tolerance of μ_o is ±20%.
2. For extended temperature ranges in all materials or tighter temperature coefficients of permeability, contact Krystinel Engineering Dept.
3. Loss data include both coil and core losses as read on a one/half inch diameter toroid.
4. Hysteresis loop data were taken @ 25°C.



BOBBINS (partial listing)

PART NO.	MTL	DIMENSIONS – INCHES OVERALL LENGTH	FLANGE OD	SPINDLE LENGTH	SPINDLE OD	LEAD SIZE
H01-3A1J-1LPP	K01	.115	.054	.056	.039	#24
H01-5C1R-2MPP	K01	.187	.061	.092	.040	#24
H01-1A20-0F	K01	.045	.070	.015	.045	—
H01-2V20-1F	K01	.100	.070	.050	.040	—
H01-9F32-6KM4	K01	.330	.107	.230	.070	#22
H51-EA5Q-BFM2	K51	.500	.200	.400	.110	#22
H51-LFAQ-EAK2	K51	.750	.375	.500	.210	#20
H72-EA5L-BFM2	K72	.500	.196	.400	.107	#22
H72-LFAK-EAK2	K72	.750	.370	.500	.187	#20
H72-MIS0-E2	K72	.788	.945	.492	.512	—
H72-SIS0-E2	K72	.946	.945	.650	.512	—



RECTANGULAR FLANGES

PART NO.	MTL	OVERALL LENGTH	FLANGE HEIGHT	FLANGE WIDTH	SPINDLE Ht.xTh.
S52-8XLF-EA	K52	.750	.312	.330	.210 x.110
S72-8XLF-EA	K72	.750	.312	.330	.210 x.110

BINOCULAR BALUN CORES (partial listing)

DIMENSIONS INCHES					MATERIAL	K01	KA1	K52	K72	K82
					PREFIX	G01	GA1	G52	G72	G82
HT	W	TH	ID	ADD PREFIX HERE TO BASE PART NO.	BASE P/N	A_L (NH/N²) @ 100 KHz				
.100	.141	.083	.031		2V41-2D1	60	185	–	–	–
.100	.141	.081	.031		2V41-2B1	–	–	414	–	–
.100	.138	.081	.030		2V3Y-2B1	–	–	–	1776	2523
.250	.280	.165	.073		7580-4Q1	124	–	–	–	–
.250	.275	.160	.070		757V-4K1	–	390	–	–	–
.250	.270	.155	.070		757Q-4F1	–	–	858	3534	5049
.545	.525	.295	.165		FKFO-8F1	190	595	–	–	–

SHIELD BEADS (partial listing)

DIMENSIONS inches				MATERIAL	K01	KA1	K14	K52	K82
				PREFIX	E01	EA1	E14	E52	E82
HT	O.D.	I.D.	ADD PREFIX HERE TO BASE PART NO.	BASE P/N	A_L(NH/N²) ± 25%				
.050	.138	.051		1F3Y-1G0	30	93	202	214	1264
.128	.138	.051		3N3Y-1G0	77	239	517	550	3237
.128	.138	.062		3N3Y-1S0	62	192	416	442	2601
.125	.163	.062		3K4N-1S0	73	227	491	521	3069
.250	.163	.062		754N-1S0	147	454	982	1043	6139
.125	.190	.090		3K5F-2K0	57	175	379	403	2373
.250	.190	.087		755F-2H0	114	351	779	806	4745
.250	.200	.062		755Q-1S0	178	550	1190	1264	7439
.250	.300	.125		758K-3K0	133	411	889	945	5560
.394	.236	.036		B96R-106	218	664	1458	1550	–

NOTE: B96R-106 has six holes – tolerances for these are ±30%.

Also available wound with 1 1/2 and 2 1/2 turns

STANDARD COIL FORMS (partial listing)

PART NUMBER	DIMENSIONS – INCHES Length	O.D.	Leads
C01-4A1H-R5P	.150	.052	#26
C01-5C1R-P5N	.187	.081	#24
C01-9725-MAN	.322	.075	#22
C01-AQ3K-M2N	.375	.125	#22
C01-EA4G-K2N	.500	.156	#20
C01-LF5C-K2N	.750	.187	#20
C01-TK70-K2G	1.00	.245	#20
C01-10Q70-K2G	1.250	.245	#20

STANDARD SLEEVES (partial listing)

PART NUMBER	DIMENSIONS – INCHES Length	O.D.	I.D.
P01-4A3A-2G	.150	.115	.086
P01-8F3N-2T	.295	.128	.098
P01-AT49-35	.368	.148	.110
P01-CH7A-60	.437	.256	.210
P01-EA7A-60	.500	.255	.210

SEND FOR FREE CATALOG

DESIGN KITS

KIT A: toroids. KIT B: Coil Forms, Sleeves, Bobbins.

KIT C: Beads, Balun Cores.

$20. each kit. Compartmented storage tray – with engineering information – containing a wide range (over 100 pcs.) of various shapes, sizes, and magnetic characteristics.

KRYSTINEL

KRYSTINEL CORPORATION
DEPT. GB, 126 PENNSYLVANIA AVE.
PATERSON, NJ 07503
(201) 345-8900 • TWX 710-988-5931

HumiSeal COATINGS FOR ELECTRONICS
GENERAL CHART OF PROPERTIES

HumiSeal

Listed in this General Chart of Properties are ten of the most frequently used HumiSeal Protective Coatings and their principal properties. These have been tabulated in order to facilitate comparison of their characteristics and selection of the most suitable type for a specific application. In addition to these HumiSeal types we manufacture a variety of coatings for special purposes, including high temperature applications. Should none of the coatings listed in this chart fulfill your requirements, we suggest that you contact us for recommendations.

HumiSeal Protective Coatings are available in one-quart or one-gallon cans, five-gallon pails, or fifty-five gallon drums. HumiSeal types 1B15 and 1A27 are also available in 12-ounce aerosol containers. All HumiSeal types listed in this chart may be applied by dip, brush or spray. Literature on recommended techniques for the proper application of coatings and the preparation of the subtrates is available upon request.

	PROPERTIES OF LIQUID HumiSeal											PROPERTIES OF CURED HumiSeal COATING																	
												THERMAL PROPERTIES			PHYSICAL PROPERTIES						ELECTRICAL PROPERTIES					CHEMICAL PROPERTIES			
HumiSeal Type[1]	Specific Weight (lbs. per gallon)[2]	Solids Content (% by weight)[3]	Viscosity, with catalyst when applicable (centipoises)[4]	Flash Point (°F)[5]	Drying Time for Handling[6]	Recommended Curing Conditions	Time Required to Reach Optimum Properties	Pot Life, at Room Temperature	Shelf Life, at Room Temperature	Coverage per gallon (in sq. ft.) After One Dip	Mixing Ratio Part A to Part B (By Weight)	Continuous Use Temperature Range (°F)	Thermal Shock Test[7]	Solderability[8]	Clarity[9]	Average Build After One Dip (mils)[10]	Flammability[7]	Flexibility[7]	Adhesion[12]	Mar Resistance[12]	Dielectric Constant[13]	Dissipation Factor[13]	Dielectric Strength (volts)[7]	Insulation Resistance (teraohms)[7]	Moisture Resistance (gigaohms)[14]	Main Constituent	Fungus Resistance[7]	Resistance to Solvents	HumiSeal Type[1]
1B12	7.3	20	30	40	10 min.	24 hrs. at room temp. or 30 min. at 170°F	24 hrs.	1 year	1 year	550	one component	−75°F to +280°F	Passes	Good	Transparent	0.5	Self-extinguishing	Very Good	Excellent	Very Good	2.8	.010	6000	250	30	Acrylic	Excellent	Very Good	1B12
1B15	7.6	35	470	30	10 min.	24 hrs. at room temp. or 30 min. at 170°F	24 hrs.	1 year	1 year	450	one component	−75°F to +270°F	Passes	Good	Transparent	2	Self-extinguishing	Fair	Excellent	Fair	2.3	.010	8000	350	40	Acrylic	Excellent	Fair	1B15
1B31	7.6	35	180	30	10 min.	24 hrs. at room temp. or 30 min. at 170°F	24 hrs.	6 mos.	6 mos.	450	one component	−75°F to +270°F	Passes	Good	Transparent	2	Self-extinguishing	Excellent	Excellent	Very Good	2.5	.010	7500	800	60	Acrylic	Excellent	Good	**1B31**
1A20	8.5	50	120	80	60 min.	24 hrs. at room temp.	1 week	6 mos.	6 mos.	375	one component	−70°F to +250°F	Passes	Excellent	Transparent	2	Self-extinguishing	Excellent	Very Good	Excellent	3.5	.028	8000	300	48	Polyurethane	Excellent	Excellent	**1A20**
1A27	8.0	50	5000	80	15 min.	24 hrs. at room temp. or 4 hrs. at 170°F	1 week	1 year	1 year	450	one component	−90°F to +250°F	Passes	Excellent	Transparent	5	Self-extinguishing	Excellent	Excellent	Fair	3.6	.020	7500	200	12	Polyurethane	Fair	Good	1A27
1A33	7.7	44	180	30	15 min.	24 hrs. at room temp. or 4 hrs. at 170°F	1 week	6 mos.	6 mos.	300	one component	−90°F to +250°F	Passes	Excellent	Transparent	2	Self-extinguishing	Excellent	Excellent	Fair	3.6	.030	7500	200	16	Polyurethane	Excellent	Good	**1A33**
2A64	8.9	55	80	85	4-5 hrs.	3 hrs. at 170°F	1 week	6 hrs.	6 mos.	470	1:1	−70°F to +270°F	Passes	Excellent	Transparent	1	Self-extinguishing	Excellent	Excellent	Good	3.5	.024	3500	450	35	Polyurethane	Excellent	Excellent	**2A64**
2B13	7.5	42	50	40	30 min.	90 min. at 200°F	1 week	24 hrs.	1 year	480	100:2	−70°F to +270°F	Passes	Poor	Transparent	2	Self-extinguishing	Excellent	Excellent	Excellent	3.0	.030	8000	300	33	Epoxy	Excellent	Excellent	2B13
2A51	9.2	100	6000	non flammable	2 hrs.	24 hrs. at room temp. or 2 hrs. at 200°F	1 week	6 hrs.	6 mos.	200	1:1	−70°F to +250°F	Passes	Poor	Transparent	15	Self-extinguishing	Fair	Good	Good	3.0	.030	6000	400	6	Epoxy	Excellent	Good	2A51
2A53	7.8	54	300	70	30 min.	2 hrs. at 200°F	1 week	24 hrs.	6 mos.	400	1:1	−70°F to +250°F	Passes	Poor	Transparent	1	Self-extinguishing	Excellent	Excellent	Excellent	3.0	.030	8000	200	28	Epoxy	Excellent	Excellent	**2A53**

HumiSeal TYPES LISTED IN BOLD PRINT COMPLY WITH THE REQUIREMENTS OF MIL-I-46058C

All technical data in this bulletin are based on test results using the stated standards and are believed to be correct. However, since the end use of HumiSeal materials (and the manner of storing and handling them) is beyond our control, we make no warranty — expressed or implied — as to the fitness of use, results to be obtained from or effects of use with respect to these materials. Their use shall be solely by the judgment of and at the risk of the end-user notwithstanding any statement contained in this bulletin.

1. The first digit in the type number specifies whether the product is a one-, or a two-component system.
2. Fed-Std 141a, Method 4184.
3. Fed-Std 141a, Method 4044.
4. Fed.Std 141a, Method 4287.
5. Fed-Std 141a, Method 4291.
6. Fed-Std 141a, Method 4061.
7. Mil-I-46058C.
8. Visual evaluation for ease of soldering with an 65 watt iron through a 2 mil film.
9. Fluorescent dye may be added if required.
10. Fed-Std 141a, Method 2121.
11. Fed-Std 406, Method 7031, Procedure A.
12. Fed-Std 141a, Method 6303.
13. ASTM-D150-65T, at 1 MHz and 25°C.
14. Mil-I-46058C insulation resistance during 10th cycle, at 65°C and 98% RH.

HumiSeal®

HumiSeal Division
Columbia Chase Corporation
28-60 Bklyn-Queens Expressway, W.
Woodside, New York 11377
Phone: (212) 932-0800 TWX: 710-582-2141
Cable Address: COLTECHNIC NEWYORK

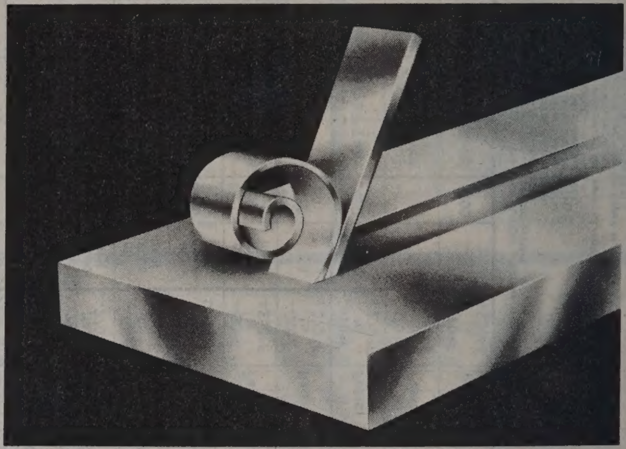
COLUMBIA CHASE all about energy

For More Information. Circle No. 263

Designing with inlay clad metals

What Is Inlay Cladding?

The combination of two or more metals, metallurgically bonded under high pressure, resulting in a one-piece composite with physical and electrical properties not available in a single metal or alloy. TMI's skive inlay cladding is a special application of this process, a technique of precisely locating stripes of precious or non-precious metal.

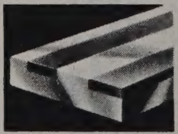


The Reliability of Metallurgical Bonding

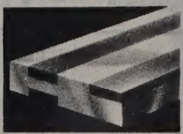
High pressure and temperature causes highly attractive atomic forces to interact with increased magnitude which produces diffusion at the bond interface. Clad inlays are far more reliable than welded or plated contacts as testified by preferences in the computer and telecommunications field.

Possible Clad Configurations

TMI offers a wide variety of options which include multiple inlays, top and bottom inlays and edgelays. These can be combined to provide a variety of design possibilities.



Inlay and edgelay stripes.



Top/bottom inlay and edgelay stripes.

TMI Clads vs. Plating

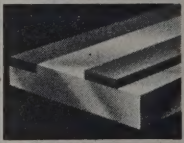
TMI clad inlays offer many advantages not possible with alternate processes:

- Utilization of low karat and precious metal alloys
- Improved porosity over electroplating
- Superior formability
- Low contact resistance

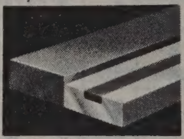
Clad Metal Variations

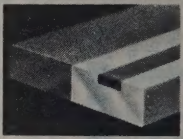
Multigauge—Contour shaped base metal configurations produced by skiving.
Dual Metal—An Electron Beam welded products combines dissimilar metals and different tempers.
Solder Striping—Selectively located solder stripes from .0002 to .020″ in thickness to provide automated solderability of parts.

Over/under thin solder stripes with precision metal inlay.



Multigauge with inlay stripe.





Thrulay with inlay.

Applications for TMI Clads

Used in a broad range of high reliability products in the appliance, automotive, computer, electronics, semiconductor and telecommunications industries. In addition, cost-effective designs are used in cameras, calculators and other consumer products.

For Complete Information Contact:
TECHNICAL MATERIALS, INC.
at the address below or
TWX 710-384-0600,
TMI LCLN.

TMI TECHNICAL MATERIALS, INC.
5 Wellington Rd., Lincoln, Rhode Island 02865
Telephone: (401) 333-1700
Subsidiary of Brush Wellman, Inc.

C-TEK INCORPORATED

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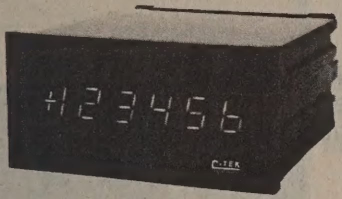
COUNTING SYSTEMS—DIGITAL COMPARATORS
NUMERICAL POSITION READOUTS—DIGITAL CLOCKS
DATA LOGGING PRINTERS—RATE METERS
TOTALIZERS—DIGITAL PANEL METERS
SPECIAL SYSTEMS TO YOUR SPECIFICATIONS

TELEX # 882485

SPECIFICATION GUIDE

C-TEK, Inc. 617-246-1720
4 Railroad Avenue, Wakefield, Mass. 01880

PANEL MOUNTED COUNTERS AND DISPLAYS



DIN/NEMA CASE 3.78'' x 1.89'' x 3.75'', Cutout 3.6'' x 1.8''

Series 2020, 2120 and 2220 Digital Displays
Accepts BCD data, up to six full digits or 5½ digits with ± sign. CMOS inputs allow daisy chaining many displays from one BCD source. Series 2220 designed to work with programmable controller outputs. Digit height .56'' Red LED. Optional line power supply.

Series 3020, 3124 and 4120 Up-Counters
Up to six .56'' high Red LED digits. Field selectable for fast (up to 5 MHZ), slow, or contact closure type inputs. Remote or front panel resets. Optional line power supply on all models. Battery backup (data retention) on Series 3020. Full parallel Tri-State BCD output standard on Series 4120.

Series 3920 Totalizer (BCD Adder)
Accepts parallel BCD and converts to total counts. Upon command present BCD input is added to existing reading. Up to six .56'' LED digits. Line power supply, battery backup, BCD out optional.

Series 4020 Up-Down Counter
For count rates to 1 MHZ, or with input filter for slower signals. Requires separate count line and up-down control line, or can have separate up and down count lines. With option card can have quadrature inputs. Optional internal line power supply and full parallel Tri-State BCD outputs for control applications. Up to 6½ digits with ± sign. .56'' high Red LED digits.

Series 4320 Presettable Up-Down Counter
Two to six digit field selectable up or down counter with front panel thumb wheel presets. Internal comparators allow selection of two set points, plus zero detect. Optional line power supply. Optional time base card allows use as presettable interval timer. Many other useful features. .56'' LED displays.

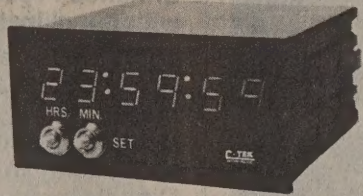
Series 5720 Rate Meters
Two to six digits. Line derived or crystal controlled time base can be scaled to display measurement in engineering units. Options include input amplifier, line power supply, BCD outputs. For rate measurement, tachometers, flow measurement. .56'' LED digits.

Series 8320 Interval Timers
Two to six digit interval timers with start-stop and reset inputs. Crystal controlled time base. Field settable resolution from 0.1 second to 1 micro second. Optional Tri-State BCD outputs. .56'' LED digits.

TELEPHONE : (617) 246-1720
TELEX :882485

SPECIALS: C-Tek Has Designed and Manufactured Many Special Systems Involving Counting and Control. Consult C-Tek for Your Next Requirements.

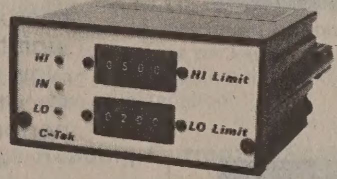
PANEL MOUNTED DIGITAL CLOCKS



DIN/NEMA CASE 3.78'' x 1.89'' x 3.75'', Cutout 3.6'' x 1.8''

Series 8020, 8120 and 8220 Digital Clocks and Timers
Hours, minutes and seconds. Line derived or crystal time base. Optional internal supply, battery backup, BCD outputs, microprocessor interface. Series 8220 is dual display calendar clock. .56'' LED digits.

PANEL MOUNTED DIGITAL COMPARATORS SET POINT CONTROLLERS



DIN/NEMA CASE, 3.78'' x 1.89'' x 3.75'', Cutout 3.6'' x 1.89''

Series 6620, 6720 and 6820 Digital Comparators
Two to six digit thumbwheel settable set point, BCD input, ''Above'', ''Equal'', and ''Below'' logic and relay driver outputs and front panel. Panel LED indicator lamps. Series 6820 Dual Comparator can be set up for ''In Band'' comparisons. CMOS circuitry.

RELATED PRODUCTS:

Series DDC Bi-Directional Counters
For use with rotary or linear optical incremental encoders.

Series DAC Angle Counter
Similar to DDC series except reads out in degrees.

Series ACR-101 Counter-Controllers, LIN-101 Counters
Packaged systems using various C-Tek panel mounted counters, comparators, and power supplies.

Series SYM-101, Gauge Wheel Encoders
High, medium or low resolution bi-directional gauge wheel encoders and pulse generators for linear measurement of sheet and film materials.

Series MPC Microprocessor Controlled Counter-Readout
Versitile bi-directional single or multi-axis counter-controller. Up to 8½ digits per axis. Serial and parallel data outputs for computer interface.

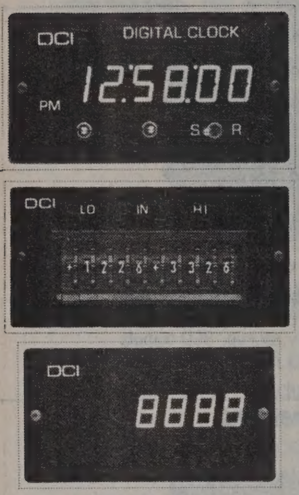
Series MPD Remote Numerical Display
Single or multi-axis display with RS-232 interface.

Series 1601 Printer-Multiplexer
Accepts up to six channels of parallel BCD numerical data. 16 columns, 5 x 7 dot matrix on 2-3/8'' aluminized paper.

Series CTP Power Supplies
Card type 2½ watt and 5 watt linear regulated supplies. 110-220 volt 50-60 HZ input. Also open frame type 10 and 25 watt linear supplies.

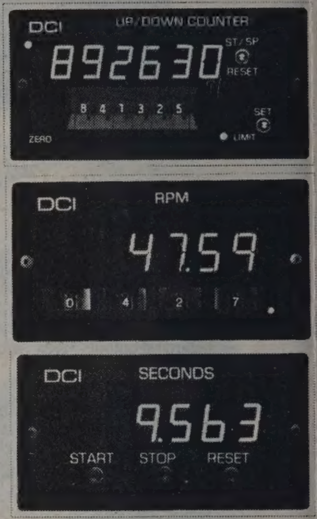
Series MR 19'' Rack Mount Panels
Various combinations of C-Tek instruments, controls and power supplies mounted on standard EIA 19'' panels for inclusion into your system console.

Digital Panel Counters, Timers, Tachometers, Voltmeters, Controllers, Temperature Indicators for Systems or Stand-Alone Use


DCI
DIGITAL CLOCK
PM
12:58:00
S R
DCI
LO
IN
HI
DCI
8888

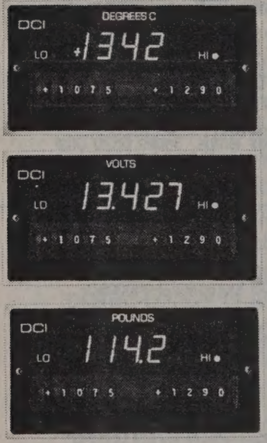
Enhance Process Controller performance with panel instruments from DCI

Time-of-Day and Calendar Clocks with BCD outputs and Battery Back-up provide master timing for your process controller. Remote Readouts accept BCD information and display in digital form. Digital Comparators and Counter/Comparators give convenient remote setpoint control via thumbwheel switches.


DCI
UP/DOWN COUNTER
892630
ST/SP
RESET
SET
ZERO
LIMIT
DCI
RPM
4759
DCI
SECONDS
9.563
START
STOP
RESET

Timing, Counting and Controlling

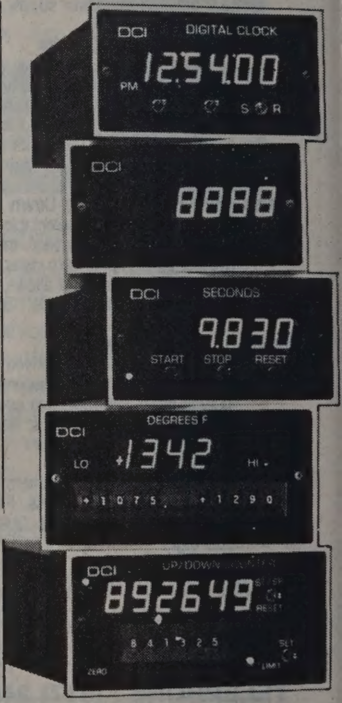
Totalizing counters and Timers measure, display and control time from microseconds to hours. Display events per unit time (Frequency, RPM, etc.), measure low frequencies (100 Hz. and below) with resolution to .01 Hz in one second, or perform bi-directional counting at rates up to 1MHz.


DCI
DEGREES C
LO
+1342
HI
DCI
VOLTS
LO
13.427
HI
DCI
POUNDS
LO
114.2
HI

Monitor and Control Process Variables

High/Low Setpoint Controller monitors and controls process variables such as Temperature, DC Voltage, AC Voltage, 4-20 ma. current loop and many others.

- 4 or 4½ Digit display
- Heavy-duty relay closures
- Analog output
- Transducer excitation voltage
- Easily scaled to read out in engineering units
- Differential input
- BCD Outputs


DCI
DIGITAL CLOCK
PM
12:54:00
S R
DCI
8888
DCI
SECONDS
9.830
START
STOP
RESET
DCI
DEGREES F
LO
+1342
HI
DCI
UP/DOWN
892649
RESET
SET
ZERO
LIMIT

DCI has a whole stack of reliable solutions for your measurement/control problems, all with BCD outputs, aluminum cases, .56" high-efficiency LED Displays and Remote-Control inputs. For more information or applications assistance call Bill Cook at (913) 782-5672 or write 14812 W. 117th St., Olathe, Kansas 66061.

DCI incorporated

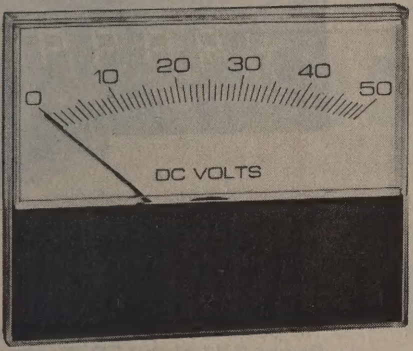
14812 W. 117th St., OLATHE, KS 66062 • (913) 782-5672

For More Information. Circle No. 266

EMICO
ELECTRICAL/ELECTRONIC INSTRUMENTS

A complete line of AC and DC analog meters and indicators. Shown here are just a few of the more popular EMICO products currently available for OEM applications.

TAUT BAND METERS



for Front Panel Mounting

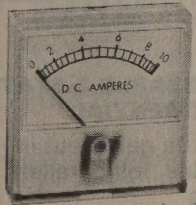
Series 60

Three sizes to choose from: 2½", 3½", and 4½". These meters are handsome in design and lend a distinctive look to any control panel.

This model 64 series comes in all commonly used ranges: expanded scale, elapsed time, UV, and frequency (reed and electronic).

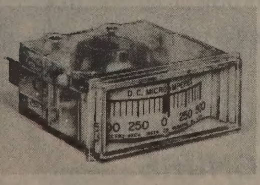
- ±2% FS accuracy in DC, 3% in AC
- ±1½% tracking, DC, ±2% AC
- Response time, 1.5 sec. maximum except 0-50 uA and below where response time is 3.0 sec. maximum
- ±1.5% FS
- Repeatability ±1.5% FS
- Self shielded
- Scale arc 100°

ANALOG METERS
Square-Shaped Panel Meters



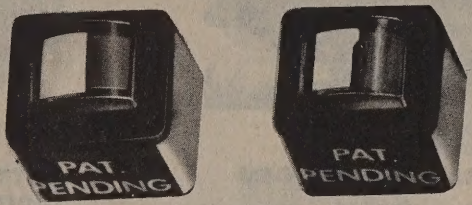
Featuring the unique EMICO High-Tork movement, these versatile plastic bezel meters are available as AC or DC ammeters, voltmeters, and milliammeters in choice of three sizes. They can be supplied 2.3125" square (Model 42), 2.3690" square (Model 50 series), and 2.8125" square (Model 44). Additional sizes available in models with a metal bezel. All AC meters have 5% accuracy; DC meters available with 3% or 5% accuracy. Regardless of the type or size of the bezel, any model can be mounted into a 2-1/16" diameter panel hole.

Edge-Reading Panel Meters



These space and cost saving meters, supplied with choice of flat-across front (Model 13-F) or curved-front (Model 13), are available as AC or DC ammeters, voltmeters, and milliammeters. They measure 1-13/16" x 3/4" and have clear molded plastic cases for easy illumination. Either 3% or 5% accuracy depending upon range. Standard quick disconnect-type terminal fits ¼" x .032" connector...screw-type also available. Can be supplied with zero-left, zero-center, or zero-right. Vertical or horizontal installation.

INDICATORS
Micro-Miniature Current Indicators



Measuring only ½" square, these rugged, dependable indicators (Model 802) are extra low in cost. Extremely popular to:

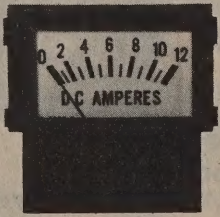
- Monitor on-off conditions
- Indicate battery-charge conditions
- Indicate circuit-operating conditions

Less than 2 milliwatts required to move flag or pointer. Overload capacity is 15 times current rating without burn-out or calibration shift. All models are packaged in a high-impact, clear plastic case and are available either with wire leads or plug-in jacks for ease of installation.

Edge-Reading Current Indicator

Model 12 is ideal as "go — no go" check on condition or to check circuit balance. Available in virtually any range up to a sweep of 100 milliamperes DC.

AMMETER Model 58



Compact size, 2.16 x 1.30; dependable and low in price; clean, modern design.
- Fast installation, snaps into panels .02 to .09
- Range 0 to 200 amperes
- Conventional terminals in lower ranges
- Above 30A. the terminals are replaced by a formed metal guide through which a charger lead is passed. A simple solution of hooking up heavy duty leads. Exceptionally low in price.

How to Order The more information you supply the better we can serve you. Information should include:
- Model number
- Ammeter, Milliameter or Voltmeter
- Range
- AC or DC
- Accuracy
- Zero-left, center or right
- Custom dial info
- Use of meter
- Quantity
- Delivery date(s)

For more information contact your nearest Emico representative or call factory direct.

THORN EMI

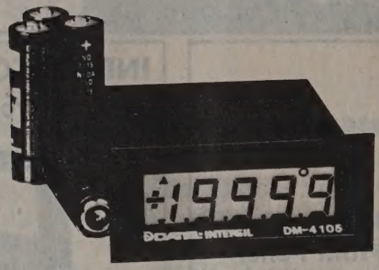
EMICO INCORPORATED
A Member of the THORN EMI Group
123 North Main Street, P.O. Box 368, Dublin, PA 18917 • Phone 215-249-9330 • TWX 510-665-9583

MINIATURE DIGITAL INSTRUMENTS

ULTRA-LOW COST OEM

- Tiny 2″ x 3.5″ single-board with .62″ panel depth
- Accepts components for 2 to 200V, 20μA to 2A, and digital ohmmeter ranges
- Noise-rejecting balanced differential inputs
- 5 Vdc power @ 280 mA

DM-31



BATTERY-POWERED 4½ DIGIT DIFFERENTIAL LCD

True balanced differential inputs, 1000 Megohm input impedance, 5 pA bias current.
Needs only 15 milliwatts (5 Vdc @ 3 mA)
Autozeroing with ratiometric reference for drift correction.
Digit-serial multiplexed BCD data outputs for remote DM-4106 slave display or computer input.

DM-4105

±1.9.9.9.9
DATEL·INTERSIL
DM-4200

MINIATURE LOW-COST DIFFERENTIAL 4½ DIGIT

True balanced differential inputs, 1000 Megohm input impedance, 5 pA bias current.
Bright 0.3″ high LED displays +5 Vdc power at 200 mA
Autozeroing with ratiometric reference for drift correction.
Digit-serial multiplexed BCD data outputs for remote DM-4102 slave display or computer input.

DM-4200

CLR
A
B
C
D
E
F
7
8
9
4
5
6
1
2
3
0
Ent

PROGRAMMABLE VOLTAGE CALIBRATOR

Accuracy ±.015% Traceable to NBS
4½ digit LCD display 100 microvolt resolution
Low power requirement 9V transistor battery operation
Two modes of operation Decimal/Hexadecimal entry
AC adapter/charger operation

DVC-350

±1999.
DATEL·INTERSIL DM-3100

LOW-COST MULTIRANGE

Accepts user-installed components for:
Any voltage range ±2V to ±200V
Any current range ±20 μA to ±2A
Digital Ohmmeter 200Ω to 10MΩFS
Offset pot for 4-20 mA and others
Noise-rejecting balanced differential input
+5 Vdc power @ 280 mA

DM-3100N

±1.9999
DATEL·INTERSIL
DM 4100D

MICROBUSSABLE 3-STATE BCD DIFFERENTIAL

4½ digit data gated out in 4-bit nibbles, full parallel selectable
Connects directly to shared microprocessor busses
1000 Megohm input impedance, 5 pA bias current
Autozeroed, ratiometric to correct drift
5 Vdc power @ 580 mA

DM-4101D

SEND FOR YOUR FREE DIGITAL INSTRUMENT BROCHURE

DATEL

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• Santa Ana, CA (714) 835-2751 • Sunnyvale, CA (408) 733-2424 • Los Angeles, CA (213) 933-7256
• OVERSEAS: DATEL (UNITED KINGDOM) TEL. BASINGSTOKE (256)69085 • DATEL (FRANCE) TEL. 602 57 11
• DATEL (GERMANY) TEL. (89) 530741 • DATEL (JAPAN) TOKYO TEL. 793-1031 • DATEL (JAPAN) OSAKA TEL. 06-3542025

For More Information. Circle No. 268

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D.C. VOLTS
Shurite
D.C. AMPERES
A.C. VOLTS
D.C. VOLTS
A.C. VOLTS
A.C. VOLTS
A.C. VOLTS
Shurite model 750.
D.C. MILLIAMPERES
MODEL 750
D.C. AMPERES
A.C. AMPERES
D.C. MILLIAMPERES

The old reliables at old-fashioned prices with the new look.

Shurite Panel Meters.

Rugged and reliable from as far back as 1904.

They got even better. And better-looking.

And today, there are many more to choose from.

For both OEM*and end-user applications, write or phone for the new quick-selection guide for low cost panel meters from Shurite.

Or see your local distributor.

Shurite® METERS INC.
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260 combinations of models and ranges.
±5% accuracy.
****Special ranges and colors available.***

The Family of Jewell(s)
PANEL METERS/INDICATING & TEMPERATURE CONTROLLERS/AVIONIC PRODUCTS
DEGREES FAHRENHEIT
Jewell
AC VOLTS
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°C
ADC

- *Standard Panel Meters*
- *Custom Panel Meters*
- *Meter Relays & 1/4 Din Process Controllers*
- *Prime Flight Instruments*
- *Electro-Mechanical Mechanisms for Avionic & Other Precision Requirements*

Jewell

ELECTRICAL INSTRUMENTS, INC.
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Manchester, N. H. 03108
(603) 669-6400 Telex 74-3435

For over 45 years we've made standard and customized products which are reliable, rugged, accurate and competitively priced. This is how we've always done business . . . it's a family tradition.

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CORPORATION

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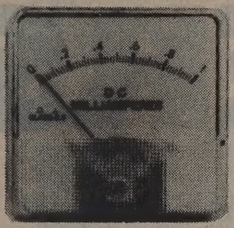
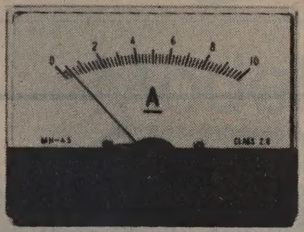
ANALOG PANEL METERS

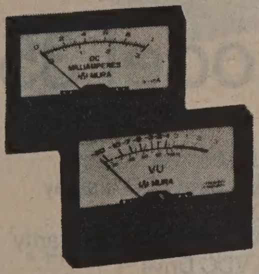


HMS Smart looking and economical. The HMS Series is available in case sizes 1¾", 2", 2½" and 3" square with ranges thru 300 volts or 30 amps, AC or DC, and VU. Meters are accurate to ±2.5% of their full scale sensitivity. Four stud mounting.

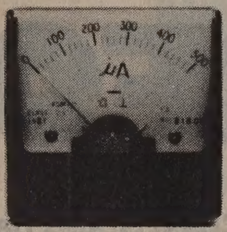


MH Classic styling in 2½, 3½ and 4½ inch case sizes. Available in ranges as follows: A.C.—10V to 300V, 1A to 30A; DC—50μA to 30A, 3 to 300V; VU. Four stud mounting. Optional illumination kit available.

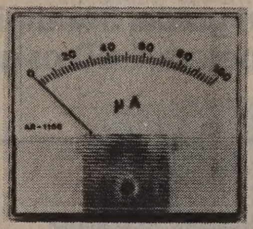
PM-700 Linear panel meters at non-linear meter prices. This internal d'Arsonval movement meter line is extremely versatile. The 5 basic measuring capabilities (50μA DC, 1mA DC, 10A DC; 150VAC and VU) can be greatly extended with the addition of an external series resistor. Each meter is packaged with detailed instruction sheet, with diagrams, describing the meter's various potential functions. Front illumination is available. Meters are 4 stud mounting.



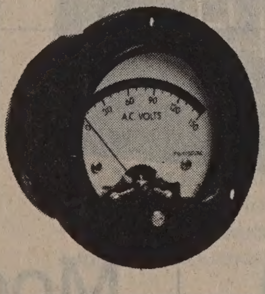
TLA The TLA Series is available in 2", 3" and 4" sizes. D.C. ammeters and voltmeters utilize moving coil type movements and are available in ranges from 50μA to 30A and 30mV to 500V. A.C. ammeters and voltmeters are either moving iron or rectifier type and are available in ranges from 200μA to 30A and 3V to 300V. Four stud mounting.



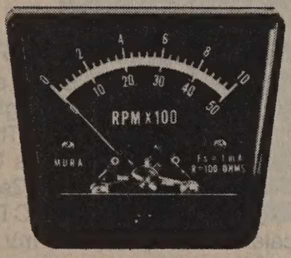
KSM Available in 2½", 3½" and 4½" case sizes. D-C ranges from 50μA to 30A and 50mV to 300V using moving coil type magnet. A-C ranges from 1A to 30A and 10V to 300V are the rectifier type.



AR Suitable for front or rear mounting. Available in 5 standard case sizes: 2", 2½", 3½", 4½" and 6". D.C. ranges are 50μA to 50A and 15V to 1KV. A.C. Ranges are 1mA to 10mA and 15V to 1KV. VU also available.



OPM Available in 4 standard sizes: 2", 2½", 3" and 4" diameter. DC ranges use moving coil type and AC ranges use either rectifier or moving iron. Ranges are identical to TLA Series.



TK-134 An extremely popular small panel meter that is moderately priced, available with front illumination, various pointer styles and is 4 stud mounting. Available in the same A.C. and D.C. ranges as the HMS Series.

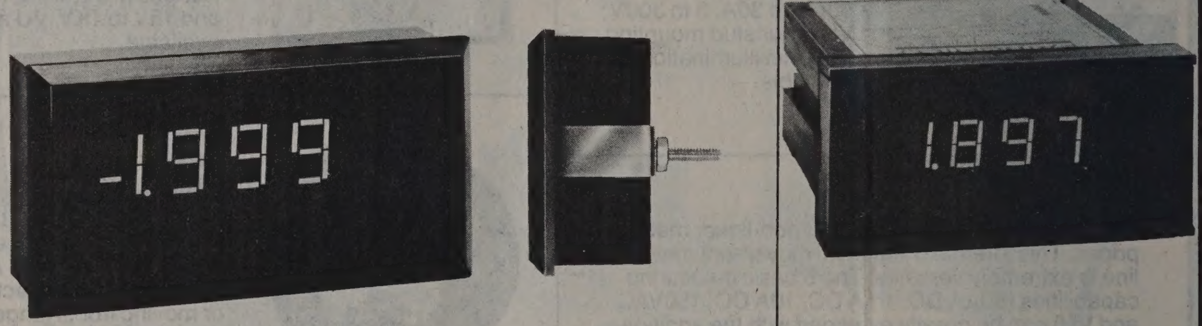
MFW Available in 2" and 3" window lengths. A.C. ammeters and voltmeters are rectifier type and are available in 100μA to 3mA and 3V to 300V. D.C. ammeters and voltmeters are moving coil type and are available in ranges 50μA to 3A and 10mV to 300V.

For More Information. Circle No. 271

GRALEX DIGITAL PANEL METERS

THE STAR PERFORMERS

From Coast to Coast Gralex has the DPM's you want, in stock, for quick delivery. And we can custom scale every meter to meet your specific application. Gralex state-of-the-art meters from 0.05%, 3½ digit, high-quality instrument grade, 3¾ digit units, AC line power meters, ¾″ deep units, true RMS meters, LED or gas planar.



Model 30

America's Largest Selling D.P.M.

LOW COST

- ±0.05% accuracy
- 3½ digit LED display
- 0.75″ Thick
- Draws 1 watt max.
- Auto Zero, Auto Polarity
- 5 VDC Drive • 2 volts full scale

Model 32

LOW COST

- ±.1% accuracy
- 3½ digit LED display
- 0.75″ Thick
- Draws 1 watt max.
- Auto Zero, Auto Polarity
- 5 VDC Drive
- 200 mV full scale

- New: Model 40 series—4½ digits in model 30 case size.

Model 35

- ±0.05% accuracy
- 3½ digit LED display
- Draws 1 watt max.
- Auto Zero, Auto Polarity
- 5 VDC Drive
- 2 volt full scale
- AC Drive 100, 115, 200, 230, Vac
- 5 VDC, 7-15 VDC

GRALEX
INDUSTRIES INC
295 Community Dr.
Great Neck, N.Y. 11021

(516) 487-7289
Outside N.Y.
(800) 645-6535

see vol. 4 for our immediate action card.

For More Information. Circle No. 272

GRALEX DIGITAL PANEL METERS

Model 36-4

Digital Panel Meter

- Instrumentation Input
- Adjustable conversion rate • External trigger
- Gas discharge display • Compact case

-1.999
GRALEX

GRALEX
3359

Model 37

Digital Panel Meter

• Gas discharge • Isolated BDC output option • Floating input • 4-20 mA transducer option • Event counter/voltmeter option • Reads to 3999

Model 37 DLM

Digital AC Line Monitor

The Modern Way to Read
AC Power Line Voltages:

- Gas discharge display • Ranges to 600V true RMS
- Floating input • Reads to 3999

GRALEX
3359

GRALEX
3359

Model 37-PVI

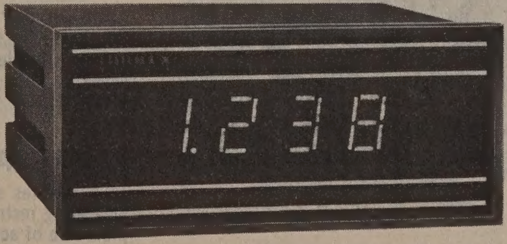
Digital Panel Meter
Scaleable Transducer Readout

- Custom scaled for any transducer
- Low Cost • Reads to 3999
- Ideal for industrial controls

Model 38-2

Digital Panel Meter

• Floating differential input • Economical BCD output option • High intensity LED display
• LSI reliability • NEMA case



GRALEX
INDUSTRIES

295 Community Dr.
Great Neck, N.Y. 11021

(516) 487-7289
Outside NY (800) 645-6535

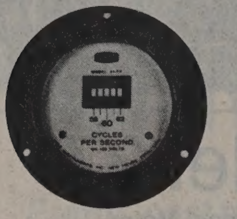
Gralex meters are available at these distributors:

Alabama, Summit, Dania, FL., 305-920-6253; **Arizona**, *Metermaster, Phoenix, AZ., 602-243-4111; Fisher-Brownell, Santa Clara, CA., 408-988-6041; **Arkansas**, Meters & Instruments, Houston, TX., 713-644-1631; **California LA**, Fisher-Brownell, Alhambra, CA., 213-770-0110; *Metermaster, LA CA., 213-685-4340; **Palo Alto**, Metercraft, Irvine, CA., 714-979-1420; Fisher-Brownell, Santa Clara, 408-988-6041; **San Diego**, Fisher-Brownell, San Diego, 714-231-1041; **Connecticut**, Bond Elec, Norwalk, CT., 203-852-1001; Calibron, Waltham, MASS., 617-894-6440; **Delaware**, Sunshine Scientific, Phila, PA., 215-673-5600; **Florida**, Summit, Dania, 305-920-6253; **Idaho**, Fisher-Brownell, Santa Clara, 408-988-6041; **Illinois**, *Metermaster, Elk Grove Village, 312-593-8650; Summit, Buffalo, NY., 716-884-3450; **Indiana**, *Metermaster, Chicago, IL., 312-593-8650; Summit, Buffalo, NY., 716-884-3450; **Iowa**, Fisher Brownell, Santa Clara, CA., 408-988-6041; **Kansas**, Fisher Brownell, Santa Clara, CA., 408-988-6041; **Kentucky**, P.I. Burks, Louisville, KY., 502-589-3960; **Louisiana**, Summit, Dania, FL., 305-920-6253; **Maine**, Calibron, Waltham, MA., 617-894-6440; AST Servo, No. Bellerica, MA., 617-667-8541; **Maryland**, Pyttronic Industries, Savage, MA., 301-792-0780; **Massachusetts**, Calibron, Waltham, MA., 617-894-6440; AST Servo, No. Bellerica, MA., 617-667-8541; **Michigan**, *Metermaster, Elk Grove, IL., 312-593-8650; Summit, Buffalo, NY., 716-884-3450; **Minnesota**, *Metermaster, Chicago, IL., 312-593-8650; Summit, Buffalo, NY., 716-884-3450; **Mississippi**, Summit, Dania, FL., 305-920-6253; **Missouri**, Fisher Brownell, Santa Clara, CA., 408-988-6041; **Montana**; **Nebraska**; **Nevada**, Fisher Brownell, Santa Clara, CA., 408-988-6041; **New Hampshire**, Calibron, Waltham, MA., 617-894-6440; AST Servo, No. Bellerica, MA., 617-667-8541; **New Jersey**, Instrument Mart, Great Neck, NY., 516-487-7430; **New York**, Instrument Mart, Great Neck, NY., 516-487-7430; Summit, Buffalo, NY., 716-884-3450; Summit, Rochester, NY., 716-334-8110; **N. Carolina**, Sunshine Scientific, Phila., PA., 215-673-5600; **N. Dakota**, Fisher-Brownell, Santa Clara, CA 408-988-6041; **Ohio**, Summit, Buffalo, NY., 716-334-8110; *Metermaster, Chicago, IL 312-593-8650; *Christie Lab, Cleveland, OH., 216-651-4100; **Oklahoma**, Fisher-Brownell, Santa Clara, CA., 408-988-6041; **Oregon**, Fisher-Brownell, Santa Clara, CA., 408-988-6041; **Pennsylvania**, Sunshine Scientific, Phila. PA., 215-673-5600; **Rhode Island**, Calibron, Waltham, MA., 617-894-6440; S. Carolina, Summit, Dania, FL., 305-920-6253; **Tennessee**, PI Burks, Louisville, KY., 502-589-3960; **Texas**, Meters & Instruments, Houston, TX., 713-844-1631; **Utah**, Fisher-Brownell, Santa Clara, CA., 408-988-6041; **Vermont**, Calibron, Waltham, MA., 617-894-6440; AST Servo Systems, N. Bellerica, MA., 617-667-8541; **Virginia**, Sunshine Scientific, Phila, PA., 215-673-5600; **Washington**, Fisher-Brownell, Santa Clara, CA., 408-988-6041; **W. Virginia**, Sunshine Scientific, Phila, PA, 215-673-5600; **Wisconsin**, *Metermaster, Elk Grove, IL., 312-593-8650; Summit, Buffalo, 716-884-3450; **Wyoming**, Fisher-Brownell, Santa Clara, CA., 408-988-6041.

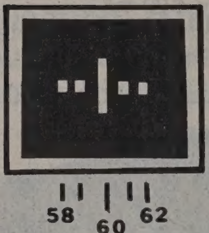
*MODEL 30, 31, 35 only

For More Information. Circle No. 272

J-B-T INSTRUMENTS



31-FX



TYPICAL RESPONSE PATTERN

VIBRATING REED FREQUENCY METERS

Operate on AC or interrupted DC to provide direct reading of frequency by viewing reed. Exceptional long-life and stability is assured by simple rugged construction. Standard meters are shown in table. Other styles and closer accuracies are available.

Model	Range Hz	Reeds	Hz/ Reed	Standard V.	Ω/V	Power Watts	Accuracy ±%	Size (In.)	Style
30-FX	48-52*	10	1	100-130	140	0.9	0.3	3½	Round Molded Case
31-FX	58-62†	5	1	100-130	120	1.0	0.3	3½	Round Molded Case
31-FX-7	57-63†	7	1	100-130	140	0.9	0.3	3½	Round Molded Case
33-FX	380-420	9	5	100-130	130	0.7	0.3	3½	Round Molded Case
34-FX	56-64†	9	1	100-130	140	0.9	0.3	3½	Round Molded Case
34-FX-Z	58-62†	9	0.5	100-130	140	0.9	0.2	3½	Round Molded Case
36-FX-21-115	380-420	21	2	100-130	130	0.7	0.3	3½	Round Molded Case
31-FHXX	58-62†	5	1	100-130	120	1.0	0.3	3½	Round Metal Case (Sealed)
31-FHXX-7	57-63†	7	1	100-130	140	0.9	0.3	3½	Round Metal Case (Sealed)
33-FHXX	380-420	9	5	100-130	130	0.7	0.3	3½	Round Metal Case (Sealed)
34-FHXX	56-64†	9	1	100-130	140	0.9	0.3	3½	Round Metal Case (Sealed)
36-FHXX-21-115	380-420	21	2	100-130	130	0.7	0.3	3½	Round Metal Case (Sealed)
23-FHXX	380-420	5	10	100-130	125	0.55	0.3	2½	Round Metal Case (Sealed)
15-FHAC	60 & 400	2	—	8-10	270	0.04	0.5	1½	Round Metal Case (Sealed)
15-FH-400	380-420	5	10	100-130	115	1.25	0.3	1½	Round Metal Case (Sealed)

* Also 58-62 † Also in 50 Hz range

NEW 34-FXP Portable Frequency Tester — To check generator loads, speeds, or performance; to verify unknown frequency at campsites; to simplify maintenance work, this 9-reed 56-64 Hz instrument is housed in a sturdy molded case 5½" x 5½" x 5¼" wide. Comes complete with prods and grounded plug-in cord.

FREQUENCY METER
380 400 420
CYCLES PER SECOND

33-FB

ELAPSED TIME METERS (NON-RESETTABLE)

Used to record operating time of AC equipment synchronously by 1/10th hour steps up to 9,999.9 or 99,999.9 hours.

31-EGW-5: Supplied in a jewel-like case 3½" wide and 3" high. Reading to 9,999.9 hours for 110-125 VAC, 60 Hz.

31-EGW: Same as 31-EGW-5 except reading to 99,999.9 hours. 110-125 VAC, 60 Hz.

Both models available with half-bezel adapters 3.83" wide x 2.27" high as 13A-239 (metal) or 13A-234 (molded plastic).

31-EXW-5: 3½" round style shown to left. Meter reads to 9,999.9 hours and automatically resets to zero. Tenths are red on white with units white on black. Meets MIL-M-6B. 110-125 VAC, 60 Hz.

31-EX: Similar to 31-EXW-5 but with smaller numbers; same 3½" round case. Reads to 9,999.9 hours. 110-125 VAC, 60 Hz.

31-EX-200: Same as 31-EX except for 200-240 VAC, 60 Hz.

31-EXW: Versatile elapsed time meter in 3½" round case reading to 99,999.9 hours with large numerals same size as 31-EXW-5 and interchangeable with all FX type frequency meters. 110-125 VAC, 60 Hz.

31-ES: Same readout as 31-EX except housed in 3" black square molded case. Reads to 9,999.9 hours. 110-125 VAC, 60 Hz.

34-FXP

TEMPERATURE TESTERS & ACCESSORIES

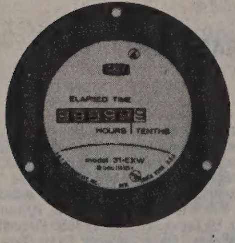
J-B-T supplies several widely-used temperature measuring instruments and testers with a complete line of accessories for each.

23-JP-1: Portable indicating pyrometer in black vinyl carrying case. Reads from zero to 650°F on 2.48" scale in 10°F increments and readable to 3°F. Automatic ambient temperature correction for accurate reading. Supplied with attached SA-199 thermocouple, clip and convection shield with 5½ foot long cord.

32-JP-7P: An extremely versatile and easy to read pyrometer in a handsome black vinyl carrying case. Reads 0-650°F on a large 4" scale. Is supplied with the SA-199P plug-in thermocouple, clip and convection shield with a 5½ foot long cord. Widely used for checking appliances and electronic equipment. Also available with scale reading 0-1200°F.

32-JG: Laboratory pyrometers in three ranges, 0-650, 0-1200 or 0-2000°F with large easy to read dial, thermocouple, lead and connector block. Normally supplied in sloping front stand.

Write for catalog of temperature measuring accessories.



31-EXW

CALL OR WRITE FOR GENERAL CATALOG 180

J-B-T INSTRUMENTS, INC., BOX 1818, NEW HAVEN, CONNECTICUT 06508
24 Hour Telephone (203) 776-1111

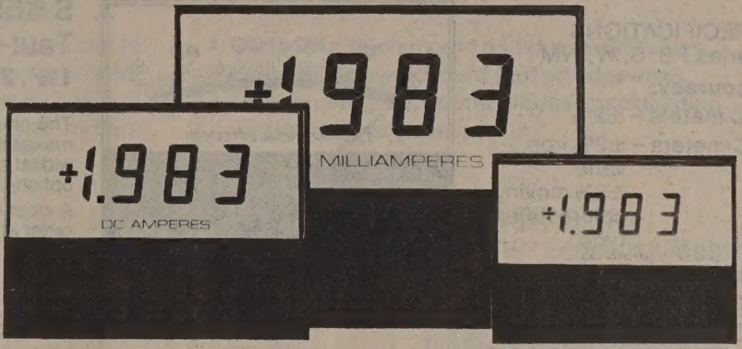
DIGITAL Panel Meters MODUTEC

D SERIES—LCD readout

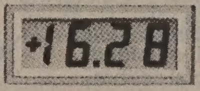
Surface Mount, Windo-Mount, Bezel Mount
2½", 3½", 4½" sizes

Interchangeable with Modutec S and W Series Analog Meters—same cases and covers, same cutouts, similar terminal arrangement.

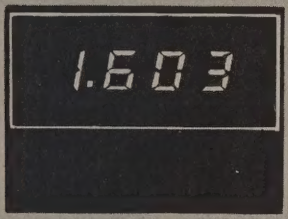
- Good looking—*the most copied* meter design.
- Extra-large 3½ digit LCD readout.
- 5 power options—very low dissipation (8000 hr. 9V battery life typical).
- Standard AC & DC ranges, plus PYROMETERS and LOOP RECEIVERS.
- True diffused backlighting available.
- Threaded terminal studs—hookup like analog counterparts.
- Automatic polarity and decimal.



2" edgewise style (flush mount only) also available.



DH SERIES—3"
LED readout

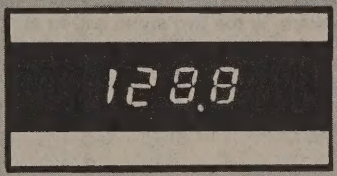


- **Extra-bright LED display, 11mm high.**
- **Flat back saves space and facilitates installation.**
- **Appearance compatible with Modutec D, S, and W Series.**
- **Automatic polarity indication.**
- **External decimal placement.**

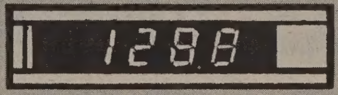
A versatile space-saver that can be surface mounted, requiring only two ¼" holes, or Windo-mounted. Seven wire leads, for signal, power, and decimal location, are carried through the hollow mounted studs.

DM SERIES—DIN case
LED readout
AC and DC ranges

For users who prefer cases conforming with the widely accepted DIN Standards. They are easily installed, requiring but a single rectangular panel cutout.



2DM Series—48 × 96mm size

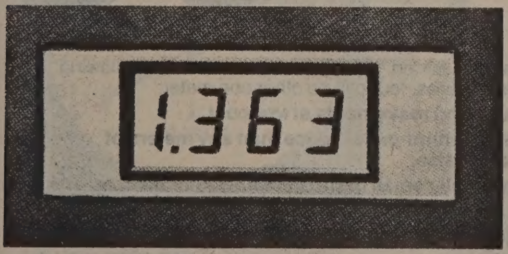


1DM Series—24 × 96mm size, DC only

- **Highly visible red LED display.**
- **Case configuration has worldwide acceptance.**
- **Attractive low-silhouette covers.**
- **Quick-connect push-on terminals.**
- **Automatic polarity indication.**

DT SERIES—DIN case
Excellent performance at low cost

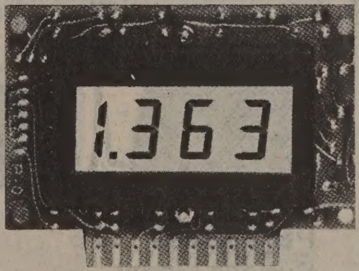
- **Choice of AC or DC power.**
- **Case has worldwide acceptance. 48 × 96mm size.**
- **Automatic polarity indication.**
- **Convenient screw terminals on barrier strip.**



Good-looking DIN cases are fitted with installation hardware; the LCD displays offer fine legibility and low power consumption. This series makes digital metering possible on a small budget.

DTU SERIES
LED Display Module

PCB digital display modules can be supplied in DC ranges only, at very low cost. A low battery indication (LOBAT) is available.



Also in the Modutec Digital Line, and available by date of publication:
—Ultra-compact flat LCD display meters, with or without true backlighting;
—Single bar graphs, horizontal & vertical;
—Double vertical bar graphs.

Request Catalog DM3 - For fast service phone 1-800-METERS-1

THORN EMI

Modutec Incorporated
A THORN EMI company
18 Marshall St., P.O. Box 778, Norwalk, CT 06856 ■ (203) 853-3636 ■ TWX 710-468-2039

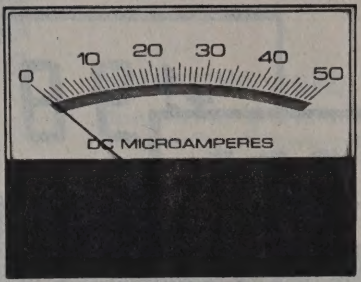
MODUTEC 2% Panel Meters

SPECIFICATIONS
Series PB, S, W, WM

Accuracy:
DC meters - ±2%
AC meters - ±2% iron vane
±3% moving coil rectifier type

Tracking:
DC meters - ±1.5%
AC meters - ±2%, all types

Shielding:
All types are self-shielded, require no special calibration for steel or non-ferrous panel mounting.



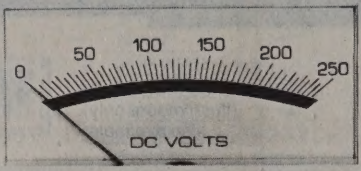
S SERIES—Surface Mount

Taut-band & Iron-vane types

1½", 2½", 3½", 4½", 5½", 8" sizes

The pleasing aspect ratio and impeccable styling of this series makes it the favorite among all panel meters. It is available in the widest spectrum of types and ranges, with many desirable factory options.

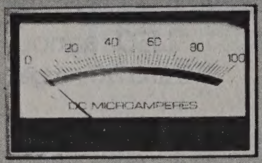
A clear cover version, finely ribbed on the inside, is available on order at no extra cost.



W SERIES— Windo-Mount

Taut-band & Iron-vane types

This original Modutec design provides a true flush mount, easily accomplished without special adapters. Attractive black or white edge options are available. **Ranges, sizes, prices:** Same as S Series, above.



Above: Style BA1 Below: Style BA3

0
20
40
60
80
100
DC MICROAMPERES

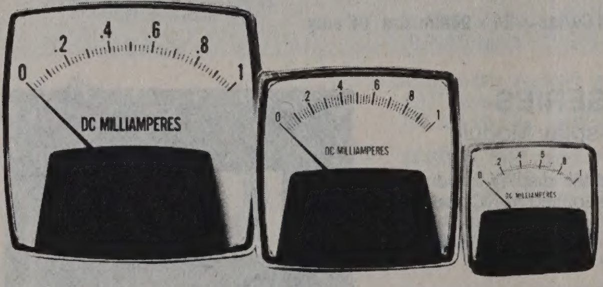
Bezel Mounts

Bezel mounts are available for the S Series meters, in the two styles shown at right. These high-strength units provide handsome protection and attach the meter securely behind the panel. All hardware included. May be ordered in colors as well as black, sizes 1½" through 5½".

Optional Features

The following options are available in Modutec 2% meters, at very reasonable extra cost.

- Improved accuracy
- Colored fronts & bezels
- Blank & custom dials
- Custom resistance
- Fast response
- Custom pointers
- High temperature case/cover
- ANSI symbols on dial
- Dead set pointer
- Illumination
- Mirror scale
- Heavy damping
- Single point calibration
- Tinted covers
- Improved resistance tolerance
- Sealed case
- Temperature compensation
- Unit packaging
- High resistance voltmeters
- Metric studs and terminals
- Insulated terminals
- Rear zero adjust



PB SERIES

Surface Mount

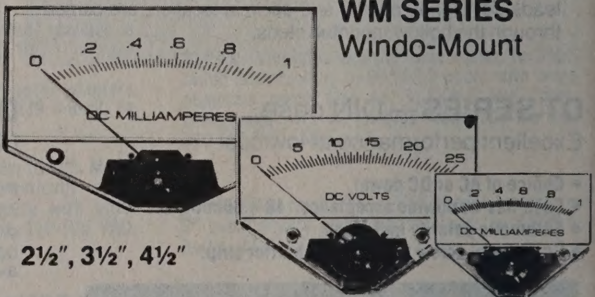
1½", 2½", 3½"—
Taut-band & Iron-vane

These meters have the bold-look styling that is preferred by many for industrial panel board applications. They have the same ranges and prices, size for size, as the S Series, above (VU ranges not available).

PB Series meters are furnished in the ANSI standard 3-stud mounting configuration, and are available for standard 4-stud mounting at no extra cost.

WM SERIES

Windo-Mount



2½", 3½", 4½"

These sophisticated "World Meters" have the following desirable features, found in no other one meter:

- **2% taut-band movements at low cost.**
- **Use less behind-panel space than any meters of equivalent size.**
- **Exceptionally small barrels are fully insulated.**
- **Front zero adjust standard, rear optional.**
- **Designed for shadow-free backlighting.**
- **Quick-connect terminals on case or barrel.**
- **Designed to facilitate PC board attachment.**
- **Many desirable options available.**

Request Catalog 185A - For quick action phone 1-800-METERS-1

THORN EMI

Modutec Incorporated
A THORN EMI company
18 Marshall St., P.O. Box 778, Norwalk, CT 06856 ■ (203) 853-3636 ■ TWX 710-468-2039

For More Information. Circle No. 274

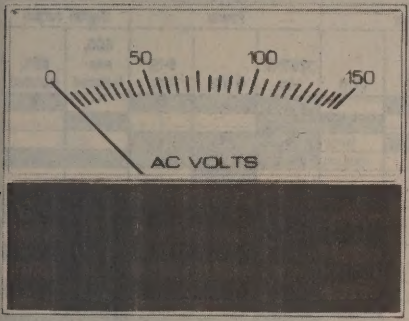
5% Panel Meters MODUTEC

M SERIES—Moving Magnet Type

For the user whose needs are served by their dependable 5% accuracy, these meters provide handsome styling at low cost, in several configurations. They are nicely finished and detailed, with features not usually found in meters anywhere near their price range.

- **Surface or flush mount without modification.**
- **Zero adjusters standard (not on edgewise).**
- **Translucent dials permit diffused backlighting (optional on edgewise).**

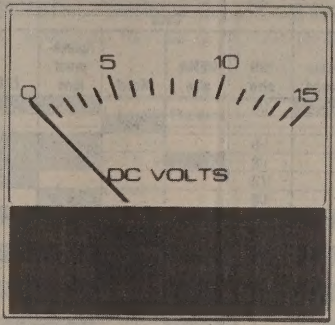
MAS Series—1½", 2½", 3½"



Beautiful contemporary designs with the typical Modutec low aspect ratio. All have operating zero adjusters and scales printed on translucent plastic, permitting reflection-free diffused backlighting.

Typical prices (500 units):
1½" DC voltmeter—$5.60
2½" DC voltmeter—$6.50
3½" DC voltmeter—$6.80

OMS (1½") & MSQ (2½") Series



Traditional square meters with the look of the 80s and a low price tag, these have operating zero adjusters and scales printed on translucent plastic, permitting reflection-free diffused backlighting.

Typical prices (500 units):
OMS Series DC voltmeter—$5.15
MSQ Series DC voltmeter—$6.20

MD, ME, & MF Series 1¼", 2", 2½" Edgewise Meters

DC AMPERES
0
2
4
6
8
10

Useful space-saving meters in three sizes, interchangeable with many meters from other sources, and featuring flat flush-to-panel covers. Internal backlighting optional on MD and MF meters.

Typical prices (500 units):
MD Series (1¼") DC voltmeter—$4.70
ME Series (2") DC voltmeter—$4.85
MF Series (2½") DC voltmeter—$6.10

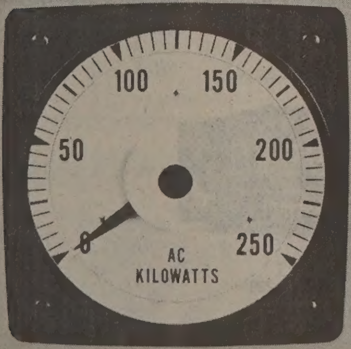
OPTIONS & MODIFICATIONS

Many desirable factory-installed options and modifications are available on M Series meters in quantities of 100 minimum. These are fully described in Catalog 125, available on your request.

Switchboard Meters MODUTEC

4SB Series—4½" Square

1% moving-coil and iron-vane types
Meet requirements of ANSI Spec C39.1 for switchboard instruments.

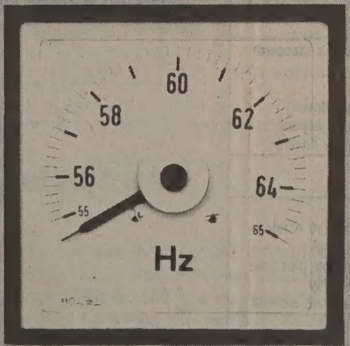


Available in the following ranges:

- DC Microammeters
- DC Milliammeters
- DC Ammeters
- DC Voltmeters
- AC Ammeters
- AC Voltmeters
- AC Varmeters
- AC Wattmeters
- Frequency Meters
- Synchroscopes

DN Series—DIN Spec Cases

Sizes: 48mm, 72mm, 96mm, 144mm
1½% moving-coil and iron-vane types
Meet IEC requirements

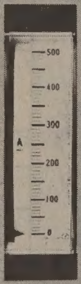


Available in the following ranges:

- DC Microammeters
- DC Milliammeters
- DC Ammeters
- DC Voltmeters
- AC Ammeters
- AC Voltmeters
- AC Varmeters
- AC Wattmeters
- Frequency Meters
- Synchroscopes

SBE Series—Edge Reading

Size (nominal) 1¾" × 6½"
Meet requirements of ANSI Spec C39.1 for edge-reading meters.



Available in the following ranges:

- DC Microammeters
- DC Milliammeters
- DC Ammeters
- DC Voltmeters
- AC Ammeters
- AC Voltmeters
- AC Varmeters
- AC Wattmeters
- Frequency Meters

Special Purpose Meters

Blue-Dot Meters— meet MIL environmental specs.
Control Meters— new approach to IC control.
Lite-Box Meters— built-in through-the-dial lighting.
Trans-Lit Meters—S & W meters with backlighting.
Write or phone for information and literature.

For full information phone 1-800-METERS-1

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A THORN EMI company
18 Marshall St., P.O. Box 778, Norwalk, CT 06856 ■ (203) 853-3636 ■ TWX 710-468-2039

NEWPORT

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Santa Ana, CA 92705 (714) 540-4914 • TWX: 910-595-1787

YOUR RELIABLE SOURCE FOR PANEL INSTRUMENTATION

MULTIPURPOSE DIGITAL PANEL METERS

MODEL 2004

Newport is your source for the most complete line of digital panel meters. Specialized models are available for a wide range of input signals. Input power can be 24 Vac, 120 Vac, 240 Vac, 5 Vdc, or 9-32 Vdc (isolated). Some models can take power directly off a 4-20 mA current loop (see Process Transmitter and Indicator Section).

Three types of displays are offered: LED, PGD (gas discharge), and LCD. Most units are designed for panel mounting in a standard 1/8 DIN cutout (92 x 45 mm). Some offer an optional case for mounting in a NEMA cutout (99.7 x 42.7 mm). Most models offer BCD as a standard feature or as an option to interface to printers, comparators, and other instruments.

			Signal					Case				Display			Power			Digital output	
Model	Display range (counts)	Readings per sec	DC	AC avg	AC rms	Process	Strain gauge	DIN size	NEMA size	Metal	Splash-proof lens	LED	LCD	PGD	120/240 Vac	5 Vdc	9-32 Vdc	BCD, non-isolated	BCD, isolated
QUANTA	± 1999	2.5	•	•	•	•	•	1/8			•	•	•		•	•	•		•
200A/S	± 1999	4-60	•							•				•	•			•	
201P	± 1999	2.5	•			•		1/8			•	•	•		•	•	•		
203A	± 1999	4	•	•	•			1/8	•		•	•			•	•	•	•	•
215	± 1999	2.5	•					1/16				•				•			
258	± 1999	.5-30	•					1/8			•			•	•			•	•
204B	± 3999	3.6	•	•	•	•	•	1/8	•		•	•			•	•	•	•	•
400A/S	± 3999	4-60	•							•				•	•			•	
204B, ER1	± 4999	3.5	•	•	•	•	•	1/8	•		•	•			•	•	•	•	•
400A/S, ER	± 4999	4-60	•							•				•	•			•	
204B, ER2	± 5999	3.4	•	•	•	•	•	1/8	•		•	•			•	•	•	•	•
2000B/S	±19999	4-30	•							•				•	•			•	
2003B	±19999	4.3	•	•	•		•	1/8	•		•	•			•	•	•	•	•
2520	±19999	2.5	•				•	1/16				•				•		•	
2000A/S	±39999	.5-20	•							•				•	•				•
2004	±39999	3.3	•	•	•	•	•	1/8	•		•	•			•	•	•	•	•
8203	±39999	4-30	•							•				•	•			•	
2004, ER1	±49999	3.2	•			•		1/8	•		•	•			•	•	•	•	•
2004, ER2	±59999	3.1	•			•		1/8	•		•	•			•	•	•	•	•
2004, ER3	±69999	3.0	•			•		1/8	•		•	•			•	•	•	•	•

QUANTA MODULAR METER/ CONTROLLERS

QUANTA LED

QUANTA LCD

The QUANTA series is a new achievement in modular 3 1/2-digit (± 1999 count) panel instruments. A universal, compact 1/8 DIN case houses a motherboard and up to three plug-in boards to provide an unmatched choice of signal conditioner inputs, analog outputs, and control outputs. Standard features of all QUANTA configurations include a screw terminal barrier strip for signal and power inputs and a 1 mV per count analog output to drive a chart recorder. The table serves as a configuration guide. Fully configured, scaled, and calibrated units are available from Newport's worldwide network of QUANTA distributors.

Model	Modules
Motherboards (with case & display)	
Q20xxx	LED, 120 Vac (50/60 Hz)
Q21xxx	LCD, 120 Vac (50/60 Hz)
Q22xxx	LED, 240 Vac (50/60 Hz)
Q23xxx	LCD, 240 Vac (50/60 Hz)
Q24xxx	LED, isolated 9-32 Vdc
Q25xxx	LCD, isolated 9-32 Vdc
Q26xxx	LED, 5 Vdc
Q27xxx	LCD, 5 Vdc
Q28xxx	LED, 24 Vac (50/60 Hz)
Q29xxx	LCD, 24 Vac (50/60 Hz)
Analog output boards (optional, maximum one)	
Q2x0xx	None (1 mV/count is standard)
Q2x1xx	0-5 Vdc
Q2x2xx	0-10 Vdc
Q2x3xx	0-1 mA (internally driven)
Q2x4xx	4-20 mA (internally driven)
Q2x5xx	4-20 mA (externally driven)
Control output boards (optional, maximum one)	
Q2xx0x	None
Q2xx1x	Dual-setpoint, dual 10 A relay
Q2xx2x	4-20 mA proportional
Q2xx3x	4-20 mA proportional plus time proportional 2 A relay
Q2xx4x	Parallel BCD, buffered, isolated
Signal conditioner input boards (one required, maximum one)	
Q2xxxA	DC voltage
Q2xxxB	DC current
Q2xxxC	AC AVG voltage
Q2xxxD	AC AVG current
Q2xxxF	AC RMS voltage
Q2xxxG	AC RMS current
Q2xxxH	Frequency/rate
Q2xxxJ	Type J thermocouple
Q2xxxK	Type K thermocouple
Q2xxxT	Type T thermocouple
Q2xxxN	3-wire ratio potentiometer
Q2xxxO	2- or 4-wire resistance
Q2xxxP	Process (span & zero adjust)
Q2xxxM	RTD, 1 degree resolution
Q2xxxR	RTD, .1 degree resolution
Q2xxxS	Strain gauge
Q2xxxZ	Prototype/kluge board

TEMPERATURE METERS

Newport offers a comprehensive line of DPMs for temperature measurement with direct thermocouple or 100-Ohm platinum RTD input. All models provide cold junction compensation, linearization, and scaling as needed to display degrees C or F. Input power can be 120/240 Vac, 5 Vdc, or isolated 9-32 Vdc. A plastic case for panel mounting in a 1/8 DIN cutout (92 x 45 mm) is standard. A bench-style case is optional.

QUANTA and Model 267B use signal conditioning boards for different inputs. Model 269 is a microcomputer based instrument which allows different thermocouple types to be selected by plug-in jumpers. Fully configured units of all series are available from Newport or its worldwide network of distributors.

MODEL 269

		Thermocouple type								RTD resolution			Display		Digital output		
Model	Range (counts)	J	K	T	E	R	S	B	W	1.0°	0.1°	0.01°	LED	LCD	BCD non-isolated	BCD isolated	Serial ASCII
QUANTA	−1999 to +1999	•	•	•						•	•		•	•		•	
267B	−2000 to +7800	•	•	•	•	•	•	•	•	•	•	•	•			•	
268	−1999 to +1999	•	•	•	•	•				•	•		•		•	•	
269	−1999 to +7999	•	•	•	•	•	•						•				•

For More Information. Circle No. 275

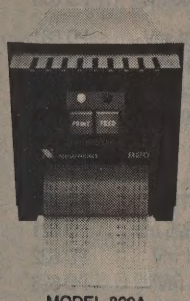
NEWPORT

Newport Electronics, Inc. 630 E. Young St.,
Santa Ana, CA 92705 (714) 540-4914 • TWX: 910-595-1787

European Subsidiaries	*Phone*	*TLX*
The Netherlands	*(025) 2687381*	*71287 (NEWPT NL)*
German Federal Republic	*(7056) 3017*	*726157 (NEWPT D)*
England	*(0438 65671*	*826454 (NEWPEL G)*
France	*(3) 0621400*	*697797 (NEWPORT 697797F)*

YOUR RELIABLE SOURCE FOR PANEL INSTRUMENTATION

PANEL-MOUNT COMPACT PRINTERS


MODEL 820A

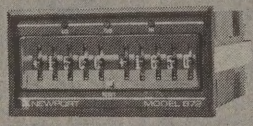
Newport's printers are compact, microcomputer controlled units for panel mounting in a standard 1/4 DIN cutout (92 x 92 mm). All models can print 20 columns at up to 1.5 lines per second on internally-stored thermal paper.

Model 820A features a built-in time-of-day clock and can turn any DPM or other instrument with BCD output into a datalogger by printing days, hours, minutes, readings, and engineering units. The addition of a Model 320 BCD bus controller allows one Model 820A printer to record data from up to 15 instruments.

Model	Interface	Special Features
820A	BCD, character serial BCD, character parallel	Time-of-day clock, .6 sec to 2 hr print intervals
821	RS-232C or TTL serial ASCII 20 mA serial ASCII Centronics parallel ASCII	5 x 9 dot matrix, 102 alphanumeric characters
822	IEEE-488, listener	5 x 9 dot matrix, 102 alphanumeric characters
320	BCD bus controller	Connects up to 15 DPM's with BCD output to Model 820A printer

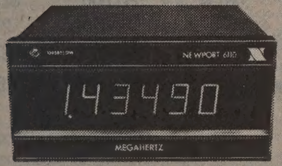
DIGITAL COMPARATOR/ CONTROLLERS

Newport's comparator/controllers accept BCD output from a DPM or other instrument and compare it to one (Model 871) or two (Model 872) thumbwheel-programmable setpoints to open or close 5A Form-C relays. They are designed for panel mounting in a 1/8 DIN cutout (92 x 45 mm). Model 872 can control one channel with hysteresis, one channel with two switching points for three-zone control, or two independent channels.


MODEL 872

Model	Relays	Control Function
871	1	HI-LO (1 channel)
872	1 2 2	HI-LO w/ hysteresis (1 channel) HI-GO-LO (1 channel) HI-LO and HI-LO (2 channels)

TACHOMETER/COUNTER/TIMERS AND CLOCK



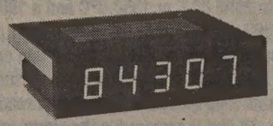
MODEL 6110

Models 6110 and 6130A can be used as tachometer, event counter, or time interval counter over a wide dynamic range. Model 6110 features a gas discharge display and a metal case. Model 6130A is an LED unit in a plastic case for panel mounting in a 1/8 DIN cutout (92 x 45 mm). Model 6720 is a 12- or 24-hour panel mountable clock with remote stopwatch capability. All units provide BCD output.

Model	Maximum counts	Frequency range	Frequency gate period	Stopwatch resolution
6110	999,999	DC to 1 MHz	10 µs to 6 sec	1 µs to 10 sec/count
6130A	99,999	DC to 10 MHz	100 ms to 10 sec	1 µs to 10 sec/count
6720	23:59:59	50/60 Hz line or internal crystal		1 sec

5-DIGIT REMOTE DISPLAYS

These units accept BCD output from a DPM or other instrument to provide a remote .56" LED display. The appearance is that of a 1/8 DIN DPM (Model 6152) or 1/16 DIN DPM (Model 6153).



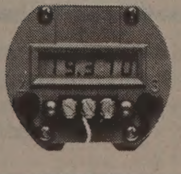
MODEL 6153

Model	Power	Panel Cutout
6152	120/240 Vac or 5 Vdc	92 x 45 mm
6153	5 Vdc	92 x 22.5 mm

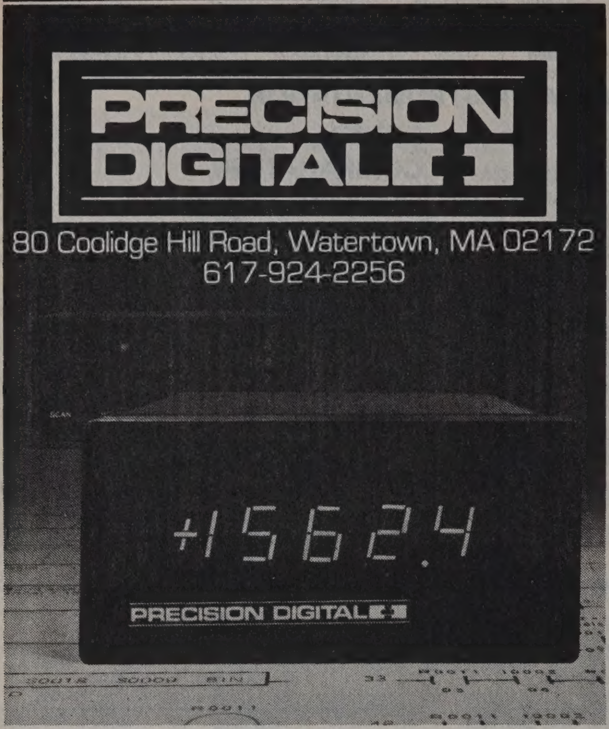
PROCESS TRANSMITTER AND INDICATORS

MODEL 502

Model 502 is a 4-20 mA two-wire thermocouple transmitter with outstanding industrial specs: waterproof housing, −40 to 85°C operating temperature, 500 Vrms input-to-output isolation, 120 Vac differential input and output protection, and 9 to 45 Vdc supply compliance. Model 508 is a current loop indicator, which derives its power directly from the current loop with a 2.5 Vdc voltage drop. Its 5-digit LCD readout can be programmed to show engineering units. It features the industrial specs of Model 502. Model 558 is an unsealed version of Model 508 for panel mounting in a 1/8 DIN cutout (92 x 45 mm). A splashproof lens is optional.


MODEL 508

Model	Operating temperature	Input	Output	Programmable scaling	Case
502	−40 to 85°C	J, K, E, T thermocouples	4-20 mA	Zero Suppression to 800°C Span ranges from 50°C	63.5 mm H x 51.8 mm D Hockey puck
508	−40 to 85°C	4-20 mA, or 10-50 mA	±19990 display	±full scale zero 10% to 100% span	63.5 mm H x 51.8 mm D Hockey puck
558	0 to 60°C	4-20 mA, or 10-50 mA	±19990 display	±full scale zero 10% to 100% span	1/8 DIN, 84 mm D plastic case



PRECISION DIGITAL

80 Coolidge Hill Road, Watertown, MA 02172
617-924-2256

Precision Digital's line of digital meters allows the specifiers so many options and different models that virtually any requirement can be met with a standard model. There are readouts for thermocouple, process control loop, AC volts and current, etc. Plus BCD outputs for programmable controller and computer. And also an alarm option with two independent channels for HI and LO alarm or for perhaps WARNING and ALARM functions.

Our research and development programs assure you of the latest advancement in meter technology like our new Thermocouple readouts which read to 1/10 degree up to 2000.0° F or 1350.0°C and a 100 ohm platinum RTD readout that reads to 1/100 degree. Both these new high performance developments have auto zero input circuits to virtually eliminate errors from drift. Another PDC development is the bulit-in transducer power supply in the strain gauge/load cell and the control loop readouts. Systems for readout only are greatly simplified by this feature. All that is required is the signal source and a Precision Digital meter. One meter can be made to do the work of 8, or even 128, using the Panelmux. The Panelmux and Precision Digital Meter are an ideal combination for a multipoint alarm system, or for bringing several analog signals into a programmable controller.

THERMOCOUPLE

INPUT	DISPLAY	STEP	MODEL	PRICE
J	−274 to 1340°F	1.0°F	PD 720 FJ	$230
J	−170 to 725°C	1.0°C	PD 720 CJ	230
J	−274.0 to 1340.0°F	0.1°F	PD 740 FJ	276
J	−170.0 to 725.0°C	0.1°C	PD 740 CJ	276
K	−165 to 1999°F	1.0°F	PD 720 FK	$230
K	−110 to 1350°C	1.0°C	PD 720 CK	230
K	−165.0 to 1999.9°F	0.1°F	PD 740 FKA	276
K	−165 to 2460°F	1.0°F	PD 740 FKB	276
K	−110 to 1350.0°C	0.1°C	PD 740 CK	276
T	−330 to 750°F	1.0°F	PD 720 FT	$230
T	−200 to 400°C	1.0°C	PD 720 CT	230
T	−330.0 to 750.0°F	0.1°F	PD 740 FT	276
T	−200.0 to 400.0°C	0.1°C	PD 740 CT	276
S	570 to 3130°F	1°F	PD 740 FS	$276
S	300 to 1725°C	1°C	PD 720 CS	230
R	482 to 3180°F	1°F	PD 740 FR	$276
R	250 to 1750°C	1°C	PD 740 CR	230
E	−150 to 1470°F	1°F	PD 720 FE	$230
E	−100 to 800°C	1°C	PD 720 CE	230

DC VOLTS

INPUT	DISPLAY	STEP	MODEL	PRICE
199.9 mV DC	0 to ±199.9	0.1 mV	PD 632	$103
1.999 V DC	0 to ±1.999	1 mV	PD 633	97
19.99 V DC	0 to ±19.99	10 mV	PD 634	103
199.9 V DC	0 to ±199.9	100 mV	PD 635	103
199.99 mV DC	0 to ±199.99	.01 mV	PD 661	$226
1.9999 V DC	0 to ±1.9999	.1 mV	PD 662	176
19.999 V DC	0 to ±19.999	1 mV	PD 663	186
199.99 V DC	0 to ±199.99	10 mV	PD 664	186

AC VOLTS

INPUT	DISPLAY	STEP	MODEL	PRICE
50.00 mV AC	0 to 1999	.025 mV	PD 621	$210
199.9 mV AC	0 to 199.9	.1 mV	PD 622	210
1.999 V AC	0 to 1.999	1 mV	PD 623	210
19.99 V AC	0 to 19.99	10 mV	PD 624	210
199.9 V AC	0 to 199.9	1 V	PD 625	210
50.000 mV AC	0 to 19999	.0025 mV	PD 650	$276
199.99 mV AC	0 to 199.99	.01 mV	PD 651	276
1.9999 V AC	0 to 1.9999	.1 mV	PD 652	276
19.999 V AC	0 to 19.999	1 mV	PD 653	276
199.99 V AC	0 to 199.99	10 mV	PD 654	276

AC CURRENT

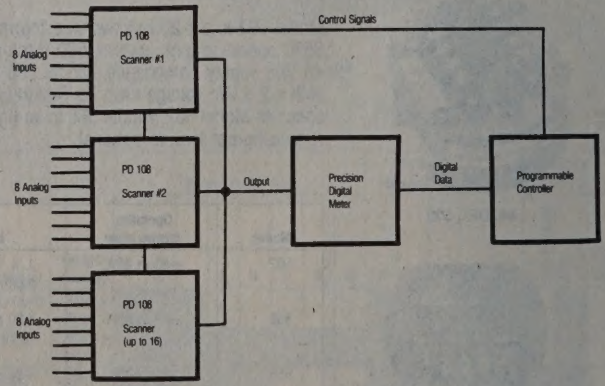
INPUT	DISPLAY	STEP	MODEL	PRICE
19.99 Amp AC	19.99	.01 A	PD 621*	$210
199.9 Amp AC	199.9	.1 A	PD 621*	210
1999 Amp AC	1999	1 A	PD 621*	210
19.999 Amp AC	19.999	.001 A	PD 650*	$276
199.99 Amp AC	199.99	.01 A	PD 650*	276
1999.9 Amp AC	1999.9	.1 A	PD 650*	276

*With user supplied 5 A, 50 mV shunt and current transformer rated at 20A/5A, 200A/5A or 2000A/5A.

CONTROL LOOP

INPUT	DISPLAY	MODEL	PRICE
4 to 20 mA	3 1/2 Digits. Low and high	PD 637*	$230
10 to 50 mA	display may be set by user	PD 638	230
1 to 5 V	anywhere between ±1999.	PD 639*	230
4 to 20 mA	4 1/2 Digits. Low and high	PD 670*	$276
10 to 50 mA	display may be set by user	PD 671	276
1 to 5 V	anywhere between ±19.999.	PD 672*	276

Factory calibration $20.00
*Built-in control loop power supply with 20 mA output at 20 VDC.



For More Information. Circle No. 276

RTD

INPUT	DISPLAY	STEP	MODEL	PRICE
100Ω Platinum	−150.00 to 199.99°F	.01°F	PD 530	$276
	−150.1 to 1000.0°F	0.1°F	PD 531	276
	−100.00 to 199.99°C	.01°C	PD 532	276
	−100.0 to 600.0°C	0.1°C	PD 533	276
100Ω Platinum	−150.0 to 199.9°F	0.1°F	PD 510	$230
	−150 to 1000°F	1°F	PD 511	230
	−100.0 to 199.9°C	0.1°C	PD 512	230
	−100 to 600°C	1°C	PD 513	230
Thermistor	0.0 to 100.0°C	0.1°C	PD 501	$230
	−30.0 to 50.0°C	0.1°C	PD 502	230
	32.0 to 199.9°F	0.1°F	PD 503	230
	−22.0 to 122.0°F	0.1°F	PD 504	230
10ΩCopper	−100 to 260°C	1°C	PD 515	$270
	−148 to 500°F	1°F	PD 516	270
120Ω Nickel	−10 to 320°C	1°C	PD 517	$270
	14 to 600°F	1°F	PD 518	270
604Ω Ni Fe	−200 to 110°C	1°C	PD 519	$270
	−85 to 260°C	1°C	PD 520	270
	−328 to 230°F	1°F	PD 521	270
	−121 to 500°F	1°F	PD 522	270

STRAIN GAUGE/LOAD CELL

INPUT	DISPLAY	MODEL	PRICE
350 Ohm strain gauge/load cell.	3 1/2 Digits. Scale set by user for any display between 200 and 1999	PD 640	$230
	4 1/2 Digits. Scale set by user for any display between 200 and 19.999.	PD 675	$276

Factory Calibration $20.00
Power Supply for 350 ohm bridge excitation built in.

OPTIONS for PRECISION DIGITAL METERS

DASH #	FUNCTION	PRICE
-1	5 VDC, 350 mA power, regulated ±5%	N/C
-2	8 to 28 VDC, 350 mA power, unregulated	$19
-3	110 VAC ±20%, 50 to 400 Hz power	19
-4	220 VAC ±20%, 50 to 400 Hz power	19
-5	Alarm, 2 independent channels	89
-6	BCD output, microprocessor format	95
-7	BCD output, digit serial format	49
-8	BCD output, parallel output	49
-9	BCD output, digit serial, 4 1/2 digit	95
-R	Special range calibration for PD 600 Series Specify input voltage and display	25
-L	Faceplate label up to 6 letters	20

PANELMUX

PD 108 Panelmux*	**$276.00**
PD 102 Panelmux Interface	**95.00**

The Panelmux is an Automatic Scanner that handles a large number of different types of signals such as thermocouple, RTD, control loop, strain gauge, load cell, AC and DC volts, etc. Each Panelmux can handle up to 8 inputs and up to 16 Panelmux may be ganged together to serve up to 128 points. The Panelmux is housed in the same DIN case as the Precision Digital Meters.

Multi-channel alarm systems can be constructed using one or more Panelmux feeding into a single Precision Digital Meter equipped with the Alarm option. A more elaborate system with a programmable controller for alarm and control is shown below.

PANELMUX OPTIONS

DASH #	FUNCTION	PRICE
-1	5 VDC, 350 mA power, regulated ±5%	N/C
-2	8 to 28 VDC, 350 mA power, unregulated	$19
-3	110 VAC ±20%, 50 to 400 Hz power	19
-4	220 VAC ±20%, 50 to 400 Hz power	19
-5	PD 102 Digital Control Interface	95

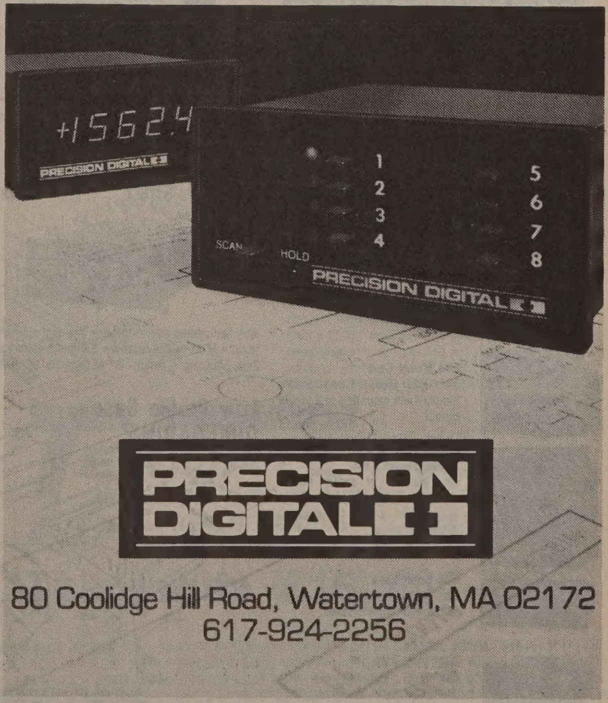
ORDERING GUIDE FOR PRECISION DIGITAL METERS

Precision Digital Meter Model Numbers are of the form:
PD XXX (XX) -X-X-X-X

MODEL NO.	( )
INPUT*	
Fahrenheit	F
Celsius	C
TC type, J, K, T, E, R, S.	( )
POWER	
5 VDC	1
8-28 VDC	2
110 VAC ±20%, 50/400 Hz	3
220 VAC ±20%, 50/400 Hz	4
ALARM	
No Alarm	N
PD 162 Alarm	5
DIGITAL OUTPUT	
None	N
PD 161#	6
PD 163#	7
PD 165#	8
PD 167	9
Special Range Calibration	R
Label on Faceplate	L

*For PD 720 and PD 740 thermocouple models only.
For 3½ digit models only.

The Model Number for a type J thermocouple PDM, reading to 0.1° F, 110 VAC power, alarm and no BCD output is: PD 740-FJ-3-5-N. The cost is $384.00.



80 Coolidge Hill Road, Watertown, MA 02172
617-924-2256

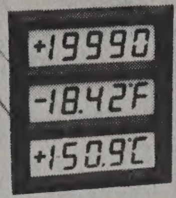
TEXMATE INC

Texmate employs no sales representatives or salesmen, so none will call on you. Instead we offer factory direct contact, quality products, fast delivery and lower prices.

2-WIRE PROCESS DPM's

POWERED DIRECTLY FROM THE SIGNAL CURRENT LOOP

CM-35X $75 — $64 (100's)



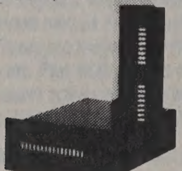
Powered by 4 to 20mA signal loop power • No external power source required • Translates 4 to 20mA input into 0 to 1999 digital display • May be user scaled to any required engineering unit • Programmable extra digit for use as trailing "0" or as °C or °F descriptor • 48" LCD display • Bipolar • 50 PPM TC • Programmable decimals • Safe for hazardous areas • Available in stackable cases as shown

CM-35XHC $79 — $67 (100's)

Identical features to the CM-35X but configured for operation from 10 to 50mA signal loop current

ANALOG METERS

AM-20 $49 — $41 (100's)



Rugged Versatile Solid State Analog DPM • Accuracy ±2% of Full Scale • 10 Meg Ω Input Impedance • User Programmable for Bargraph Display • Moving Dot Display • Moving Proportional Brightness 3 to 4 Dot (slinky) Display • 0-4V FS to 0-1200V FS Input • 4/20mA Input • Offset Capability • Bipolar Center Zero Null Meter • Unipolar Center Zero with expanding Bar or intersecting Bars • Selectable LED Scale Points • Flashing Overrange • Overrange Alarm Output • 5V DC Pwr Bar Mode • 4V to 24V DC Pwr Dot Mode

AM-20S $65 — $56 (100's)

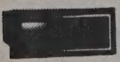
Solid State Dual or Single Set Point Controller • Set Point Accuracy ±1% • 20 Selectable Set Points • Two Opto-Isolated Relay or Alarm Drivers • Max Off Voltage 30V • Max on current 200mA • 5V DC Pwr Bar Mode • 4V to 24V DC Pwr Dot Mode

Texmate's Popular Low Profile 1" x 2½" DPM Cases

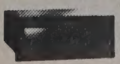
For Twin Mounting or multiple arrays order your DPMs in cases to suit your panel layout.

End Mount Case
Two End Mount Cases enable simple Twin mounting in a single cutout.

Center Mount Case
Any number of center mount cases may be fitted between two end mount cases for multiple mounting arrays.



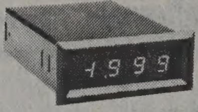
Full Bezel Case
has complimentary styling to multiple mounting cases.



Slim Line Case
Standard Texmate case with attractive matte finish.
(Shipped with all orders unless otherwise specified.)

DIGITAL PANEL METERS

PM-35U $39 — $29 (100's)

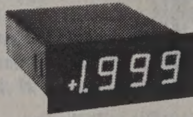


Lowest prices quality 3½ digit DPM available • Bright .3" LEDS • Differential Inputs • Bipolar • Auto Zero • Ratiometric • OHMs/Amps • Programmable Decimals • 200mV 2V 20V 200V 1200V rgs • Edge connector or direct solder tab connections • TC 100 ppm typ. 200 max. • 4V DC Pwr

PM-35A $49 — $37 (100's)

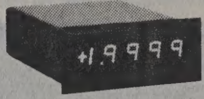
Popular, general purpose 3½ digit instrument. More than 50,000 units have been installed throughout the world in thousands of different applications, attesting to the meter's reliability • Differential Inputs • Programmable Current & Ohmmeter Capability • Ratiometric • 200mV 2V 20V 200V 1200V inputs • Scaling in Engineering Units with Offsets • Lamp Test • Low TC 50 ppm Typ. • Auto Zero • Bipolar • Programmable Decimals • 5V DC Pwr

PM-35AR $74 — $63 (100's)



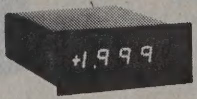
World's Smallest Size Lowest Priced Autoranging DPM. Has all the features of the PM-35A except Ratiometric ohms measurement • Autoranges between 200mV-2V, 2V-20V, 20V-200V, 200V-1200V • 1000 meg Ω input impedance on 200mV-2V range, 10 meg Ω on others • Auto Switching Decimals • Programmable to Display Engineering Units • 5V DC Pwr

PM-45 $79 — $67 (100's)



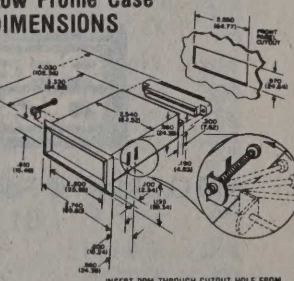
Popular economical 4½ Digit DPM • Single ended Input • MUX BCD Available • Sample & Hold • Leading Zero Blanking • 0.015% Rdg Accuracy • .0001 volt resolution • Ratiometric • Bright .3" LEDs • 5V DC Pwr

PM-3.5 $59 — $50 (100's)



Very fast update rate available • 3½ digit • Single ended Input • MUX BCD Available • Sample & Hold • Leading Zero Blanking • Bright .3" LEDs • 5V DC Pwr

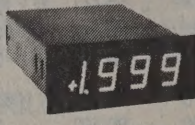
Low Profile Case DIMENSIONS



INSERT DPM THROUGH CUTOUT HOLE FROM FRONT OF PANEL. ATTACH MOUNTING BRACKETS AND SCREWS AS SHOWN. USING SECOND SLOT WHEN PANEL THICKNESS IS GREATER THAN ¼ INCH. TIGHTEN SCREWS AGAINST REAR OF PANEL.

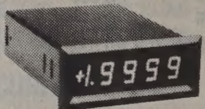
DIGITAL PANEL METERS

PM-35D $59 — $50 (100's)



Super Bright .56" LEDs • 20mA Drive Per Segment • HI/Rel Design for Long MTF • Accuracy ± (.05% reading +1 digit) • Sample Hold Feature • Ideal Replacement for Low Drive capability single chip DPMs
The PM-35D is a full feature 3½ Digit Instrumentation DPM • Full Differential Inputs • Bipolar • Auto Zero • Ratiometric • 4/20mA • Ohmmeter/Ammeter • Programmable Decimals • Scaling in Engineering Units with offsets • Low TC • Lamp Test • Sample Hold • ±12V DC @ 5mA Power Output from Internal DC to DC Convertor • 5V DC pwr

PM-45D $100 — $86 (100's)

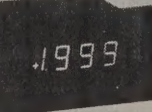


Ultra Stable, Super Accurate Top of the Line 4½ Digit Instrument • Accuracy ± (.01% reading + 1 digit) • Differential Input • 10 Micro Volt Resolution • 200K Hz Quartz Crystal Clock for 120dB 50/60 Hz Normal Mode Noise Rejection • 80 dB Common Mode Rejection at DC.
The PM-45D represents the ultimate in miniature Hi Rel DPM Design featuring very bright .4" LEDs • 4/20mA Inputs • Ohmmeter/Ammeter Ratiometric • Programmable Decimals • Scaling in Engineering units with Offset • +7 to −3V Common Mode Voltage • Sample and Hold • Usable at 0 to 100mV to display 0 to 20,000 Counts • Internal Altenuator for 2V, 20V, 200V, 1200V Rgs • Lamp Test • Overrange Output • Busy Output • Clock Output • 5V DC Pwr

SECOND SOURCE DPM'S

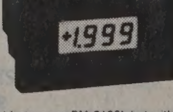
SHORT DEPTH CASES TO FIT DATEL AND IMC PANEL CUTOUTS

DM-3100L $49 — $42 (100's)



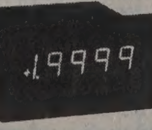
Low cost short depth DPM • (.05% Rdg + 1 Digit) accuracy • Differential input • .56" LED display • Autozero • 200mV to 1200V FS • Auto Polarity • 5VDC Pwr • Ratiometric • Current • Ohms • Programmable decimals

DM-3100X $65 — $56 (100's)



Identical features as DM-3100L but with low power 0.5" LCD display • Battery Pwr or 5/9VDC Pwr

DM-4100L $85 — $72 (100's)

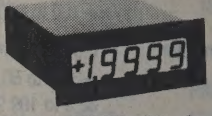


Low cost general purpose 4½ digit DPM • (.01% Rdg + 1 Digit) accuracy • 100 microvolt resolution • .56" LED display • Autozero • 2V to 1200V FS • Auto polarity • 5VDC Pwr • Sample/hold • Ratiometric • Ohms • Programmable decimals • MUX BCD output available

ENERGY MISER LOW POWER DIGITAL PANEL METERS

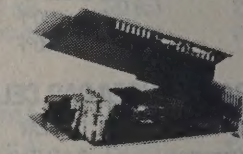
Incorporating TEXMATE's propriety Hi-Rel Hi-Contrast 0.48" LCD Displays

PM-45X $150 — $129 (100's)



Smallest 4½ digit .48" LCD DPM available • Super stable temperature compensated reference • (0.01% Rdg + 1 Digit) accuracy • True differential & single ended inputs • 100KHz quartz crystal controlled clock for 120dB 50/60Hz NMR • 80dB CMR • 200mV to 1200VFS • 4/20mA • Ohms • Current • Ratiometric • Programmable decimals • Scaling in engineering units with offset capability • Overrange/underrange output • Busy Output • Clock output • Run/Hold • MUX BCD output • Ultra low power requirements 3~5mA at +4.5V to +5.5VDC (25mW)

PM-45XBCD $180 — $153 (100's)



The worlds smallest 4½ Digit DPM with a buffered Tri-State parallel BCD output is created by adding an internally mounted PCB to the standard PM-45X. Data outputs include polarity • overrange and underrange • Data Ready • Controls include Run/Hold • Clear and Output Select • Interconnection is by a standard 26 pin PCB to ribbon cable connector

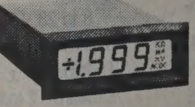
PM-45XU $97 — $87 (100's)

Low cost utility version of the PM-45X. Has all the same low power features of the PM-45X except uses a standard TC reference and has derated specifications • Accuracy (0.015% Rdg +2 Digits)

PM-45XUBCD $127 — $108 (100's)

All the same features as the PM-45XU but with an internally mounted buffered Tri-state parallel BCD output

PM-35X $65 — $52 (100's)

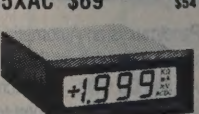


Versatile 3½ digit low pwr LCD meter • Wide operating voltage range capability 3.5V to 50VDC @ 4/15mA • Differential inputs • Programmable current & Ohmmeter capability • Ratiometric • 200mV 2V 20V 200V 1200V inputs • Scaling in Engineering units with offset • Lamp test • Auto zero • Bipolar • Programmable decimals • 8 selectable Function Descriptors

PM-35XAR $81 — $69 (100's)

Autoranging LCD DPM • Has all the features of the PM-35X except Ratiometric Ohms • Autoranges between 200mV-2V, 2V-20V, 20V-200V, 200V-1200V • 1000megΩ input impedance on 200mV-2V range. 10megΩ on others • Decimals and Descriptors can be programmed to Auto Switch • 3.5V to 50V DC pwr

PM-35XAC $69 — $54 (100's)



The World's smallest 115/230V AC Line Operated DPM, Fully Isolated with internal transformer.
PM-35XAC has all the features of the PM-35X but with AC pwr • can also operate from DC Voltages of 9V DC to 50V DC.

PM-35XACAR $85 — $73 (100's)

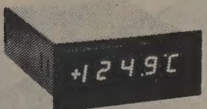
Auto ranging version of PM-35XAC has all the features of the PM-35XAR but operates from 115/230VAC power

For More Information. Circle No. 277

Ask about our new ruggedized, dust and waterproof Industrial Panel Meter line. For complete data sheets and application notes on these and other Texmate measurement and control products, call (619) 481-7177.

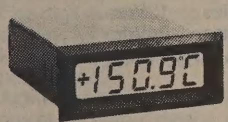
TEMPERATURE METERS

TM-150/150F $55 $47 (100's)
TM-150R/150RF $59 $50 (100's)



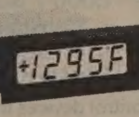
Low cost direct reading temperature meters 0.3"LED • 5V DC pwr • TM-150 and TM-150F are configured for voltage and current sensing and are factory prescaled to display °C and °F with popular IC transducers such as NSC LM 135, LM 235, LM 335 or Analog Devices AD590 sensors • TM-150R and TM-150RF are configured for resistance sensing with a precision 1µA to 10mA current source and are factory prescaled to display °C and °F with platinum 100 ohm RTD sensors • Two programmable decimal positions • Auto polarity

TM-150X $75 $64 (100's)
TM-150XR $79 $67 (100's)
TM-150XAC $79 $67 (100's)
TM-150XACR $83 $71 (100's)



Low cost low power direct reading temperature meter • High contrast .48" LCD display • Operates with most popular RTD and voltage or current output transducers/probes • The TM-150X 5VDC Pwr and TM-150XAC 115VAC Pwr are configured for voltage and current sensing and are factory prescaled to display °C with NSC LM135, LM235, LM335 or Analog Devices AD590 sensors • The TM-150XR 5VDC Pwr and TM-150XACR 115VAC Pwr are configured for resistance sensing with a precision 1µA to 10mA current source and are factory prescaled to display °C with Platinum 100 ohm RTD sensors • Programmable °C and °F descriptors and two programmable decimal positions • Measurements from −185° to +600°C & Accuracies to 0.1°C are possible depending on sensor/probe selected • Auto polarity

TM-150XF $75 $64 (100's)
TM-150XRF $79 $67 (100's)
TM-150XACF $79 $67 (100's)
TM-150XACRF $83 $71 (100's)



Identical features to the TM-150X, TM-150XR, TM-150XAC & TM-150XACR but factory prescaled to display °F • Any of the TM-150 Series may be user modified and calibrated to display either °C or °F, or user modified to enable switch selection of °C or °F display

RV-C8 $49 $41 (100's)

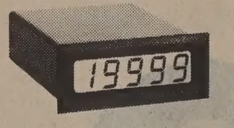
Thermistor Linearizer to suit interchangeable curve-8 NTC Thermistors manufactured by Sierracin-Western Thermistor, Tel. (714) 433-4484 • Output is adjustable from 1mV/°C to 10mV/°C • The RV-C8 is mounted in its own Slim Line DPM case • Calibration requires only two precision resistances • 5V DC Pwr

TEMPERATURE PROBES

For user convenience, Texmate offers a broad line of temperature transducers, probes, and accessories that can be ordered with your meter. Included is an all Teflon probe designed especially for the semiconductor industry to measure hydrofluoric etchant baths

EVENT COUNTERS

PC-45X $59 $50 (100's)



A versatile event counter/totalizer featuring 19999 counts with overrange indication, or 9999 counts with cascade output • contact closure, AC or logic signal inputs • High contrast .48" LCD • 4~6VDC Power with outputs for user supplied Ni-Cad battery backup • Capable of Signal Powered Operation • Internal Debouncing Circuit • Controls include count reset, count inhibit and display hold • 4 user programmable decimal points • Overload indication

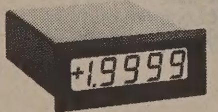
PC-45XAC $65 $52 (100's)

All the same features as the PC-45X but designed to be operated from 110VAC or 220VAC mains power • The Internally mounted transformer provides a 1.8mA output to trickle charge a user supplied 7.2V standard Ni-Cad back-up battery. (Eveready CH 22 or eqv.)

PC-45 $49 $37 (100's)

A versatile event counter/totalizer featuring 19999 counts with overrange indication, or 9999 counts with cascade output • contact closure, AC or logic signal inputs • High brightness .4" LED display • +5VDC powered • outputs for user supplied Ni-Cad battery backup • Internal debouncing circuit • controls include count reset, count inhibit and display hold • 4 user programmable decimal points • overload indication

REMOTE DISPLAYS .48" LCD



RD-45XMUX4 $49 $42 (100's)

Accepts standard 4-wire BCD Data inputs with 2µ second minimum spacing between Digit scan/digit drive outputs • Positive or negative logic • Polarity sign and 5 selectable decimal positions • Overrange indication • 26 pin Ribbon cable/Edge connector input • +3V to +6V operation at 2~3mA

RD-45XMUX4I $49 $42 (100's)

All the same features as the RD-45MUX4 but designed to operate with Intersil A/D converters where the Digit scan outputs overlap and a STROBE signal identifies the data for each Digit

RD-45XMUX7 $54 $46 (100's)

Accepts multiplexed 7 segment inputs • Common Anode or Common Cathode • Negative or Positive Logic • Requires 2µs minimum spacing between Digit scan/Digit Drive outputs • Polarity sign • Overrange indication • 5 decimals • +3V to +6V DC operation at 2~3 mA

REMOTE DISPLAYS .4" LED

RD-45MUX4 $40 $34 (100's)
RD-45MUX4I $40 $34 (100's)
RD-45MUX7 $45 $39 (100's)

The RD-45MUX4, RD-45MUX4I and RD-45MUX7 have corresponding features to the RD-45XMUX4, RD-45XMUX4I and RD-45XMUX7 but feature high brightness .4" LED displays instead of LCD • 26 Pin Ribbon cable/Edge connector input • Low Ripple +4V to +4.4V DC Pwr at 200mA typ.

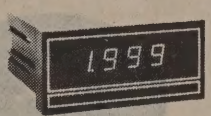
REGULATED POWER SUPPLIES LOW COST +5VDC OUTPUT

PS-505 $17 $14 (100's)
PS-510 $19 $16 (100's)

The PS-505 with a 500mA output and the PS-510 with a 1 Amp lamp output are general purpose low ripple regulated power supplies suited for +5VDC powered DPM's • Both units provide user selectability for 110VAC or 220VAC operation

AC POWERED DPM'S

RP-35U $49 $42 (100's)



World's lowest priced 115/230VAC line operated DPM • 3½ Digits • .56" Standard Red LEDs • True Differential Inputs • 200mV to 1200V FS • Ratiometric • Ohms • Current • Bipolar • Auto Zero • Programmable Decimals • TC 100ppm typ.

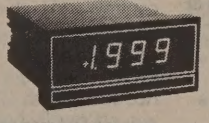
RP-35A $59 $50 (100's)

Extremely versatile full feature 3½ digit 115/230VAC line operated DPM • Differential Inputs • Customer Programmable Current and Ohmmeter Capability • Ratiometric • 4/20mA • Scaling in Engineering Units with Offset • DC Outputs Available • Display Test • Low TC 60 ppm Typ. • Auto Zero • Bipolar • Programmable Decimals

RP-35AR $85 $73 (100's)

World's lowest cost autoranging AC PWR DPM • Has all the features of the RP-35A except Ratiometric ohms measurement • Auto Ranges between any two Ranges from 200mV-2V to 200V-1200V • Auto Switching Selectable Decimals

RP-35AA $71 $61 (100's)



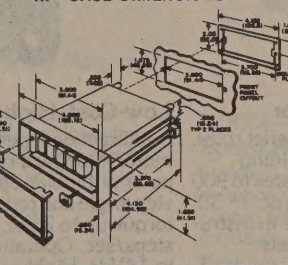
High display drive capability DPM • MUX .56" LED display • 200mV to 1200V FS • High CMV • Scaling in engineering units with offset • 60PPM TC • Bipolar • Ratiometric • Ohms • 4/20mA • Display test • Autozero • 115/230VAC Pwr

RP-35UU $65 $56 (100's)

Utility version of RP-35AA • Same High Brightness Display but uses single sided PCB • Selectable but non-switchable decimal points

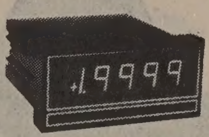
THE REPLACER (RP-) SERIES OF AC POWERED DPM's UTILIZE A CASE DESIGNED TO FIT MOST OTHER DPM MANUFACTURERS CUT-OUTS INCLUDING DIN/NEMA STANDARDS.

RP- CASE DIMENSIONS



AC POWERED DPM'S

RP-3500D $97 $87 (100's)
RP-4500D $125 $108 (100's)



RP-3500D 3½ digit and RP-4500D 4½ digit are top of the line 115/230VAC Pwr instrumentation DPMs • High normal mode noise rejection at 50/60 Hz of 120dB with internal 200K Hz quartz clock • Scaling in engineering units with offset • 4/20mA • Ratiometric • Ideal for load cell measurements • 20Ω to 20MΩ ohmmeter capability • 10 microvolt resolution on RP-4500D

RP-3500DBCD $127 $108 (100's)
RP-4500DBCD $160 $137 (100's)

All the same features as RP-3500D and RP-4500D but with buffered Tri-state parallel BCD output. **Note**: Parallel BCD output board is also available for field retrofit of previously purchased RP-3500D/4500D meters

RP-3500 $79 $67 (100's)
RP-4500 $95 $81 (100's)

RP-3500 3½ digit and RP-4500 4½ digit are low cost 115/230VAC line operated DPMs • Single-ended inputs • MUX BCD • Remote control sample/hold feature • Display blanking • Leading zero blanking • Autorange outputs • Display test • Autozero • Bipolar • Flashing overload • 2V FS to 1200V

RP-3500BCD $109 $93 (100's)
RP-4500BCD $130 $111 (100's)

All the same features as RP-3500 and RP-4500 but with buffered Tri-state parallel BCD output. **Note**: Parallel BCD output board is also available for field retrofit of previously purchased RP-3500/4500 meters

RP-3500AC $122 $104 (100's)

Measures AC input signals with autozero • Frequency range of 40Hz to 1KHz • Average reading calibrated in RMS • 200mV to 200V FS (higher voltages require external divider) • ±(1.0% Rdg + 1 Digit) accuracy • 2.5 readings/seconds • .56" LED display • Programmable decimals • 60 PPM TC • 115/230VAC Pwr

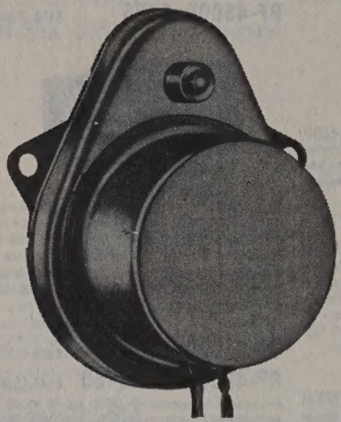
TEXMATE INC
348 SOUTH CEDROS AVENUE, P.O. BOX 2000
SOLANA BEACH, CA 92075 TWX-910-322-1738

Telephone (619) 481-7177

AUSTRALIA: SYDNEY (02) 792-9222; MELBOURNE (03) 329-8873 • **CANADA**: TORONTO (416) 661-3193; MONTREAL (514) 337-0425; EDMONTON (403) 432-7746; OTTAWA (613) 238-7077 • **FRANCE**: PARIS (1) 575-53-53 • **GERMANY**: QUICKBORN 041 06/612-1; HANOVER 05 11/88 6086; DUSSELDORF 02 11/66 61 45; DARMSTADD 0 61 51/2 64 46; STUTTGART 07 11/73 63 57; MUNICH 089-47 3023 • **NEW ZEALAND**: AUCKLAND 546-745/543-214 • **SPAIN**: BARCELONA (93) 692-35-19 • **SWEDEN**: STOCKHOLM 08-710 06 20 • **TAIWAN**: TAIPEI 592-3509/591-9651 • **UNITED KINGDOM**: WALSALL (0922) 27266

For More Information. Circle No. 277

AC, DC, and Stepper Motors

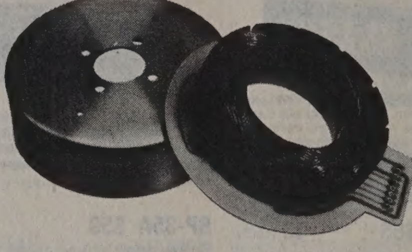


Reversible Synchronous Motors

For commercial/industrial use. 50 or 60 Hz operation; voltages from 12 to 230 Vac. PM rotor, 2-coil windings. Electrically reversible. Rotor speeds 300 rpm at 60 Hz or 720 rpm at 60 Hz. Torque 0.75 oz.-in and 1.1 oz.-in. respectively. Output speeds from 300 rpm to 1/1000 rpm.

81300 Series	300 rpm rotor
S7100 Series	720 rpm rotor

Ask for Reference Sheets CM803 and S7100



Three-phase Brushless DC Motors

Consist of 4-pole permanent magnet field rotors and 3-phase wye-connected stator windings. Electronically commutated servo; Hall cells provided. Shipped as assembly kits. User provides logic, drivers and spindles. Assembled motors with spindles available. Efficiency up to 85%. Stall torques from 30 oz.-in. to 700 oz.-in. Optimum power output. Excellent speed control. No major EMI. Minimum maintenance, long life. Particularly well-suited for rigid and floppy disk drives, phase-locked servo spindle controls and high reliability tape recorders.

L85101 Series	24Vdc
K85301 Series	24Vdc
K85401 Series	24Vdc
K85601 Series	48Vdc

Ask for Reference Sheet CM834

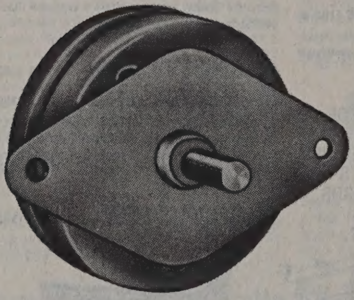
AIRPAX
CHESHIRE CONN
12 VDC
K17401-P2

Size 15
Iron Rotor DC Motors

Bidirectional, 2-pole permanent magnet motors designed for speed control and servo applications. Available with voltage ratings of 12 or 24Vdc providing stall torque of 16 oz.-in. All have linear torque speed characteristics with minimum magnetic cogging at low speeds.

K17401—P2 Series	12Vdc
K17401—P3 Series	24Vdc

Ask for Reference Sheet CM827

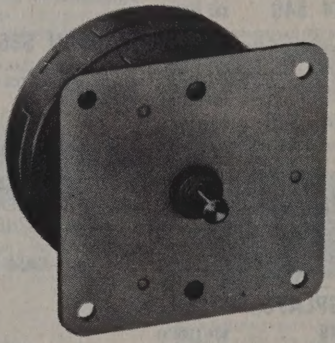


Industrial-Type Stepper Motor

2-phase stator and permanent magnet rotor. Running torque up to 8 oz.-in., holding torque up to 13.7 oz.-in. Running rates to 900 steps/sec. Bidirectional. 5V or 12Vdc. 7° 30′ or 15° step angle. Suitable for use in instrumentation and computer peripherals.

82700 Series	7° 30′ Step angle
83700 Series	15° Step angle

Ask for Stepper Motor Handbook

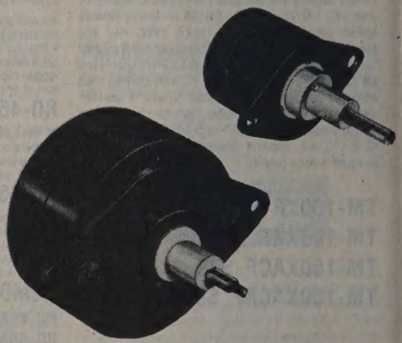


Low-Cost, High Torque Stepper Motor

A bidirectional permanent magnet stepper motor. Standard construction provides unipolar or bipolar operation, a 7° 30′ or 15° step angle and roller or sleeve bearings. Max. torque up to 28 oz.-in. Max. running rate 400 steps/sec. Operating voltages from 3.7Vdc to 14Vdc. Highly effective with long life and efficient utilization of power.

82900 Series	7° 30′ Step angle

Ask for Stepper Motor Handbook



Accurate, Incremental Digital Linear Actuators

These components accurately and incrementally actuate and control devices that must be "pushed" or "pulled". Linear forces from 15 oz. to 19 lbs. They operate on 12Vdc; offer linear travel of .001″ to .004″ per pulse. Shaft extensions from 0.5″ to 3″.

92100 Series	21 ozs. force
92200 Series	75 ozs. force
92400 Series	19 lbs. force

Ask for Linear Actuator Catalog

AIRPAX®
We give you control.

Airpax Corporation,
a North American Philips Company
Cheshire Industrial Park
Cheshire, CT 06410
(203) 272-0301

For More Information. Circle No. 278

Tachometers and Magnetic Pickups

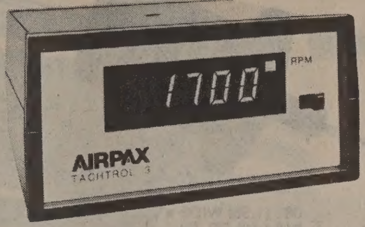
RPM
AIRPAX
TACHTROL® 2

Tachtrol® 2 – Speed/Rate Monitor

A single input digital instrument, this speed/rate monitor offers fast-response, high-precision monitoring. Measured values are displayed in engineering/units: RPM, FPM, frequency or other values. Rugged, easy to set up, yet costs less than competitive models.

Features:

- Single-channel precision speed or rate monitoring.
- Period mode measuring system.
- Five-digit auto-ranging .56" LED display; full or partial auto-ranging with leading zero suppression. Updates twice per second.
- Active or passive sensor input; accepts any pulse output device, magnetic digital pickup.
- Meets MIL-810C shock and vibration.

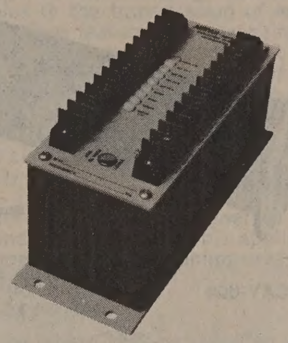


Tachtrol® 3 – Dual Input Digital Tachometer

Single or dual channel instrument, this computing tachometer measures input frequencies and displays the resulting quantities in RPM, FPM, % Draw and other rates. A unique method of setting conversion factors and instrument functions allows easy configuring or altering at any time.

Features:

- Measures speed or frequency (2 Hz to 30,000 Hz).
- Active or passive pickup inputs.
- Auto ranging LED or LCD displays.
- Meets MIL-810C shock and vibration.

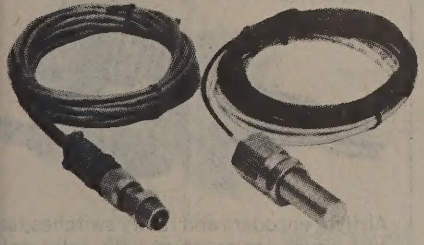


Series 300 – Analog Tachometer

A precision control tachometer to accurately monitor shaft RPM, flow rates, and other industrial applications. With up to 4 relay setpoints, it can be used for start-up, overspeed shutdown, or other process controls. Many setpoint options are available for special uses.

Features:

- Accept signals (sine wave, pulse, etc.) from many sensor types.
- Filtered 0-1mAdc meter output, proportional to input frequency, is standard.
- Signal input limiting to 150V is available.
- DPDT relay contact configuration is an option.
- 4-20mAdc industrial output, proportional to input frequency is optional.

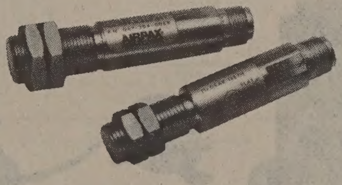


1-0001 and 1-0005 – Passive Magnetic Pickups

Convert mechanical motion to AC voltage. The frequency of the AC signal is exactly proportional to the speed or RPM.

Features:

- No moving parts.
- Wide temperature range.
- Stainless steel housing.
- 1-0005 is UL listed.

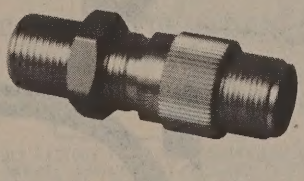


4-0070 and 4-0036 – Active Magnetic Pickups/Zero Velocity

Either pickup can be used to sense the speed of any rotating machinery, including motors, generators, turbines, compressors, conveyors – wherever speed or RPMs need to be monitored.

Features:

- Low cost.
- 12V ± 2Vdc power supply.
- $-25°C$ to $+70°C$ operating temperature range.
- 4-0036 is UL listed.
- DC to 10K Hz frequency.



8-0006 – Low-Cost Magnetic Speed Pickup

Stainless steel housing and one-piece construction, this pickup has interior section coated with epoxy resin to resist both oil and moisture.

Features:

- Wide operating and storage temperature range: $-67°F$ to $+225°F$.
- 190-volt minimum output (P-P).
- Mates with MS3106A-10SL-4S.

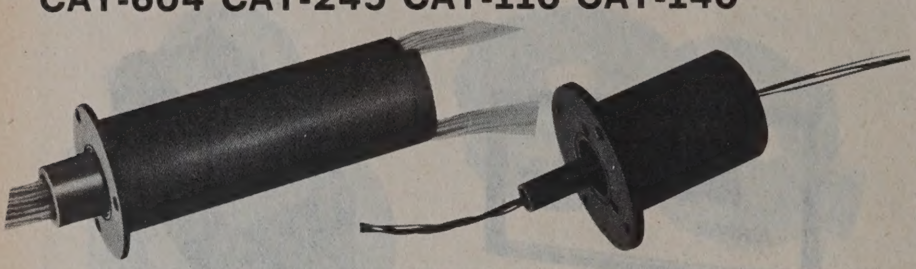
AIRPAX®

We give you control.

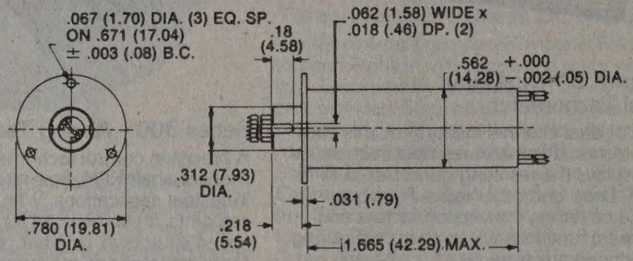
Airpax Corporation
a North American Philips Company
Ft. Lauderdale Division
6801 W. Sunrise Blvd.,
Ft. Lauderdale, FL 33313
510-955-9866

Airflyte ELECTRONICS CO.

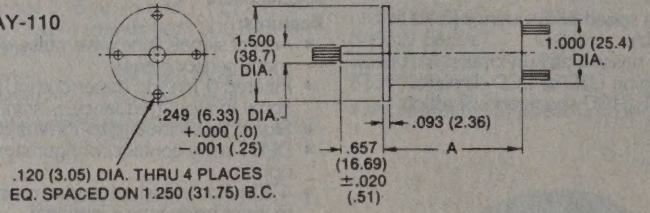
CAPSULE SLIP RING ASSEMBLIES
CAY-604 CAY-245 CAY-110 CAY-140



CAY-604



CAY-110



Illustrated are four miniature capsules which have found wide use in gyro gimbal and instrument applications. The fully enclosed and tested assemblies feature fine diameter gold alloy brushes mated to compatible gold alloy rings for excellent noise characteristics at low torque levels. Although miniature in size, the assemblies are surprisingly rugged and are able to withstand most military environmentel specifications and the sometimes severe use encountered in the laboratory.

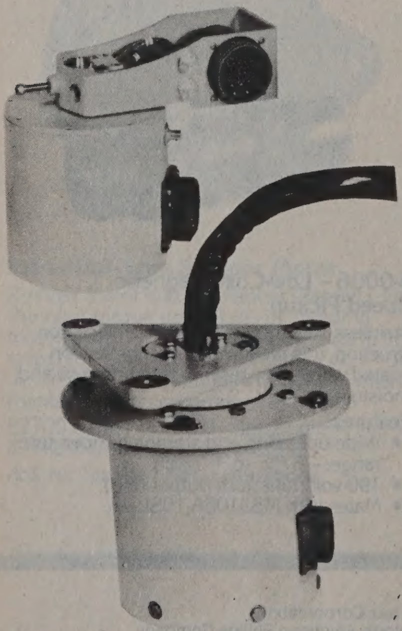
SPECIFICATIONS
ELECTRICAL

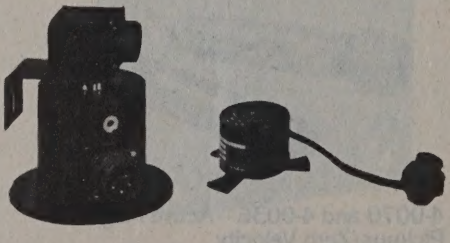
1. Current: Signal level to 1 amp maximum
2. Voltage: Micro-volts to 110 volts rms
3. Dielectric Strength: 500 Volts rms (all combinations)
4. Leadwire: =30AWG teflon insulated. 15″ long minimum
5. Torque: 1.0 in.-oz. max.
6. Speed: 200 rpm max.

ORDERING INFORMATION

CAY-1030- -
1 Without Flange
- 2 With Flange
No. of Rings

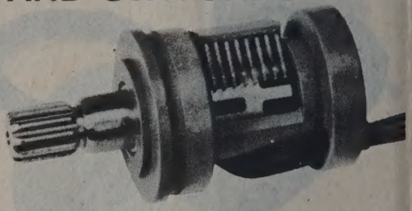
SLIP RINGS FOR MILITARY VEHICLES





Airflyte Electronics has experience in the design and manufacture of assemblies for personnel carriers, tanks and other military vehicles. We have built slip rings for periscopes, turrets and commander stations. These assemblies range in size from 6″ or less in outside diameter to slip rings with clearance holes larger than 28″. This type of assembly is characterized by its rugged construction, usually has two high power rings, several low power and up to 50 signal rings. Illustrated are several of the configurations we have built in production quantites.

ENCODERS AND SWITCHES



Airflyte encoders and rotary switches feature drum construction with solid gold alloy conducting segments embedded in epoxy and machined flush. Brushes are multi-strand, spring-temper gold-alloy. As small as Size 5.

ENCODERS

A wide variety of encoders is available: T/B, BCD, Gray, etc. Special encoders may require nominal tooling charges. Encoders can be supplied with built-in logic circuitry. Sizes: 8-33

SWITCHES

When close accuracy, repeatability and size are important, specify Airflyte rotary switches for timing and positioning applications. Successfully replaces snap action switches and cams. Pre-set to eliminate installation time. Zero hysteresis.

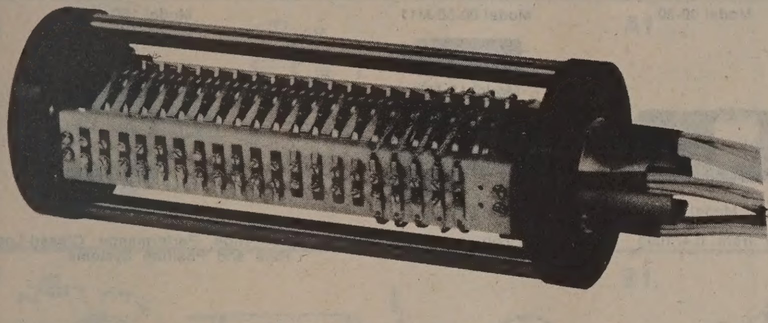
CABLE US TODAY
FOR ALL YOUR SLIP RING NEEDS...
TWX 710-729-4489

CONTACT **Airflyte ELECTRONICS CO.**
CATALOGS • MANY STOCK ITEMS • FINE DESIGN STAFF
56 HOOK RD., P.O. Box 231G, BAYONNE, NEW JERSEY
07002 (201) 436-2330 TWX-710-729-4489

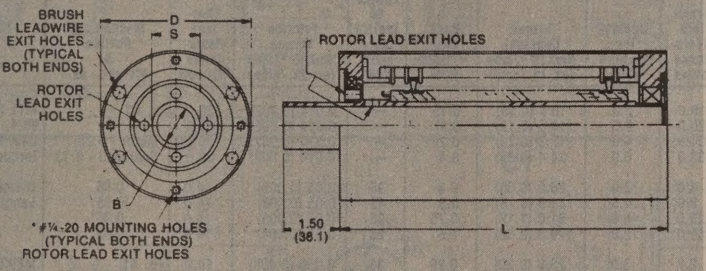
For More Information. Circle No. 280

Airflyte ELECTRONICS CO.

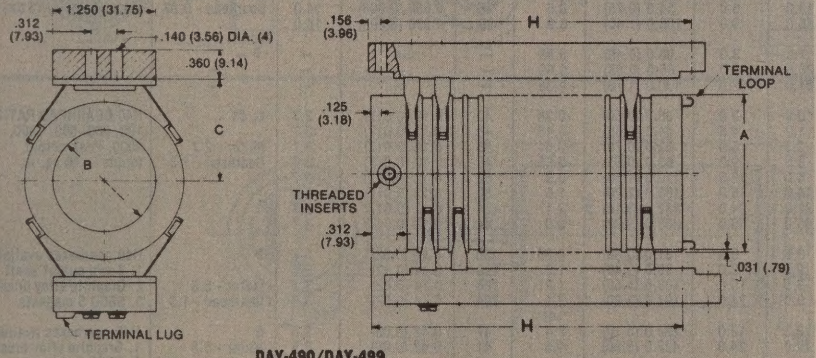
MULTI-PURPOSE SLIP RING ASSEMBLIES
DAY-490 DAY-499; CAY-731/740



DAY-490/499


BRUSH LEADWIRE EXIT HOLES (TYPICAL BOTH ENDS)
D
S
ROTOR LEAD EXIT HOLES
B
*#¼-20 MOUNTING HOLES (TYPICAL BOTH ENDS) ROTOR LEAD EXIT HOLES
ROTOR LEAD EXIT HOLES
1.50 (38.1)
L

DAY-731/740



DAY-490/DAY-499

No. of Rings	Inches "L"	Milli-Meters
6-10	4.88	123.95
11-20	6.75	171.45
21-30	8.63	219.2
31-40	10.50	266.7
41-50	12.38	314.45

To determine "H" dimension, use the following formula:
"H" = .750 + .1875 x (No. of Rings)

DAY-490 DAY-499

These assemblies, designed for use in commercial equipment, have been used in applications ranging from thermocouples to the transmission of medium power. They feature coin silver rings, silver graphite brushes, convenient terminals on both the slip ring and brush blocks, and a rotor design which allows the leadwires to be exited through the shaft bore, or under the bearing when a shaft clearance hole is required. The wide variety of sizes and configurations available, including "in-between" shaft diameters, allows the designer to select a standard assembly for his application, eliminating time consuming and costly design charges.

CAY-731/CAY-740

For use where bearing mounted assemblies are not practical, the CAY-731/CAY-740 should be specified.

SPECIFICATIONS

MECHANICAL

1. Frame: Anodized aluminum (DAY-490/DAY-499 only)
2. Rings: Coin silver
3. Brushes: Silver graphite, two per ring
4. Leafs: Beryllium copper
5. Insulation: Epoxy or laminated plastic

ELECTRICAL

1. Current: 10 amperes per circuit (20 amperes available at extra cost)
2. Voltage: 250 Volts maximum AC or DC
3. Dielectric Strength: 750 Volts rms (all combinations)
4. Insulation Resistance: 50 megohms minimum at 500 VDC
5. Contact Resistance Variation: 10 milliohms maximum at maximum speed
6. No. of rings: 50 maximum

ENVIRONMENTAL

1. Operating temperature: 0 to 250°F
2. Humidity: 95% maximum

ORDERING INFORMATION

DAY- | | | |
CAY-
No. of Rings
Models

CONSULT FACTORY FOR RING TERMINATION ON DAY-490, DAY-491, DAY-492, CAY-731 THRU CAY-733 AND *MOUNTING HOLE LOCATION FOR ALL TYPES.

Part No.	Max. Speed RPM	Min. LIFE 10⁶ Rev.	Max. Torque Per Ring		DAY-490/DAY-499						CAY-731/CAY-740					
					"B" Dia.		"D" Dia.		"S" Dia.		"A" Dia.		"B" Dia.		"C" Dia.	
			lb.-in.	gm-cm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
DAY-490/CAY-731	5000	50	.21	240	1.00	25.4	4.00	101.6	1.250	31.75	1.875	47.63	1.250	31.75	1.447	36.75
DAY-491-CAY-732	4000	40	.30	350	1.75	44.45	5.00	127.0	2.125	53.98	2.750	69.85	2.125	53.98	1.829	46.46
DAY-492/CAY-733	3000	30	.40	460	2.75	69.85	6.50	165.1	3.125	79.38	3.750	95.25	3.125	79.38	2.281	57.94
DAY-493/CAY-734	2500	25	.50	580	3.75	95.25	7.50	190.5	4.125	104.8	4.875	123.8	4.125	104.8	2.822	71.68
DAY-494/CAY-735	2000	20	.61	700	4.75	120.7	8.50	215.9	5.125	130.2	5.875	149.2	5.250	133.4	3.307	84.00
DAY-495/CAY-736	1500	15	.71	820	5.75	146.1	9.50	241.3	6.125	155.6	7.000	177.8	6.250	158.8	3.857	97.97
DAY-496/CAY-737	1500	15	.82	950	6.75	171.5	10.50	266.7	7.125	181.0	8.000	203.2	7.250	184.2	4.342	110.3
DAY-497/CAY-738	1000	10	.92	1060	7.75	196.9	11.50	292.1	8.125	206.4	9.000	228.6	8.250	209.6	4.837	122.9
DAY-498/CAY-739	1000	10	1.02	1180	8.75	222.3	13.00	330.2	9.125	231.8	10.000	254.0	9.250	235.0	5.332	135.4
DAY-499/CAY-740	750	7.5	1.12	1290	9.75	247.7	14.00	355.6	10.125	257.2	11.000	279.4	10.250	260.4	5.827	148.0

56 HOOK RD., P.O. Box 231G. BAYONNE. NEW JERSEY 07002 (201) 436-2330 TWX-710-729-4489

SERVO COMPONENTS AND SYSTEMS

PRECISION MOTORS

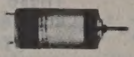
Model 00-30

Model 16-35

Model 28-52

High Efficiency Motors with Torque Ratings from 0.02 oz. in. to 16.6 oz. in.

HIGH LINEARITY TACHS


Model 16-35

Model 00-30

Model 24-45

Model 28-52

Tachometer gradients from 0.4/1000 rpm to 3.0/1000 rpm

MOTOR-GEARHEAD UNITS

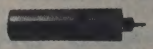
Model 00-30-M11

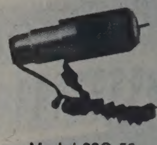
Model 18-M20

Model 24-45-4-40

Output Torque to 40 oz. in.

MOTOR-TACHOMETERS


Model 16G-35


Model 28G-52

For High Performance Closed-Loop Rate and Position Systems

MOTOR SERVO SPECIFICATIONS

MODEL	Peak Torque NmX10^{-4} (oz. in)	Peak Input Power watts	Electrical T. Constant msec.	Mech. T. Constant msec.	Armature Resistance ohms	Operating Voltage volts	Torque Constant NmX10^{-4}/amp (oz. in./amp)	Back EMF V/1000 RPM	Torque to Inertia rad./sec.^{2} X10^3	Friction Torque NmX10^{-4}/amp (oz. in./amp)	Thermal Resistance °C/watt	Mechanical Outline & Weight - oz.	NOTES
00-30-07	1.3 (0.02)	0.25	0.020	–	16.0	2.0	10.4 (0.15)	0.15	–	0.014 (0.002)	30.0	A, A1 Motor - 0.25 Gearhead - 0.32	M11 GEARHEAD RATIOS 96.4, 176, 249, 358, 487, 649, 916. Peak output torque – 3 oz. in.
00-30-06	1.3 (0.02)	0.25	0.014	–	26.0	2.5	13.5 (0.19)	0.2	–	0.014 (0.002)	30.0		
00-30-05	1.3 (0.02)	0.29	0.011	–	54.0	4.0	17.6 (0.25)	0.25	–	0.014 (0.002)	30.0		
00-30-04	1.1 (0.02)	0.27	0.007	–	133.0	6.0	24.4 (0.35)	0.4	–	0.014 (0.002)	30.0		
16-24-12	33.0 (0.47)	2.25	0.021	30	4.0	3.0	28.0 (0.36)	0.3	36	0.05 (0.008)	14.0	0.95	Diameter – 0.65′ Length – 0.94′
16-24-10	26.0 (0.37)	2.25	0.021	30	9.0	4.5	54.0 (0.75)	0.5	43	0.05 (0.008)	14.0	0.95	
16-24-08	20.0 (0.29)	1.56	0.022	30	23.0	6.0	81.0 (1.12)	0.75	35	0.05 (0.008)	14.0	0.95	
16-24-06	33.0 (0.46)	2.48	0.023	30	58.0	12.0	170.0 (2.30)	1.5	29	0.05 (0.008)	14.0	0.95	
16-35-14	25.6 (0.36)	3.3	0.021	30	2.7	3.0	23.0 (0.30)	0.25	36	0.056 (0.008)	14.0	B, B1 Motor - 1.06 Gearhead - 0.32	M20 GEARHEAD RATIOS 32.7, 65.5, 105, 210, 335, 671, 1037, 2147. Peak output torque–15 oz. in.
16-35-12	30.5 (0.43)	3.8	0.021	30	4.2	4.0	32.0 (0.45)	0.35	43	0.056 (0.008)	14.0		
16-35-10	32.6 (0.46)	3.8	0.022	30	6.6	5.0	43.0 (0.60)	0.4	46	0.056 (0.008)	14.0		
16-35-08	25.0 (0.35)	2.8	0.023	30	13.0	6.0	54.0 (0.75)	0.5	35	0.056 (0.008)	14.0		
16-35-06	20.0 (0.29)	1.8	0.022	30	46.0	9.0	103.0 (1.40)	0.9	29	0.056 (0.008)	14.0		
20-08-10	13.2 (0.00)	1.2	–	25	7.3	3.0	36.0 (0.49)	0.38	–	–	–	F –	
20-08-07	15.4 (0.00)	1.4	–	25	26.5	6.0	65.0 (0.88)	0.69	–	–	–	–	
20-08-05	12.8 (0.00)	1.6	–	25	91.0	12.0	130.0 (1.76)	1.38	–	–	–	–	
24M-45-30	143.0 (2.00)	11.3	0.031	20	0.8	3.0	38.0 (0.50)	0.38	40	0.12 (0.017)	3.7	C, C1 Motor - 2.7 Gearhead - 1.3	H40 GEARHEAD RATIOS 100, 200, 500, 1000, 2000. Peak output torque – 40 oz. in.
24M-45-24	165.0 (2.30)	16.9	0.032	20	1.2	4.5	44.0 (0.60)	0.45	46	0.12 (0.017)	3.7		
24M-45-20	125.0 (1.80)	14.4	0.031	20	2.5	6.0	52.0 (0.70)	0.5	36	0.12 (0.017)	3.7		
24M-45-16	162.0 (2.30)	23.1	0.029	20	3.5	9.0	63.0 (0.85)	0.65	46	0.12 (0.017)	3.7		
24M-45-14	220.0 (3.10)	24.0	0.028	20	6.0	12.0	110.0 (1.50)	0.9	62	0.12 (0.017)	3.7		
24M-45-12	175.0 (2.50)	16.1	0.029	20	14.0	15.0	163.0 (2.20)	1.6	50	0.12 (0.017)	3.7		
24M-45-10	190.0 (2.70)	20.6	0.029	20	28.0	24.0	222.0 (3.10)	2.1	54	0.12 (0.017)	3.7		
24M-45-08	157.0 (2.20)	19.9	0.029	20	65.0	36.0	283.0 (3.90)	3.0	44	0.12 (0.017)	3.7		
25-50-30	458.0 (6.50)	45.0	0.031	7	0.8	6.0	61.0 (0.86)	0.68	130	0.14 (0.02)	3.7	D Motor - 5.5 Gearhead - 1.3	H48 gearboxes available 1. 3 mm output shaft 2. Graphite alloy brushes 3. SECO 5 magnets
25-50-20	470.0 (6.70)	57.6	0.031	9	2.5	12.0	98.0 (1.40)	1.0	128	0.14 (0.02)	3.7		
25-50-16	454.0 (6.40)	64.3	0.028	9	3.5	15.0	106.0 (1.50)	1.2	128	0.14 (0.02)	3.7		
25-50-14	788.0 (11.20)	96.0	0.028	6	6.0	24.0	197.0 (3.80)	2.1	224	0.14 (0.02)	3.7		
28-52-30	1168.0 (16.60)	62.1	0.120	20	2.3	12.0	224.0 (3.10)	2.4	47	0.42 (0.06)	3.5	E Motor - 5.9 Gearhead - 1.3	H40 gearboxes available 1. Graphite alloy brushes 2. SECO 5 magnets
28-52-20	1013.0 (14.30)	57.6	0.120	20	10.0	24.0	422.0 (5.90)	4.5	41	0.42 (0.06)	3.5		

TACHOMETER SPECIFICATIONS

MODEL	Output Gradient volts/1000 rpm	Ripple Output %	Ripple Freq. cycles/rev.	Max. Speed rpm	Rotor Inertia* 10^{-6}	Min. Load Impedance ohms	Friction Torque oz. in.	Linearity %	Mechanical Outline
00-30-40T	0.4	5.0	6	10,000	2	10K	(.002)	2.0	A
16-25-06T	1.0	3.0	10	10,000	10	10K	(.010)	1.5	B
24M-45-48T	3.0	3.0	10	10,000	50	10K	(0.20)	1.0	C

NOTES: Gold Plated commutators and brushes available on all units at additional cost of $2.00 per unit in small quantities.
* Dimensions oz. in sec.^{2}

MOTOR — TACHOMETER SPECIFICATIONS

MODEL	Peak Torque oz. in.	Peak Power Input watts	Electrical T. Constant msec.	Mechanical T. Constant msec.	Armature Resistance ohms	Thermal Resistance °C/watt	Torque Constant gm. cm/oz. in.	Tach Gradient volts/ 1000 rpm	Tach Linearity %	Ripple Output %	Ripple Frequency Hz/rev.	Mechanical Outline
166-10-04	0.5	5.5	0.02	30	6.6	14	0.6	0.4	2.0	5.0	6.0	F

NOTES:
1. The 24-45-XX and 25-50-XX can be supplied with either metal brushes (24M-XX-XX) or graphite alloy brushes (24K-XX-XX).
2. The 25 and 28 Series can be supplied with sintered or ball bearings — standard units contain sintered bearings.
3. All units Hi-Pot tested at 220V rotor to case.

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SERVO COMPONENTS AND SYSTEMS

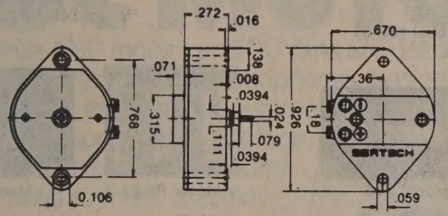
MECHANICAL DATA

CONVERSION FACTORS:

1 mm = 0.0394 in.
1N = 3.597 oz.
1Nm = 141.64 oz. in.
1 kgm² = 141.64 oz. in. s²

1 in. = 25.4 mm
1 oz. = 0.278 N (28 grams)
1 oz. in. = 0.00706 Nm
1°F = 0.556°C (temp. change only)

A


.272
.016
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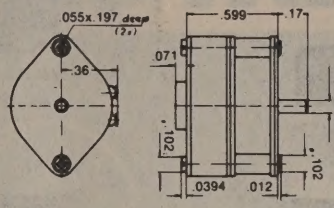
.670
.36
.18
BERTSCH
.059

A1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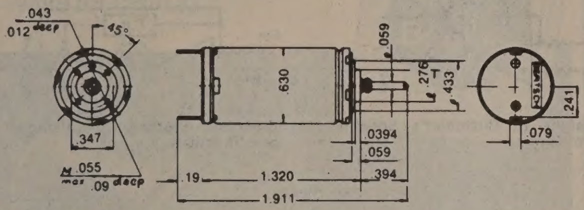
.599
.17
.071
.079
.102
.102
.0394
.012

B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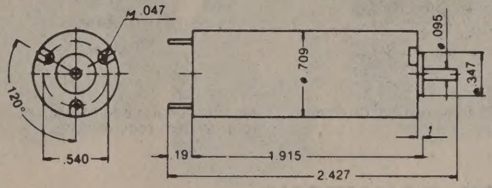
.012 deep
45°
.059
.630
.276
.433
.241
.347
.0394
.059
.079
M .055
max .09 deep
.19
1.320
.394
1.911

B1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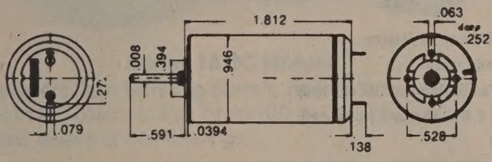
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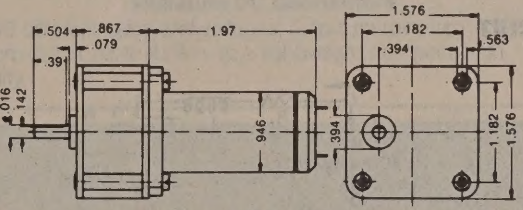
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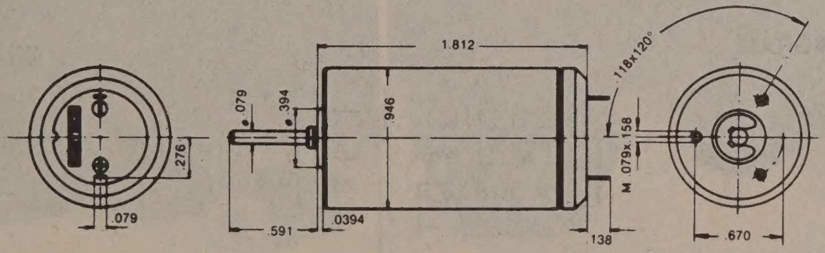
D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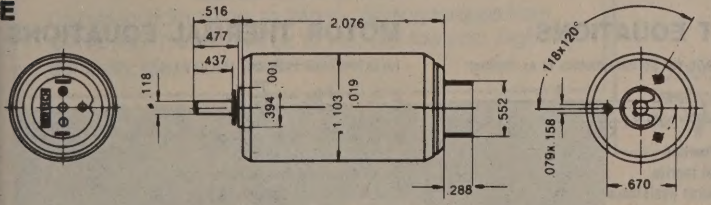
E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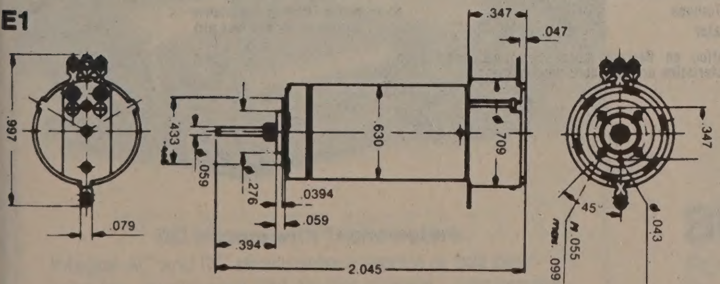
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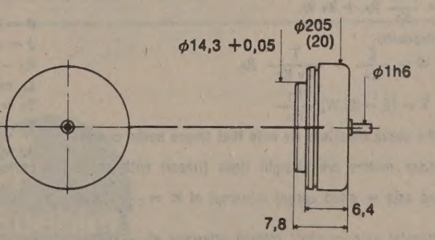
ϕ205
(20)
ϕ14,3 +0,05
ϕ1h6
6,4
7,8

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SERVO COMPONENTS AND SYSTEMS

POWER AMPLIFIERS

Model PA-10/0.5

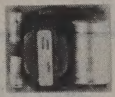
Model PA-10/1.2

Model PA-24/2.0

Optomized for Specific Customer Needs

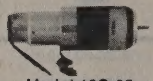
POWER SUPPLIES

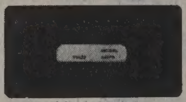
Model PS-25/2

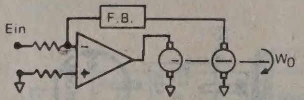

Model PS-1

Modular Designs to fit each customers total system requirements

CLOSED-LOOP RATE SYSTEMS


Model 16G-35

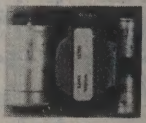

Model 24-3

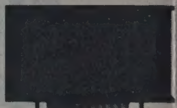


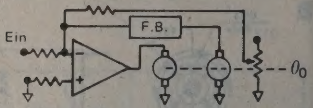
Designs to Customer's Specific Applications

CONTROL SYSTEMS

Model 24G-H40


Model PA 2A-3

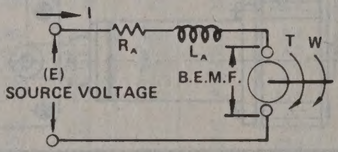

Model P5-1



Complete Systems to Customer Specifications

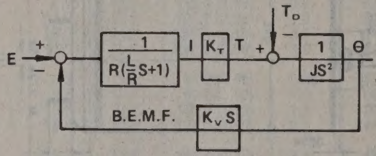
MOTOR EQUATIONS

CIRCUIT



R_A = Armature + Brush Resistance
L_A = Armature Inductance
K_T = Armature Torque Constant (in. oz./amp)
K_V = Motor Back E.M.F. Constant (volts/rpm)
B.E.M.F. = $K_V W$
W = Armature Speed in R.P.M.

SERVO BLOCK DIAGRAM



STEADY STATE EQUATIONS

1. $E = IR_A + K_V W$
2. $T = K_T I$
   Substituting for I in equation 1.
3. $E = \frac{T}{K_T} R_A + K_V W$
   Transposing:
   (a) $W = \frac{E}{K_V} - \frac{T}{K_V K_T} R_A$
   (b) $T = [E - K_V W] \frac{K_T}{R_A}$

From the above equations we note that torque speed curves of Bertsch motors are straight lines (linear) with an X (vertical axis = shaft speed) intercept of $W = \frac{E}{K_V}$ and Y (horizontal axis = shaft torque) intercept of $\frac{E}{R_A} K_T$. It should also be noted that the speed regulation capabilities of the motor ($\frac{\delta W}{\delta T}$ E = Constant) is simply equal to $-\frac{R_A}{K_V K_T}$ (rpm/in.-oz.).

TRANSIENT EQUATIONS

The La Place Transform for Bertsch motors is as follows:

$$\frac{\theta}{E} S \quad \frac{JR_A}{K_V K_T} > \frac{L_A}{R} \quad = \frac{1}{K_V S\left(\frac{JR_A}{K_V K_T} S + 1\right)\left(\frac{L_A}{R_A} S + 1\right)}$$

θ = Shaft Angular Position
J = Armature & Load Inertia
R_A – Armature & Source Resistance
L_A = Armature * Source Inductance
T_D = Disturbance Torques
S = La Place Operator

Additional information on Bertsch motor equations and performance characteristics are available upon request.

MOTOR THERMAL EQUATIONS

1. $T_A = T_{AM} + P_L \theta_R$
2. $P_L = I^2 R_A = \frac{T^2}{K^2} R_A$
3. $T_A = T_{AM} + T^2 \frac{R_A}{K^2} \theta_R$

T_A = Armature Temperature
T_{AM} = Ambient Temperature
P_L = Power Losses
θ_R = Motor Thermal Resistance
(armature to ambient air)

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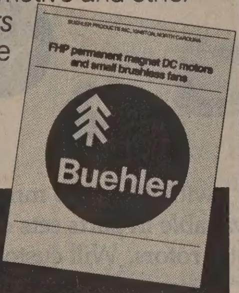
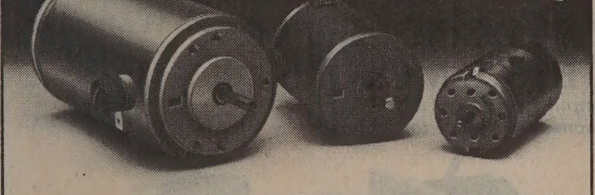
BUEHLER DC MOTORS AND FANS

Buehler FHP motors and DC fans are used the world over in computer peripherals, business machines, instruments, automotive and other industrial applications. *Motors can be customized* (if volume warrants) to meet specific OEM applications. Call or write for catalog.


BUEHLER PRODUCTS INC., KINSTON, NORTH CAROLINA

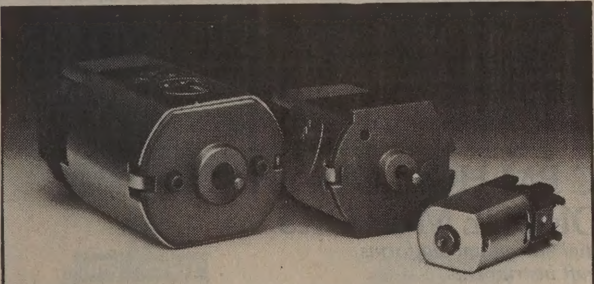
FHP permanent magnet DC motors and small brushless fans

Buehler



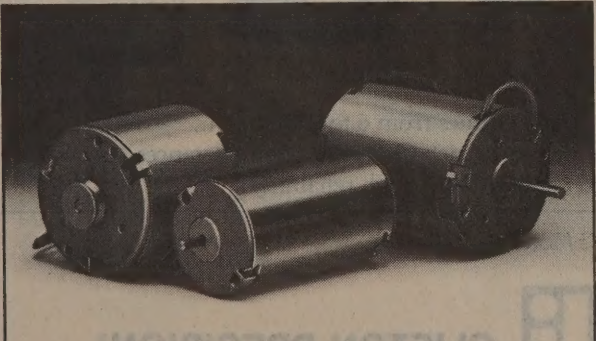
Series 13 DC Motors

Diameters from 14mm to 52mm; starting torques from .1Ncm to 70Ncm (.14 in. oz. to 100 in. oz.); 25 basic types; sleeve or ball bearings.



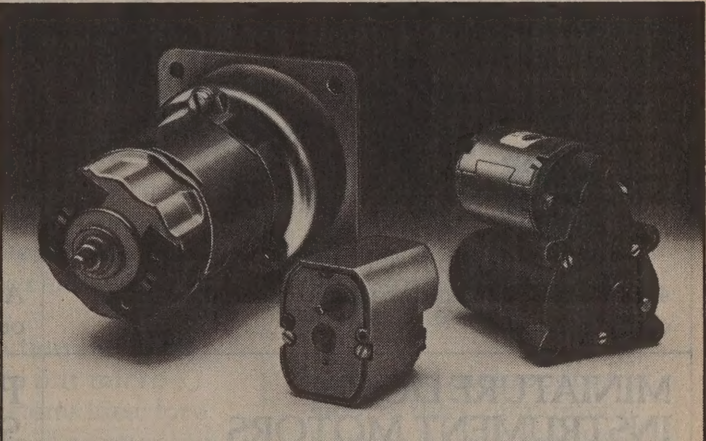
Series 16 DC Motors

Diameters from 10mm to 24mm; starting torques from .07Ncm to .7Ncm (.1 in. oz. to 1 in. oz.); low cost, high durability. Maximum space efficiency.



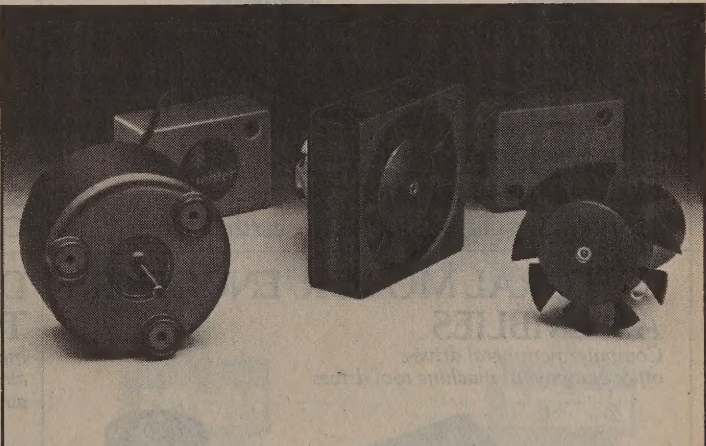
DC Motors with Tachometers

Integral AC and DC tachometers; sleeve or ball bearings; low mechanical and electrical noise. Long service life. Maximum reliability.



Miniature DC Gearmotors

Over 60 different ratios and voltages; output torques from 1.5Ncm to 300Ncm (2.1 in. oz. to 429 in. oz.); lightweight, compact, high durability.



Brushless DC Fans and Motors

10,000 hour service life at 60° ambient; low noise and electrical interference; fan air flow may be automatically regulated with temperature. Nominal fan voltages available in 12V, 24V and 48V.

Buehler

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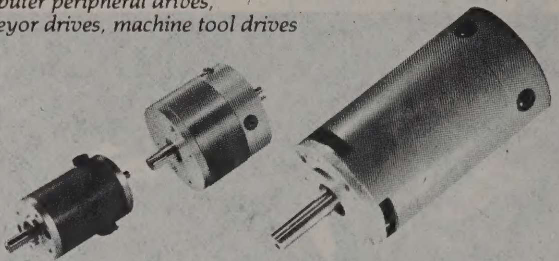
Dependable...fractional horsepower motors by Clifton Precision

FRACTIONAL HP DC PM MOTORS

Computer peripheral drives, conveyor drives, machine tool drives



. . . with torques from 90 to 3500 oz-in., 2 inch to 4 inch O.D. Advanced magnetic materials . . . cartridge brushes

BRUSHLESS DC MOTORS

Floppy and Winchester disk drives, machine tool drives, pumps, fans, robotics

. . . with 40 to 150 mm O.D.; 1, 2, or 3 phase. Available in parts sets or housed, with inner or outer rotors. Will customize upon request.

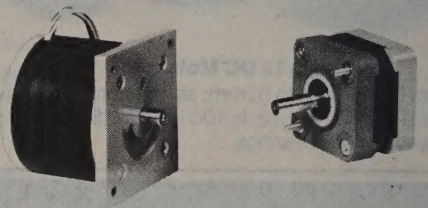
MINIATURE DC PM INSTRUMENT MOTORS

Computer peripheral drives, instrument recorders, laboratory instruments, medical equipment, robotics

. . . with torques from 2 to 50 oz-in.
.75 inch cube to 1.32 inch O.D.
Cartridge brushes, Alnico or rare earth magnets

PM, HYBRID, and VR STEPPER MOTORS

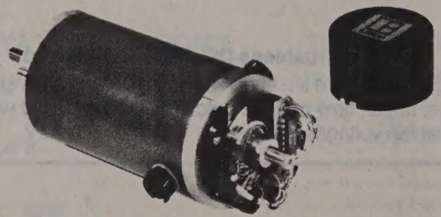
Computer peripheral drives, office equipment, machine tool drives



. . . with step angles .9°, 1.8°, 1.875°, 3.6°, 15°, 30°, 45°, 90°; .75 inch to 2.3 inch O.D.
Ceramic, Alnico or rare earth magnets

INTEGRAL MOTOR/ENCODER ASSEMBLIES

Computer peripheral drives, office equipment, machine tool drives



Optical encoder resolution to 2500 cycles. Solid-state, gallium arsenide light source, integral assemblies, no assembly or alignment necessary

DC PM HOLLOW SHAFT TORQUE MOTORS

Inertial navigation platforms, aircraft instruments, aircraft controls

. . . with torques from 6 to 2700 oz-in., 1.1 inch to 20 inch O.D. Precision tolerances, gold commutators, high reliability

For further information on Stepper Motors and Brushless DC Motors,
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It's called the Compumotor Microstepping System. And it's a high resolution motion control system that provides exceptional low speed smoothness and high accuracy. The Compumotor System includes packaged motor/drive combinations and sophisticated microprocessor based pre-set indexers with a variety of computer interfaces.

You can put the Compumotor System to work in a matter of minutes, instead of hours. It is completely self-contained. Just take it out of the box and plug it in.

High resolution and ease of use make our microstepping systems ideal for a wide variety of positioning and control applications.

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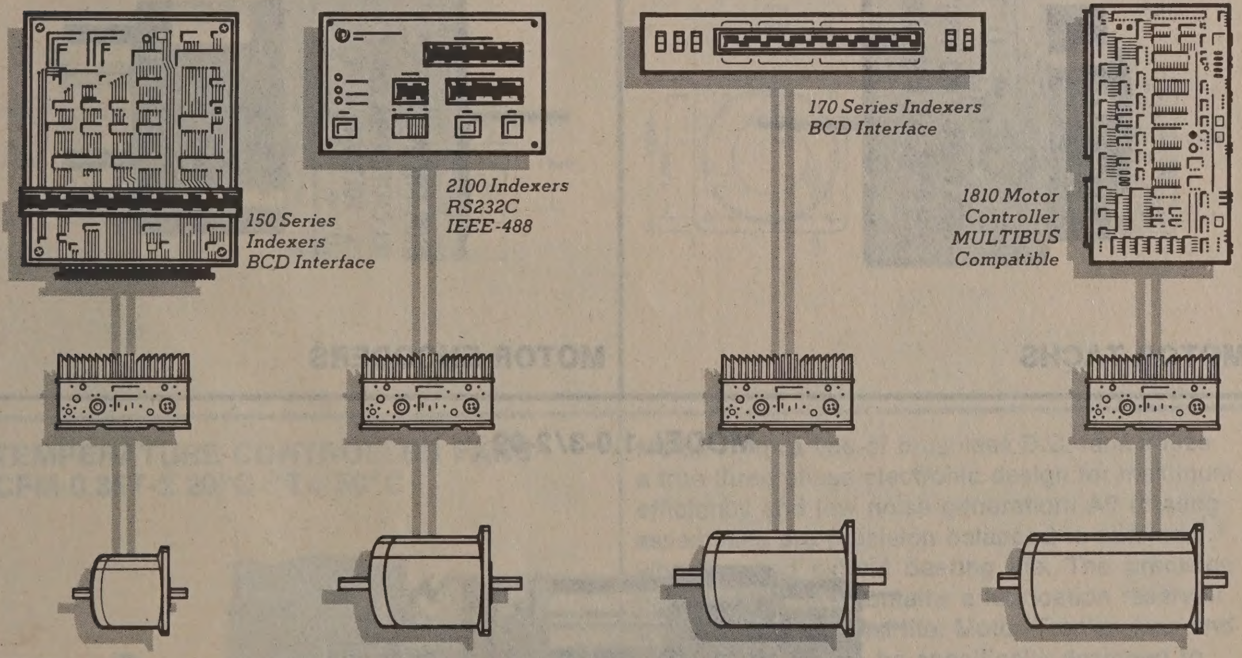
In a world of steppers and servos, the Compumotor System is the Alternative.



25,000 step per revolution motor/drive systems. Torques from 5-700 in-oz. Convection cooled drives. Self-contained power supplies. NEMA 17, 23, 34, and 42 motor sizes. 15 motor/drive combinations available.

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COMPUMOTOR CORPORATION™

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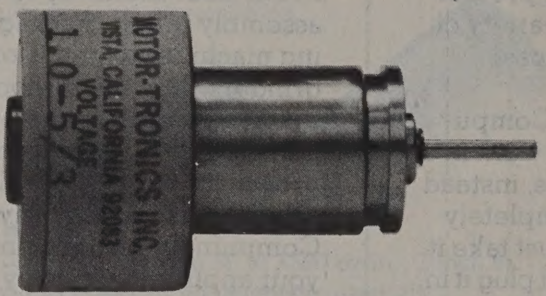
For More Information. Circle No. 284

MOTOR-TRONICS, INC.

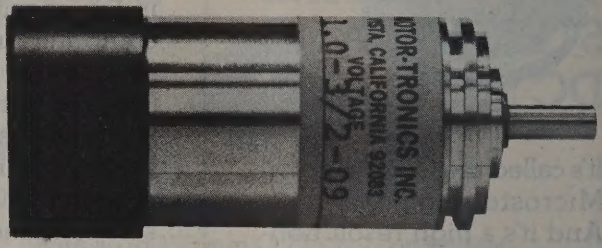
BRUSHLESS DC MOTORS AND ASSEMBLIES

MODEL 1.0-5/3


MOTOR-TRONICS INC.
VISTA, CALIFORNIA 92083
VOLTAGE
1.0-5/3

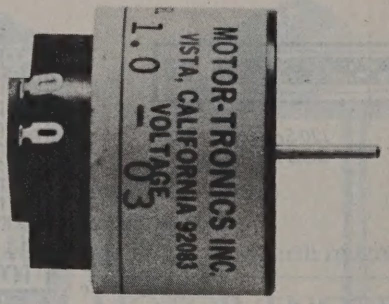
MOTOR-GEAR HEADS

MODEL 1.0-3/2


MOTOR-TRONICS INC.
VISTA, CALIFORNIA 92083
VOLTAGE
1.0-3/2-09

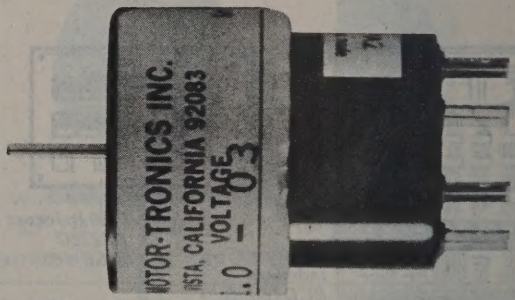
MOTOR-GEAR HEADS

MODEL 1.0-03


MOTOR-TRONICS INC.
VISTA, CALIFORNIA 92083
VOLTAGE
1.0 – 03

MOTOR-TACHS

MODEL 1.0-09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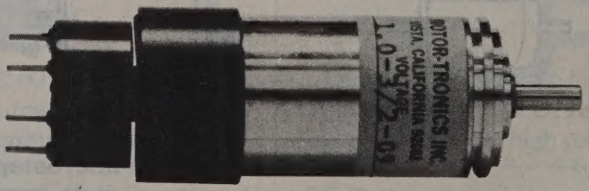
VOLTAGE
1.0 – 03

MOTOR-ENCODERS

MODEL 1.0-3/2-09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VISTA, CALIFORNIA 92083
VOLTAGE
1.0-3/2-09

MOTOR-GEAR HEAD-ENCODERS

* **Also Available — Model 12V-2A Hybrid Servo Electronics**

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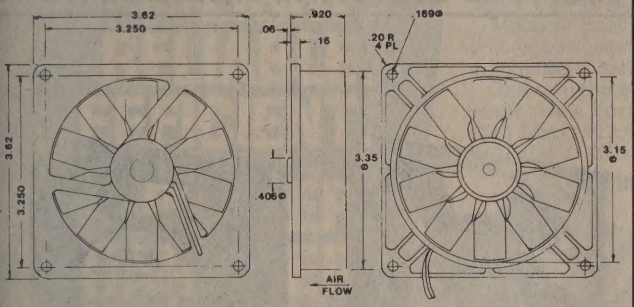
For More Information. Circle No. 285

MOTOR-TRONICS, INC.

BRUSHLESS DC MOTORS AND ASSEMBLIES

STANDARD-BRUSHLESS FAN
MF-3.15X0.9-25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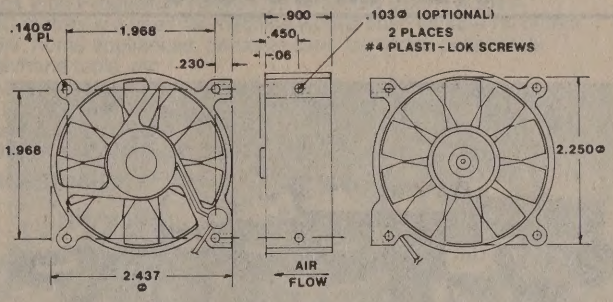
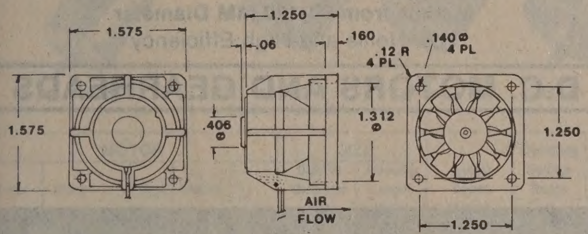
.920
.06
.16
.169⌀
.20 R
4 PL
3.62
3.250
.406⌀
3.35 ⌀
3.15 ⌀
AIR
FLOW

SMALL-ULTRA-THIN FAN
MF-2.4X0.9-15


.140⌀
4 PL
1.968
.900
.450
.06
.230
.103⌀ (OPTIONAL)
2 PLACES
#4 PLASTI-LOK SCREWS
1.968
2.250⌀
2.437 ⌀
AIR
FLOW

MINIATURE-BRUSHLESS FAN
MF-2.0X0.9-9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.12 R
4 PL
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4 PL
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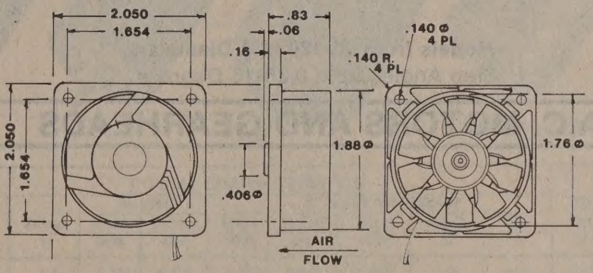
1.250
AIR
FLOW

MICRO-BRUSHLESS FAN
MF-1.6X1.2-6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4 PL
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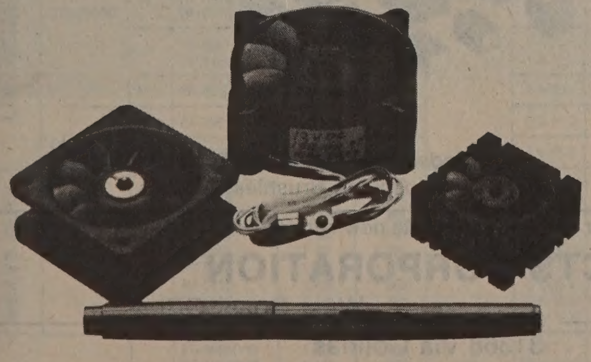
4 PL
2.050
1.654
.406⌀
1.88⌀
1.76⌀
AIR
FLOW

TEMPERATURE CONTROLLED FANS
CFM-0.35T-2 20°C<T<50°C



Motor-Tronics line of brushless D.C. fans utilize a true three phase electronic design for maximum efficiency and low noise generation. All rotating assemblies are precision balanced to minimize vibration and extend bearing life. The precision bearing structure contains a lubrication reservoir to extend operational life. Motor-Tronics fans and subassemblies can be specifically designed to meet your requirements.

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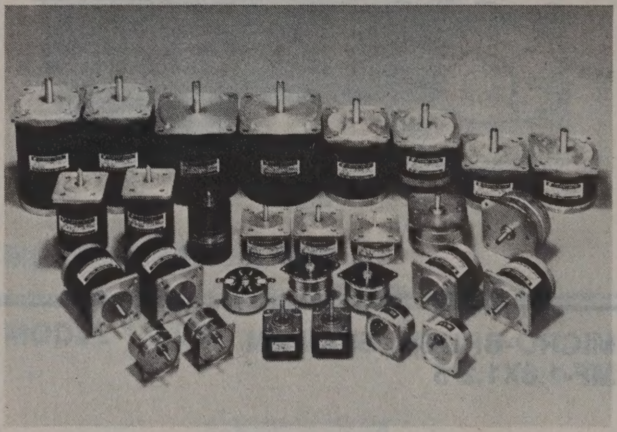
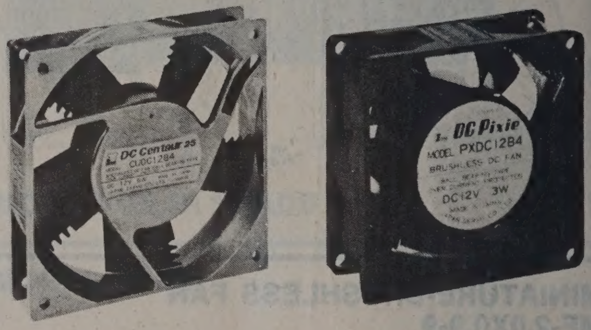
From 1/10,000 thru 1/10 H.P., Frame Sizes from 0.8 inches thru 5 inches Diameter.

STEPPER MOTORS



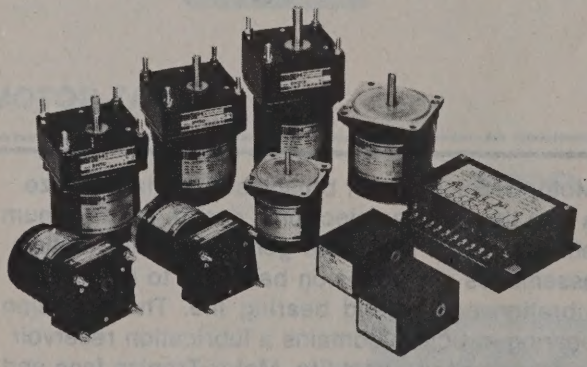
Models from 20-120 MM Diameter
Step Angles from 0.36-15 Degrees

A.C. AND D.C. FANS AND BLOWERS



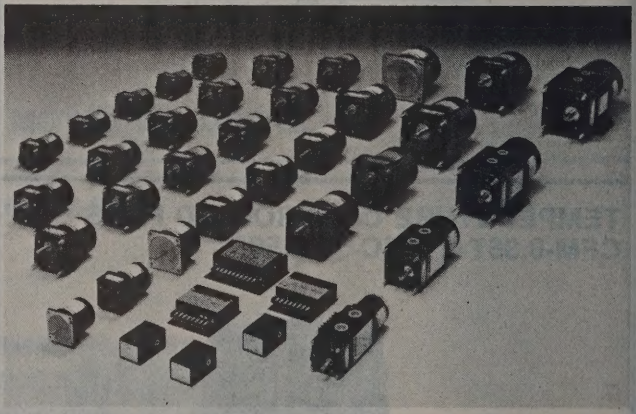
Models from 60-120 MM Diameter
Low Noise and High Efficiency

A.C. MOTORS AND GEARHEADS



Models from 60-125 MM Diameters
Single, Dual and Variable Speed Models

D.C. MOTORS AND GEARHEADS



Models from 30-100 MM Diameters
Brush and Brushless Models

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We're the world's largest manufacturer of DC mini-motors — producing over *one million per day!* So wide is our range of standard models, it's virtually certain there's one to fit your needs perfectly.

Shown here are a variety of standard motors with average performance characteristics at indicated voltage. They are also available with a variety of other armature windings for use at specific voltages to achieve different desired performances.

Please request or fill out a questionnaire and/or indicate your desired performance: we'll suggest the motors most suited to your needs. Power Curves and 3-View Drawings With Production Tolerances Available Upon Request.

Mabuchi small DC motors are used for machine worlds such as tape recorders and audio equipment, home appliances, personal care, cameras, peripherals, automotives, garden/hand tools, etc.

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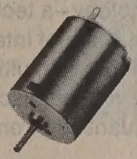
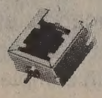
THE BIGGEST NAME IN SMALL DC MOTORS

RE-140

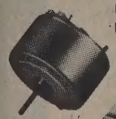
RE-260


RE-280
RC-280
RF-280

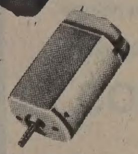

SU-020
SH-020
SH-050

FK-130
FK-260
FK-280

RF-260
RK-260


RF-500
RF-520

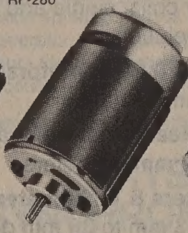
RD-050
RD-180

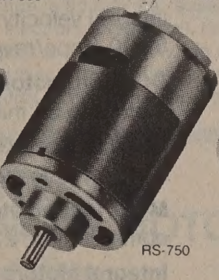

FF-180 FK-180

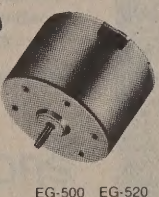
RS-360 RS-375
RS-365 RS-385

RS-395

RS-540 RS-545


RS-550


RS-750


EG-500 EG-520

MOTOR				SIZE		Typical Power Source	Operating Voltage Range V	TYPICAL CHARACTERISTICS									Stall Torque OZ-IN
Series	Group	Type	Model	Outside Diameter (Inch)	Housing Length (Inch)			Winding Code Number	Voltage V	NO LOAD		AT MAXIMUM EFFICIENCY					
										Speed RPM	Current AMP	Speed RPM	Current AMP	Torque OZ-IN	Output W	Eff. %	
ECONOMY	STANDARD	RE	RE-140	.827	.984	DRY CELL	1.5-3.0	2270	1.5	8,200	0.190	6,250	0.62	0.089	0.40	44.2	0.375
			RE-260	.937	1.059		1.5-4.5	2670	3.0	12,500	0.230	10,250	1.03	0.222	1.68	54.1	1.222
			RE-280	.953	1.201		1.5-6.0	2865	3.0	9,200	0.155	7,800	0.85	0.278	1.60	62.3	1.81
		SU	SU-020	.709x.374	.744		1.0-3.0	09170	3.0	11,800	0.080	8,150	0.18	0.022	0.132	24.6	0.071
	CARBON	RC	RC-280S	.953	1.201	DRY CELL BATTERY RECTIFIED A.C.	4.5-12.0	20120	6.0	7,800	0.125	6,450	0.60	0.417	2.00	56.0	2.430
		FK	FK-130S	.791x.594	.988		4.5-20.0	07500	12.0	7,200	0.030	5,350	0.09	0.108	0.43	40.8	0.424
			FK-260S	.953x.720	1.059		4.5-15.0	10350	12.0	7,300	0.036	5,950	0.16	0.244	1.07	56.3	1.32
			FK-280S	.953x.720	1.201		4.5-20.0	10350	12.0	5,700	0.028	4,650	0.13	0.253	0.87	57.5	1.39
		SH	SH-020S	.709x.374	.744		4.5-12.0	09170	6.0	19,000	0.110	13,600	0.28	0.061	0.608	36.8	0.213
			SH-050S	.709x.374	.866		4.5-12.0	09170	9.0	23,400	0.105	17,350	0.30	0.090	1.151	42.6	0.347
LOW NOISE	STANDARD	RF	RF-260T	.953	1.059		1.0-9.0	3255	1.2	5,700	0.160	4,750	0.800	0.164	0.575	59.9	0.986
			RF-280	.953	1.201		1.5-12.0	2485	3.0	7,300	0.115	6,130	0.602	0.236	1.069	59.2	1.472
			RF-500T	1.260	.768		1.5-9.0	14430	6.0	3,650	0.024	3,050	0.122	0.196	0.441	60.0	1.194
			RF-520T	1.260	.846		1.5-12.0	12580	12.0	4.550	0.018	3,890	0.106	0.278	0.799	62.8	1.917
		RD	RD-050T	.673	9.13		1.5-6.0	09220	4.5	7,600	0.039	5,710	0.118	0.054	0.23	43.5	0.222
			RD-180S	.839	1.142		1.2-12.0	2085	2.4	5,310	0.052	4,530	0.304	0.142	0.476	65.2	0.972
		FF	FF-180S	.803x.606	1.264		1.0-6.0	3534	1.2	7,550	0.220	6,250	1.08	0.179	0.83	63.7	1.06
	CARBON	RK	RK-260S	.953	1.059		5.0-15.0	12250	12.0	10,900	0.056	9,030	0.27	0.289	1.925	59.5	1.681
		FK	FK-180S	.803x.606	1.264		4.5-15.0	14150	6.0	7,050	0.060	5,700	0.26	0.197	0.83	53.6	1.04
HEAVY DUTY	CARBON	RS	RS-360S	1.091	1.283	BATTERY RECTIFIED A.C.	4.5-26.0	14250	12.0	7,300	0.090	5,850	0.36	0.556	2.40	55.6	2.81
			RS-365S	1.091	1.283		6.0-26.0	1885	18.0	20,800	0.220	17,000	0.99	0.897	11.3	63.3	4.93
			RS-375S	1.091	1.488		12.0-26.0	2073	24.0	25,800	0.230	21,700	1.21	1.19	19.1	65.8	7.50
			RS-385S	1.091	1.488		12.0-26.0	2073	24.0	22,000	0.180	18,800	1.05	1.27	17.6	69.7	8.68
			RS-395S	1.091	1.831		6.0-26.0	2455	12.0	10,000	0.190	8,400	1.00	1.36	8.4	69.6	8.61
			RS-540	1.406	1.969		3.0-12.0	7516	3.6	19,100	2.85	15,700	13.1	2.19	25.4	53.8	12.3
			RS-545S	1.406	1.969		6.0-26.0	5016	6.0	15,000	1.20	12,600	6.35	2.87	26.8	70.3	18.1
			RS-550S	1.406	2.244		3.6-15.0	7522	6.0	12,400	0.70	11,300	7.34	3.87	32.3	73.3	44.4
			RS-750S	1.661	2.362		4.5-18.0	8027	9.6	18,400	1.8	15,800	11.10	6.76	79.1	73.9	48.6
ELECTRONIC GOVERNOR		EG	EG-500AD-6F	1.429	.984	DRY CELL RECTIFIED A.C.	4.2-7.5	18290	6.0	2.400 RPM at 8 G-CM load							
			EG-500AD-9F	1.429	.984		6.0-11.0	14430	9.0								
			EG-500AD-2F	1.429	.984		8.4-15.0	12580	12.0								
			EG-520AD-6F	1.429	1.063		4.2-7.5	16340	6.0								
			EG-520AD-9F	1.429	1.063		6.0-11.0	14470	9.0								
			EG-520AD-2F	1.429	1.063		8.4-15.0	12580	12.0								

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The business of Portescap U.S. is putting great ideas in motion with great precision. Our escap line represents a wide selection of electronic drive and motion system components for applications ranging from relatively simple incremental motion systems, to such high-tech uses as robotics, computer peripherals, and medical implants. It incorporates steppers and micro-steppers with integrated velocity sensors in quadrature, based on samarium cobalt thin layer disk rotor technology—a technology we developed—plus ironless DC micromotors, and a full line of integral and discrete accessories including optical encoders and torque multipliers. Many models are available for immediate delivery at volume discount. New technology components are available in sample quantities from stock. Come to the source.

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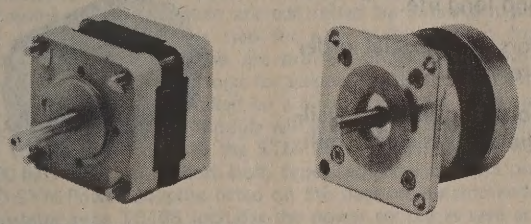
SHINANO KENSHI CORP., OFFERS A COMPLETE LINE OF ELECTRIC MOTORS

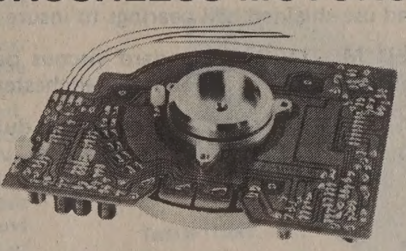
Value Engineered To Maintain Quality, Cut Costs

STEPPING MOTORS



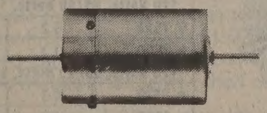
STEPPING MOTORS
Industry standard 39 mm (size 17), 57 mm (size 23) frames. Popular step angles, 0.9°, 1.8°, 3.6°, 3.75°. Hybrid, bifilar, 3% accuracy, precision ball bearings, state of the art performance. **Applications:** Floppy disk drives, rigid disk drives, printers, plotters, medical equipment, office automation machine.

BRUSHLESS MOTORS



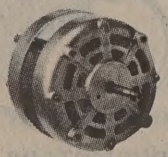
BRUSHLESS DC MOTORS
Inner or outer rotor, 30 mm to 90 mm dia., super precision spindle, integral electronics (optional), hall generator, tach (optional) 2 or 3 phase winding. 25,000 hours life. **Applications:** Precision ball bearing video recorders, Winchester disk drives, floppy disk drives.

CORELESS DC MOTORS



CORELESS DC MOTORS
Low cost, high speed and acceleration, low inertia, frame sizes 12 mm to 50 mm. Starting torque 8.5 to 1400 g-cm. Frequency generator, 5, 6, 12, 24 or 48 pulse/Rev (optional). **Applications:** Cassette recorders, office equipment, calculator, small printers, streamers.

HYSTERISIS SYNCHRONOUS MOTORS



HYSTERISIS SYNCHRONOUS MOTOR
100 VAC or 115 VAC, 50 HZ and 60 HZ, 78 mm and 85 mm dia., 900, 1800 or 3600 RPM, pullout torque to 800 gm cm, with or without cooling fan. **Applications:** Capstan drive, tape deck, video disk drive, floppy disk drive, turntables.

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INDUCTION MOTORS
Shaded pole, capacitor-run, with and without gearhead, 50 HZ and 60 HZ, 115 VAC, 60, 70, 80, 90, and 120 mm dia., starting torque 300 to 2000 g-cm gearheads for all sizes. **Applications:** Copy machines, fan and blower drive, space heater, water pump, typewriter.

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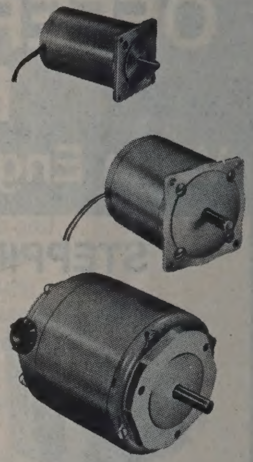
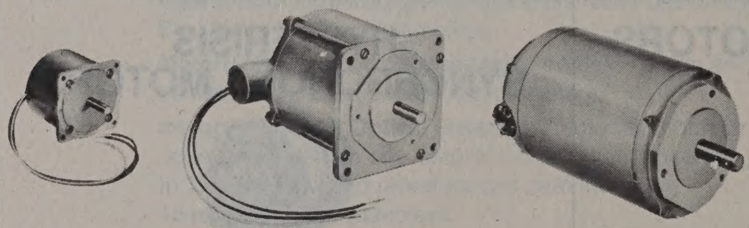
SLO-SYN® *Synchronous / Stepping Motors*

M SERIES SLO-SYN STEPPING MOTORS — Permanent magnet stepping motors that provide high torque-per-pound and torque-to-inertia ratios and can be driven at rates above 20,000 steps per second with low power input. Standard drives available for rates to 10,000 steps per second with higher rates available on special order. Motors have Class B insulation and can be operated at ambient temperature range of -40°C to +65°C. Continuous duty temperature rise is 65°C. Standard M Series SLO-SYN motors are offered in step angles of 0.72°, 1.8°, 2.5°, 5° and 15° with choice of either ±5% or precision ±3% accuracies noncumulative. The step angles can be electronically halved using appropriate half step drives. Holding torque ratings from 53 to 3000 oz-in are available. The motors have no brushes, ratchets or gears and use shielded ball bearings to insure reliability and long life.

DAMPED MOTORS — Standard viscous damped motors and special order motors having integrally mounted Lanchester dampers are available.

SPECIAL DUTY TYPES — For special duty applications, inquire for available double-end shaft, high temperature, vacuum, radiation resistant, militarized, 8-lead/terminal, and encoder stepping motors.





SLO-SYN SYNCHRONOUS MOTORS — Permanent magnet a-c motors having extremely rapid starting, stopping and reversing characteristics and a slow basic shaft speed of 72 rpm synchronous with a line frequency of 60 hertz. These types need only a single-pole, three-position switch for complete forward, reverse and "off" control. No excessive inrush current when energized because starting and operating current are nearly identical. Can be completely stalled without overheating and with no harmful effects on components. Start or stop in less than 5° of shaft rotation; no need for mechanical or electrical braking. When used with an auxiliary high speed motor, the SLO-SYN motor can remain coupled to the load and safely overdriven. Phase shifting resistor and capacitor must be used when operating from a single-phase source but not from two-phase. All standard motors are rated for continuous duty at maximum ambient temperature of 65°C. All models have Class B insulation.

REPRESENTATIVE AC MOTORS

TYPE	MAXIMUM AMPERES	TORQUE (Oz-In)	MAXIMUM MOMENT OF INERTIA OF A RIGIDLY ATTACHED LOAD (Lb-In²)
120 Volts, 50/60 hertz, 1 Phase, 28.8 RPM at 60 hertz			
LS50	0.2	40	0.5
120 Volts, 50/60 hertz, 1 Phase, 200 RPM at 60 hertz			
● TS25	0.2	25	0.12
● TS50	0.3	50	0.25
120 Volts, 50/60 hertz, 1 Phase, 72 RPM at 60 hertz			
● SS25	0.1	25	0.15
● SS50	0.3	50	0.5
● SS150	0.4	150	1.5
SS150M†	0.4	150	1.5
● SS250	0.6	250	3
● X250‡	0.6	250	3
● SS400	0.6	400	4.5
X1000‡	3.0	1000	9
X1500	3.0	1500	12
240 Volts, 50/60 hertz, 1 Phase, 200 RPM at 60 hertz			
TS52	0.2	50	0.25
240 Volts, 50/60 hertz, 1 Phase, 72 RPM at 60 hertz			
SS52	0.2	50	0.5
SS152	0.2	150	1.5
SS252	0.4	250	3
X252‡	0.4	250	3
SS402	0.4	400	4.5
X1002‡	1.5	1000	9

† Militarized.

‡ Explosion-proof.

● **Available off-the-shelf from distributor stock**

THE SUPERIOR ELECTRIC COMPANY

383G Middle Street / Bristol, Connecticut 06010 / Telephone: (203) 582-9561

For More Information. Circle No. 290

SLO-SYN® Stepping Motor Controls

SLO-SYN Stepping Motor Controls meet the need for controls that are easily interfaced with minicomputers and microprocessors and allow system design flexibility.

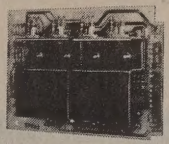
NEW MODULYNX™ MOTION CONTROLS — *Offer a modular, building block approach to step motor control system design. Each system function is on a separate circuit card to permit selection of only the cards necessary to provide features required. Some available cards include a 200 W driver, 1/10 and 1/16 microstep, digital indexer, and an IEEE 488 interface. Inquire about complete offering.*

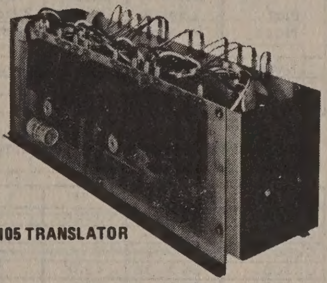
SLO-SYN® TRANSLATORS — Convert pulses from a minicomputer, microprocessor or other pulse source into the switching sequence needed for bidirectional control of SLO-SYN Stepping Motors. Stepping rate, direction and number of steps taken are controlled by external logic. The translator will drive the motor one step for each pulse received from the external source. **Translator Modules** are printed circuit boards which contain the sequencing and switching logic for stepping motor control and are used where the control must be installed on a circuit card rack in the users equipment. The STM101 Translator Module will drive a SLO-SYN motor at rates to 1000 full steps per second and the STM103 provides rates to 3000 full steps or 6000 half steps per second. Both types require a separate power supply. The SLO-SYN Power Supplies listed on this page are recommended. **Open-Chassis Translator** type TB105 includes the power supply as well as sequencing and switching logic and will drive a SLO-SYN motor at rates to 5000 full steps or 10,000 half steps per second. **Packaged Translator** types ST101, ST103 and ST105 contain all needed power supply, sequencing and switching circuits and are mounted in attractive, sturdy cabinets. Maximum speed is 1000 full steps per second for the ST101, 3000 full steps or 6000 half steps per second for the ST103, and 5000 full steps or 10,000 half steps per second for the ST105. **High Power Translators** types TC600 and TM600 provide rates to 10,000 full steps or 20,000 half steps per second. The TC600 consists of three printed circuit boards and requires an external power supply. The TM600 is an open chassis unit with an integral power supply.

SLO-SYN® BUFFERED TRANSLATORS — Accept pulses from a fixed high rate or a random rate pulse source and automatically ramp the pulse rate to accelerate and decelerate the motor. A buffered translator will drive a motor one step for each pulse received from the external source. **Type BUF105** is an open chassis model which will operate a SLO-SYN Stepping Motor at rates to 5000 full steps or 10,000 half steps per second. **The SB105** is similar, but is installed in a cabinet designed for bench, shelf or 19-inch (483mm) rack.

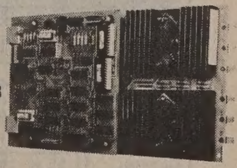
SLO-SYN® PRESET INDEXERS — Provide control of step rate, direction and distance without external logic. They incorporate oscillators and counting circuits to provide the pulses and keep track of the number of pulses given to the motor. **SLO-SYN Preset Indexer Modules** are printed circuit boards containing the needed logic but not including the power supply. These units are used where the control is to be mounted in a circuit card rack in the users equipment. A SLO-SYN Power Supply is recommended, but other supplies which meet the power specifications of the specific Preset Indexer Module can be used. The PIM151 Preset Indexer Module provides stepping rates to 1000 full steps per second and the PIM153 offers stepping rates to 3000 full steps or 6000 half steps per second. Both types are directed by external switches. The PIM153 also permits count selection using voltage levels. **Open-Chassis Type TBM155** will drive a SLO-SYN Motor at rates to 5000 full steps or 10,000 half steps per second. Index count and other control functions can be generated using external switches or voltage levels. Acceleration and deceleration can be adjusted to match the characteristics of the motor and load. **Packaged Types ST151, SP153A, and SP155A** are mounted in attractive cabinets which allow mounting on a bench or shelf or in a 19-inch (483mm) rack. All three can be directed from switches on their front panels. The SP153A and SP155A can also be controlled from external switches or voltage levels. Speed capabilities range up to 5000 full steps or 10,000 half steps per second. **A Switch Kit** is available which provides the BCD logic switch and other switches needed for controlling modular and open-chassis preset indexers. Can also provide external control of packaged models.

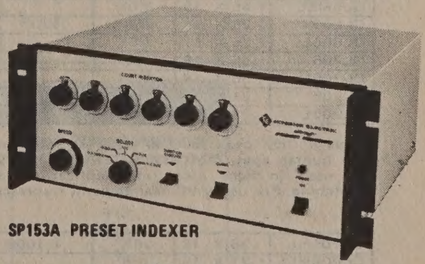
SLO-SYN® POWER SUPPLIES — Open-chassis, base-mounting power supplies for use with SLO-SYN Translator Modules and Preset Indexer Modules. The module can be installed remote from the power supply or can be mounted on the power supply chassis to form a single unit. Models are available for operation from 120 VAC or from 220/240 VAC power.

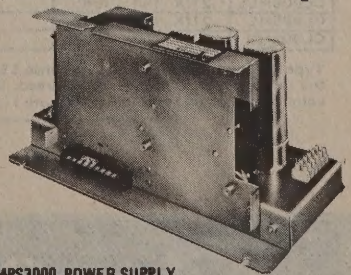

STM101 TRANSLATOR MODULE

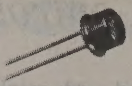

TBM105 TRANSLATOR

SB105 BUFFERED TRANSLATOR


PIM153 PRESET INDEXER MODULE


SP153A PRESET INDEXER


MPS3000 POWER SUPPLY



Clairex Photoconductive Cells

Part No.	Diam. X Length (inches)	Resistance @ 2 ftc ± 33-1/3%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)
CL5M9M	.55 X .18	11K	1:1000	170	2000 500¹
CL709L	.36 X .18	28K		100	125
CL909L	.21 X .15	100K		100	50

Type 9 CdS, peak spectral response 5500 angstroms combines high speed with extreme temperature stability and high linearity.

CL5M3	.55 X .18	7.2K	1:10,000	250	2000 500¹
CL603	.25 X .5	133K		300	75
CL603A	.25 X .5	75K		300	75
CL603AL	.25 X .5	3.5K		170	75
CL703	.36 X .18	133K		300	125
CL703A	.36 X .18	67K		300	125
CL703L	.36 X .18	2.7K		100	125
CL903	.21 X .15	133K		250	50
CL903A	.21 X .15	67K		250	50
CL903L	.21 X .15	6.0K		100	50

Type 3 CdSe, peak spectral response 7350 angstroms, fast response, and very high light-to-dark resistance ratio. Can be used for high speed switching or counting. Sensitive to near infra red. For use with incandescent or neon lamps.

CL5M4	.55 X .18	1.5K	1:400	250	2000 500¹
CL5M4L	.55 X .18	0.25K		170	2000 500¹
CL604	.25 X .5	30K		300	75
CL604L	.25 X .5	1.5K		170	75
CL704	.36 X .18	30K		300	125
CL704L	.36 X .18	0.6K		100	125
CL904	.21 X .15	30K		250	50
CL904L	.21 X .15	2K		100	50

Type 4 CdSe, peak spectral response 6900 angstroms, lowest resistance photocells available. Can be used for "on-off" applications when low resistance is desired. For use with incandescent or neon lamps.

CL5M5	.55 X .18	9K	1:100	250	2000 500¹
CL5M5L	.55 X .18	1.5K		170	2000 500¹
CL605	.25 X .5	166K		300	75
CL605L	.25 X .5	7.5K		170	75
CL705	.36 X .18	166K		300	125
CL705L	.36 X .18	3.3K		100	125
CL905	.21 X .15	166K		250	50
CL905L	.21 X .15	10K		100	50

Type 5 CdS, peak spectral response 5500 angstroms (closely matches the human eye), most stable, lowest memory photocell available. Can be used in light measuring applications and precision low speed switching. For use with incandescent, fluorescent or neon lamps.

CL705HL	.36 X .18	28K	1:1000	100	125
CL905HLL	.21 X .15	15K		60	50
CL905HL	.21 X .15	100K		100	50
CL905HN	.21 X .15	700K		100	50

Type 5H CdS, peak spectral response 5500 angstroms (closely matches the human eye). Combines high speed, stability, linearity, and uniform color temperature response. Footnote 1. with and without heat sink.

Part No.	Diam. X Length (inches)	Resistance @ 2 ftc ± 33-1/3%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)
CL707H	.36 X .18	500K	1:1000	300	125
CL707HM	.36 X .18	100K		250	125
CL907H	.21 X .15	600K		250	50
CL907HN	.21 X .15	300K		100	50
CL907HL	.21 X .15	24K		100	50

Type 7H CdS peak Spectral response 6200 angstroms. Very fast decay time coupled with low resistance and high linearity. Ideal for beam breaking applications.

CL5M7	.55 X .18	7.2K	1:300	250	2000 500¹
CL607	.25 X .5	133K		300	75
CL707	.36 X .18	133K		300	125
CL707L	.36 X .18	2.7K		100	125
CL907	.21 X .15	133K		250	50
CL907N	.21 X .15	66K		100	50

Type 7 CdS, peak spectral response 6150 angstroms, moderate speed and ratio. Can be used in general beam breaking applications. For use with incandescent, neon or fluorescent lamps.

Part No.	Diam. X Length (inches)	Resistance @ 2 fc ± 33-1/3%	Minimum resistance ratio from 2 ftc to Dark within 5 sec.	Maximum voltage	Power Dissipation @ 25°C (mw)	Type
CL703/2	.36 X .18	50K	1:10,000	300	125	3 CdSe
CL703L/2	.36 X .18	6.5K	1:10,000	100	125	3 CdSe
CL704/2	.36 X .18	17K	1:400	300	125	4 CdSe
CL704L/2	.36 X .18	1.5K	1:400	100	125	4 CdSe
CL705/2	.36 X .18	166K	1:100	300	125	5 CdS
CL705L/2	.36 X .18	7.5K	1:100	100	125	5 CdS

Plastic Encapsulated Photoconductive Cells

CL5P4	.430 X .130	2.7K	1:400	250	250	Type 4 CdSe
CL5P4L	.430 X .130	0.45K		170	250	
CL7P4	.283 X .075	54K		300	125	
CL7P4L	.283 X .075	1K		170	125	
CL9P4L	.180 X .065	2K		100	50	
CL5P5	.430 X .130	9K	1:100	250	250	Type 5 CdS
CL5P5M	.430 X .130	6K		250	250	
CL5P5L	.430 X .130	1.5K		170	250	
CL7P5	.283 X .075	166K		300	125	
CL7P5L	.283 X .075	3.3K		170	125	
CL9P5	.180 X .065	166K		250	50	
CL9P5L	.180 X .065	10K		100	50	
CL7P5HL	.283 X .075	28K	1:1000	170	125	Type 5H CdS
CL9P5HL	.180 X .065	100K		100	50	
CL7P7HL	.283 X .075	10K	1:1000	170	125	Type 7H CdS
CL7P7HM	.283 X .075	30K		400	125	
CL9P7HL	.180 X .065	24K		100	50	
CL9P7HLL	.180 X .065	4.5K		70	50	
CL5P9M	.430 X .130	9K	1:1000	250	250	Type 9 CdS
CL7P9L	.283 X .075	28K		170	125	
CL9P9L	.180 X .065	100K		100	50	
CL9P9LL	.180 X .065	15K		70	50	

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TO 18 FLAT WINDOW

Part No.	I_L (ma) V_{CE} = 5V Min	Max	H (Note 1) mw/cm²	BV_{CEO} Volts	I_{CEO} (na) V_{CE} = 10V	P_T (mw) 25°C
CLT 2065	7.0	—	5.0	40	50	250
CLT 2064	3.0	7.0	5.0	50	50	250
CLT 2030	1.0	3.0	5.0	30	25	250
CLT 2020	0.4	1.2	5.0	30	25	250
CLT 2010	0.2	0.6	5.0	50	25	250
CLR 2060	1.4 14.0	6.0 —	0.2 2.0	40	100	250
CLR 2050	0.6 6.0	1.8 —	0.2 2.0	40	100	250
CLR 2049	0.2	1.0	0.2	40	100	250

TO 18 LENS

Part No.	I_L (ma) V_{CE} = 5V Min	Max	H (Note 1) mw/cm²	BV_{CEO} Volts	I_{CEO} (na) V_{CE} = 10V	P_T (mw) 25°C
CLT 2165	15.0	—	5.0	40	50	250
CLT 2164	7.0	—	5.0	40	50	250
CLT 2160	4.0	12.0	5.0	30	25	250
CLT 2150	2.4	7.2	5.0	40	25	250
CLT 2140	1.2	3.6	5.0	40	25	250
CLT 2130	0.6	1.8	5.0	50	25	250
CLR 2180	0.6 4.0	— —	0.02 0.20	40	100	250
CLR 2170	0.2 2.0	0.8 —	0.02 0.20	40	100	250

WINDOW LENS .115 LENGTH X .077 DIAMETER

Part No.	Lens	I_L (ma) V_{CE}=5V Min	Max	H (Note 1) mw/cm²	BV_{CEO} Volts	I_{CEO} (na) V_{CE}=10V	P_T (mw) 25°C
CLT 5170	L	1.4 6.0	— —	5 20	40	25	50
CLT 5160	L	0.5 2.0	— 7.0	5 20	40	25	50
CLR 5101	L	2.0 20.0	— —	0.2 2.0	40	100	50

-2 Designation is with second lead welded to the header

PLASTIC ENCAPSULATED SIDE VIEW

Part No.	I_L (ma) V_{CE}=5V Min	Max	H (Note 1) mw/cm²	BV_{CEO} Volts	I_{CEO} (na) V_{CE}=10V	P_T(mw) 25°C
CLT 4000	.3	—	5	30	50	75
CLT 4140	.5	—	5	40	50	75
CLT 4150	1.0	3.0	5	40	50	75
CLT 4160	2.0	—	5	40	50	75
CLR 4180	.1	—	.1	40	200	75
CLR 4185	.6	—	.1	40	200	75

PHOTO DIODES

Part No.	Active Area Inches	Package	I_{SC} (ua) Min.	H mw/cm²	I_D(na) V=-.1V
CLD 31	.222 x .122	Plastic	120	5	100
CLD 41	.051 x .051	To 18	6	5	50
CLD 42	.051 x .051	To 18	35	5	50
CLD 56	.222 x .122	To 5	100	5	100
CLD 71	.125 x .125	Plastic	70	5	100
CLD 72	.051 x .051	Plastic	17	5	10

Note 1: The light source is a frosted tungsten incandescent lamp at 2854°K.

INFRARED EMITTERS

Part No.	Package	Material	Power Out (mw)	Vf (Volts)	Pt 25°C	Peak Wave Length nm
CLED-1	T046 lens	GaAs	1.0 @ 50 ma	1.8 @ 60 ma	200 mw	930
CLED-1F	T046 Window	GaAs	1.0 @ 50 ma	1.8 @ 60 ma	200 mw	930
CLED-3	Pill-lens	GaAs	0.75 @ 50 ma	1.6 @ 50 ma	75 mw	930
CLED-5	Post lens	GaAs	0.80 @ 50 ma	1.6 @ 50 ma	75 mw	930
CLED-400	Plastic	GaAs	0.50 @ 50 ma	1.6 @ 50 ma	100 mw	930
CLED-155	T046 lens	GaAlAs	3.0 @ 50 ma	1.8 @ 50 ma	200 mw	880
CLED-155F	T046 Window	GaAlAs	3.0 @ 50 ma	1.8 @ 50 ma	200 mw	880
CLED-305	Pill-lens	GaAlAs	2.0 @ 50 ma	1.7 @ 40 ma	75 mw	880
CLED-405	Plastic	GaAlAs	2.0 @ 50 ma	1.7 @ 40 ma	100 mw	880
CLED-505	Post-lens	GaAlAs	2.0 @ 50 ma	1.7 @ 40 ma	75 mw	880

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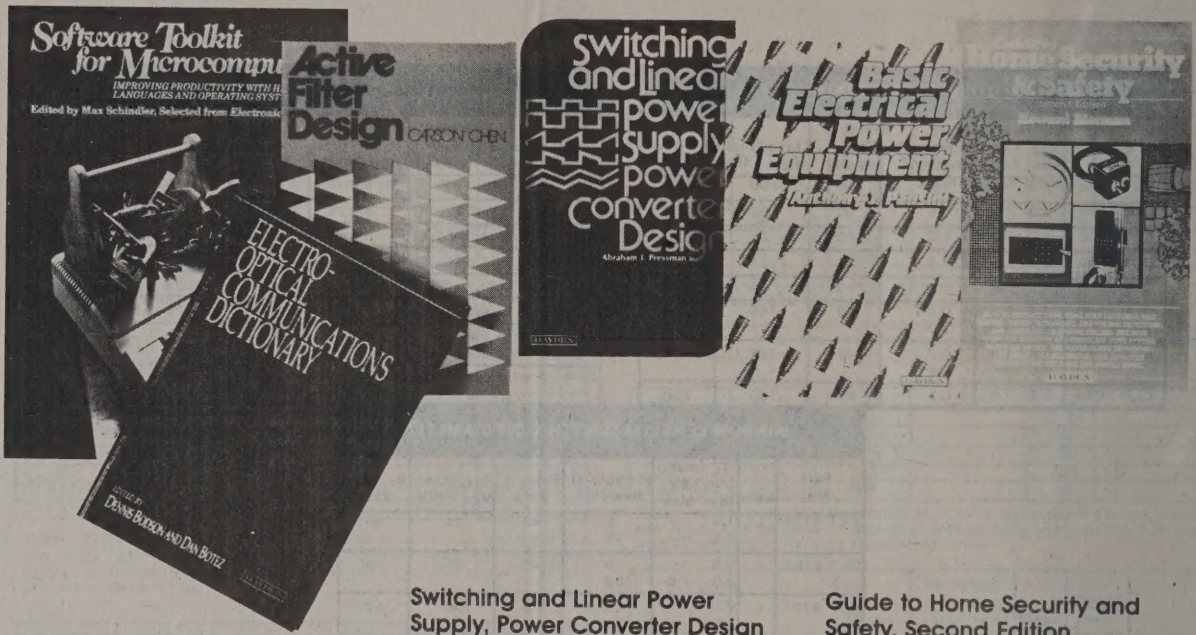
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Introduction

Honeywell

OPTOELECTRONICS INC.
830 EAST ARAPAHO ROAD
RICHARDSON, TEXAS 75081
(214)—234-4271 TELEX 73-0890
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Honeywell offers industry's broadest range of optoelectronic products. They include:

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- Transmissive switches
- Reflective switches
- Encoders
- Emitter/Detector arrays
- Discrete chips
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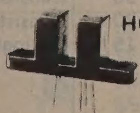
Optical switches

- LED and photodetector in the same package.
- Reflective and transmissive (interrupter) types.
- Plastic and hermetic components.
- Transistor, Darlington and Schmitt trigger outputs.
- Variety of package designs.

Optoschmitt switches

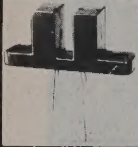
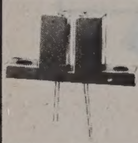
Characteristics	Components	Output voltage		Forward voltage	Propagation delay				Rise time	Fall time	Required LED current		Slot width
		Low	High		Low-high		High-low						
Test condition				$I_F = 20\,mA$									
Symbol		V_{OL}	V_{OH}	V_F	T_{DLH}		T_{DHL}		t_r	t_f	I_{FT}		d
Units		V	V	V	μs		μs		ns	ns	mA		mm
		max.	typ.	max.	typ.	max.	typ.	max.	typ.	typ.	typ.	max.	
HOA 2001	plastic	0.4	V_{CC}	1.5	1	5	2.5	5	60	6	4	10	.120
 HOA 2002 (a)	plastic	0.4	V_{CC}	1.5	1	5	2.5	5	60	6	4	10	.125

(a) Features .010 x .040 aperture (b) V_{CC} operating range = 4.5 to 16 Volts

Honeywell

OPTOELECTRONICS INC.
830 EAST ARAPAHO ROAD
RICHARDSON, TEXAS 75081
(214)—234-4271 TELEX 73-0890
TWX 910-867-4757

Transmissive switches

Characteristics	Com-ponents	Sensor aperture	On-state collector current			Off-state collector current	Saturation voltage			LED forward voltage		Response time		Slot width	Output
Test condition			$V_{CE} = 5 V$ I_F as shown			$V_{CE} = 10 V$ $I_F = 0$	I_C and I_F as shown			I_F as shown		$R_L = 1000 \Omega$, $V_{CC} = 5 V$, $I_C = 1 mA$			
Symbol			I_L			I_D	$V_{CE(SAT)}$			V_F		t_r, t_f		d	
Units		inches	mA			nA	V			V		μs		inches	
			min	max	I_F(mA)	max.	max.	I_C(mA)	I_F(mA)	max.	I_F(mA)	rise (typ.)	fall (typ.)	nom	
 HOA 1879-11	plastic		.40	2.0	20	100	0.4	.05	20	1.5	20	10	12	.125	transistor
HOA 1879-12	plastic		1.8	10.0	20	100	0.4	.22	10	1.5	20	10	12	.125	transistor
HOA 1879-15	plastic	.010x.040	.50	4.0	20	100	0.4	.06	20	1.5	20	10	12	.125	transistor
HOA 1881-11	plastic		.30	2.0	20	100	0.4	0.025	20	1.5	20	10	12	.125	transistor
HOA 1881-12	plastic		1.8	10.0	20	100	0.4	0.075	20	1.5	20	10	12	.125	transistor
HOA 1881-13	plastic		4.0	25.0	20	250	1.1	0.250	20	1.5	20	500	750	.125	darlington
 HOA 2762-1	hermetic	.007x.040	0.1	1.1	20	100	0.4	0.010	20	1.6	50	10	12	.060	transistor
HOA 2762-2	hermetic	.007x.040	1.0	5.0	20	100	0.4	0.025	20	1.6	50	10	12	.060	transistor
HOA 2762-3	hermetic	.007x.040	2.0	15.0	20	250	1.1	0.250	20	1.6	50	500	750	.060	darlington
HOA 2862-1	hermetic	.025x.040	0.2	2.0	20	100	0.4	0.025	20	1.6	50	10	12	.100	transistor
HOA 2862-2	hermetic	.025x.040	1.8	10.0	20	100	0.4	0.075	20	1.6	50	10	12	.100	transistor
HOA 2862-3	hermetic	.025x.040	4.0	25.0	20	250	1.1	0.500	20	1.6	50	500	750	.100	darlington

Notes:

(1) Storage temperature −65°C to +100°C (hermetic)
−40°C to +85°C (plastic)
(2) Operating temperature −65°C to +100°C (hermetic)
−40°C to +80°C (plastic)
(3) BV_{CEO} @ $I_C = 100\mu A$, 30V min (transistor), 15V min (darlington)
(4) BV_{ECO} @ $I_C = 100\mu A$, 5V min
(5) $I_R = 10\mu A$ max @ $V_R = 3V$

Reflective switches

Characteristics	Components	Light current				Dark current		LED forward voltage		Light current rise time	Collector-emitter breakdown	Output
Test condition		$V_{CE} = 5 V$ I_F as shown				$I_F = 0, H = 0$ V_{CE} as shown		I_F as shown		$V_{CC} = 5 V$, $I_C = 1 mA$ $R_L = 1000 \Omega$		
Symbol		I_L				I_D		V_F		t_r	BV_{CEO}	
Units		mA				nA		V		μs	V	
		min	max	I_F(mA)	d Inch (a)	max.	V_{CE}(V)	max.	I_F(mA)	typ.	min.	
HOA 1160-1	hermetic	0.5	2.5	30	.075	100	10	1.6	50	8	30	transistor
HOA 1160-2	hermetic	2.0	10.0	30	.075	100	10	1.6	50	10	30	transistor
HOA 1160-3	hermetic	5.0	35.0	30	.075	250	10	1.6	50	50(c)	15	darlington
HOA 1180-1	hermetic	.04	.20	30	.50	100	10	1.6	50	6	30	transistor
HOA 1180-2	hermetic	.16	.80	30	.50	100	10	1.6	50	6	30	transistor
HOA 1180-3	hermetic	2.0	14.0	30	.50	250	10	1.6	50	50(c)	15	darlington

For More Information. Circle No. 292

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TWX 910-867-4757

HOA 1397-1	plastic	.20	.80	20	.050(b)	100	10	1.5	20	6	30	transistor
HOA 1397-2	plastic	.70	2.8	20	.050(b)	100	10	1.5	20	6	30	transistor
HOA 1397-31	plastic	2.0	8.0	20	.050(b)	250	10	1.5	20	50(c)	15	darlington
HOA 1397-32	plastic	7.0	28.0	20	.050(b)	250	10	1.5	20	50(c)	15	darlington
HOA 1404-1	hermetic	.20	1.0	30	.20	100	10	1.6	50	6	30	transistor
HOA 1404-2	hermetic	.80	4.0	30	.20	100	10	1.6	50	8	30	transistor
HOA 1404-3	hermetic	2.0	14.0	30	.20	250	10	1.6	50	50(c)	15	darlington
HOA 1405-1	plastic	.20	1.0	30	.20(b)	100	10	1.5	20	6	30	transistor
HOA 1405-2	plastic	.80	4.0	30	.20(b)	100	10	1.5	20	6	30	transistor
HOA 2498-1	hermetic	.04	.20	30	.50	100	10	1.6	50	6	30	transistor
HOA 2498-2	hermetic	.16	.80	30	.50	100	10	1.6	50	8	30	transistor
HOA 2498-3	hermetic	2.0	14.0	30	.50	250	10	1.6	50	50(c)	15	darlington

(a) d is the distance to the reflective object (a mirror), see test circuit below.

(b) Reflective surface is an Eastman Kodak® neutral white test card having 90% diffuse reflectance.

(c) R_L = 100Ω

Light emitting diodes

- hermetic and plastic packages
- long operating life
- high conversion efficiency

Characteristics	Package	Output power			Beam angle	Forward voltage		Reverse breakdown	Radiation rise time	Forward continuous current	Peak wave-length
Test condition		I_F as shown			3	I_F as shown		$I_R = 10\,\mu A$		25 C	
Symbol		P_O			Ø	V_F		V_R	t_r	I_F	λ
Units		mW			degrees	V		V	µs	mA	nm
		min.	max.	I_F(mA)	typ.	max.	I_F(mA)	min.	typ.	max.	typ.
SE 1450-1	hermetic	0.20		50	12	1.6	50	2	0.7	100	930
SE 1450-2	hermetic	0.36		50	12	1.6	50	2	0.7	100	930
SE 1450-3	hermetic	0.7		50	12	1.6	50	2	0.7	100	930
SE 1450-4	hermetic	1.00		50	12	1.6	50	2	0.7	100	930
SE 1450-1L	hermetic	0.20		50	12	1.6	50	2	0.7	100	930
SE 1450-2L	hermetic	0.35		50	12	1.6	50	2	0.7	100	930
SE 1450-3L	hermetic	0.70		50	12	1.6	50	2	0.7	100	930
SE 1450-4L	hermetic	1.00		50	12	1.6	50	2	0.7	100	930
SE 2460-1	hermetic	0.27		50	18	1.6	50	2	0.7	100	930
SE 2460-2	hermetic	0.40		50	18	1.6	50	2	0.7	100	930
SE 2460-3	hermetic	1.00		50	18	1.6	50	2	0.7	100	930
SE 3455-1	hermetic	2.0		100	90	1.7	100	2	0.7	100	930
SE 3455-2	hermetic	3.5		100	90	1.7	100	2	0.7	100	930
SE 3455-3	hermetic	4.8		100	90	1.7	100	2	0.7	100	930
SE 3455-4	hermetic	5.4		100	90	1.7	100	2	0.7	100	930
SE 3470-1	hermetic	7.0		100	75	1.9	100	6	0.7	100	880
SE 3470-2	hermetic	9.0		100	75	1.9	100	6	0.7	100	880
SE 3470-3	hermetic	10.5		100	75	1.9	100	6	0.7	100	880
SE 3470-4	hermetic	12.0		100	75	1.9	100	6	0.7	100	880

For More Information. Circle No. 292

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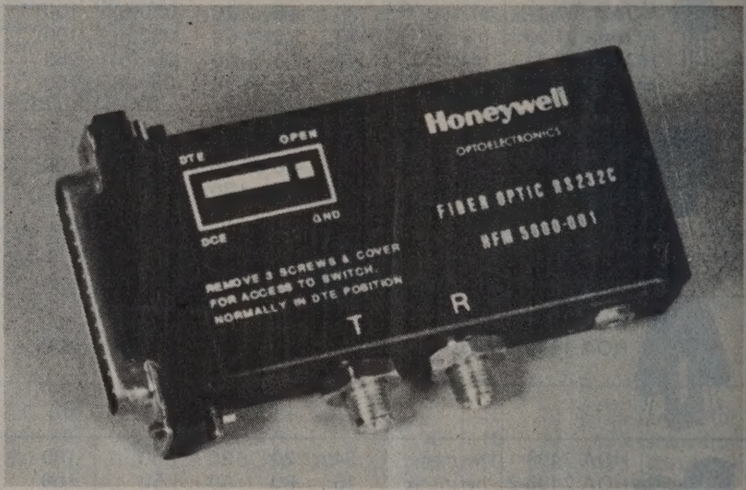
Fiber Optic Links

RS232C

RS232C fiber optic link: HFM 5000 Series

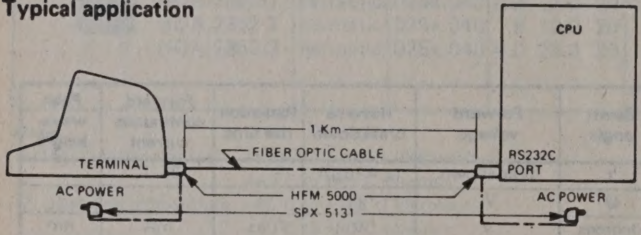
The HFM 5000 series is a plug compatible replacement for most 3 wire EIA RS232C (V24) extension cables providing an effective way of extending cables beyond the 15 meters limit of a standard RS232C.


Honeywell
OPTOELECTRONICS
FIBER OPTIC RS232C
HFM 5000-001
DTE
OPEN
DCE
GND
REMOVE 3 SCREWS & COVER FOR ACCESS TO SWITCH. NORMALLY IN DTE POSITION
T
R

Features

- Extends RS232C link length to 1.000 meters (3,281 feet)
- Optical isolation of grounds
- EMI/RFI resistant
- Full duplex, asynchronous, DC to 56 Kb/s data rate
- Plugs directly into 25 pin connector on computers, peripherals, etc.
- DCE or DTE switchable
- Power provided by AC power cube or thru 25 pin connector
- Interfaces to standard RS232C Drivers/Receivers
- Complies with FCC class A equipment requirements

Typical application


CPU
1 Km
FIBER OPTIC CABLE
TERMINAL
RS232C PORT
AC POWER
HFM 5000
SPX 5131
AC POWER

Standard cable assemblies (Duplex 200 μm, NA = 0.16)

Type	Length (m)	Optical connector
SPX 5132-302	30	AMP # 227846-1
SPX 5132-502	50	AMP # 227846-1
SPX 5132-103	100	AMP # 227846-1
SPX 5132-104	1000	AMP # 227846-1
Note 1		

HFM 5000

Module type	RS232C Connector (D type 25 pin)	Optical connector	Power supply
HFM 5000-001	AMP # 745224-1/male	AMP # 227846-1	SPX 5131- . . .
HFM 5000-002	AMP # 745114-2/female	AMP # 227846-1	SPX 5131- . . .
HFM 5000-003	AMP # 745224-1/male	AMP # 227846-1	Note 3 & 4
HFM 5000-004	AMP # 745114-2/female	AMP # 227846-1	Note 3 & 4
HFM 5000-006	AMP # 745224-1/male	AMPHENOL SMA # 905	SPX 5131- . . .
HFM 5000-007	AMP # 745114-2/female	AMPHENOL SMA # 905	SPX 5131- . . .
HFM 5000-008	AMP # 745224-1/male	AMPHENOL SMA # 905	Note 3 & 4
HFM 5000-009	AMP # 745114-2/female	AMPHENOL SMA # 905	Note 3 & 4

Note 1:
Other cable lengths on request.

Note 2:
Optional RS232C connector configurations on request.

Note 3:
Pin 18 and 25 connected internally to ± 5 V.

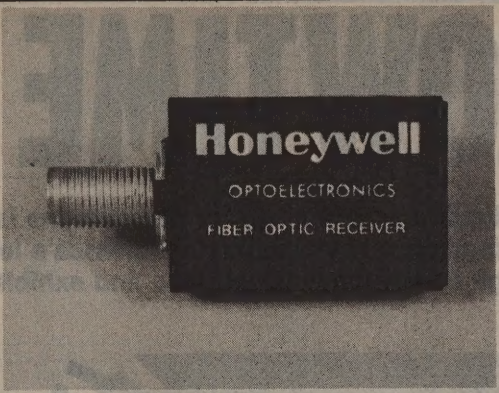
Note 4:
Power supply options:

SPX 5131-001: 120 AC/60 Hz US plug
SPX 5131-002: 220 AC/60 Hz US plug
SPX 5131-UK: 220 AC/50 Hz UK plug
SPX 5131-E: 220 AC/50 Hz

Note 5:
See fig. 60 for Dimensions

Fiber Optic Modules

10 Mbit/sec., Tri-level mode



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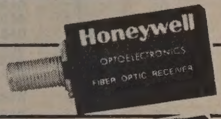
The basic version of the receiver MASTERSLICE IC that Honeywell provides in the modules shown in the Table is:

- TRILEVEL TRANSPARENT CODE This is the mate to the transmitter IC. In addition to providing a "transparent" link, the receiver IC also includes a signal quality output (TTL) that indicates when the optical signal is good enough to meet 10^{-9} bit error rate.

Features

- −31 dBm sensitivity at 10^{-9} BER (HFM 1010)
- DC to 10 Mb/s NRZ
- 24 dB optical signal range
- Signal quality output
- Low profile for use in 1/2" spaced card racks
- Choice of SMA or ADM optical connectors
- Standard DIP 0.1" lead spacing on 0.6" centers
- Standard TTL output
- Operation on single +5V supply

Receivers

	Type	Input power min. P_i (μW)	Connector type	Operating temperature range
	HFM 1010-201 HFM 1010-202	1 .8	SMA SMA	−55 to +125 °C
	HFM 2010-221 HFM 2010-222 HFM 2010-223 HFM 2010-224	10 25 50 100	SMA SMA SMA SMA	−55 to +125°C −55 to +125°C −55 to +125°C −55 to +125°C

Note 1: Power output measured out of 10 meters of 100 μm core fiber with NA = 0.25

Fiber Optic Modules

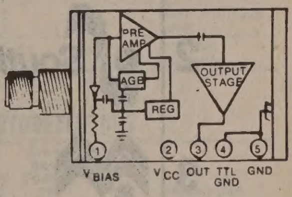
10 Mbit/sec. (Manchester), Bi-level mode

The SPX 4140 Transmitter and SPX 4141 Receiver modules comprise a complete functional optical digital data transmission system. Full internal power supply regulation and automatic gain control are provided allowing adjustment-free operation over the full operating temperature range.
TTL buffering is provided for direct logic interface.

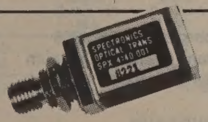
Features

- Transmission distances to 2 km used with matched SPX 4141 Receiver Module
- DC to 10 MHz data rates
- Operation on single +5V supply
- No shielding required
- Versatile mounting options
- Couples to wide variety of fibers
- TTL compatible input

SPX 4140 Transmitter



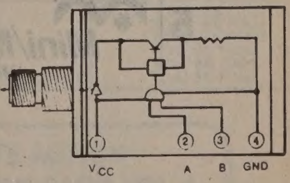
Transmitter

	Type	Output power min. P_o (μW)	Connector type	Operating temperature range
	SPX 4140-001 SPX 4140-002 SPX 4140-201 SPX 4140-202	50 90 50 90	SMA SMA SMA SMA	0 to +95 °C 0 to +95 °C −55 to +125 °C −55 to +125 °C

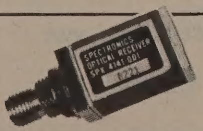
Features

- 10K bits to 10M bit/sec data rates (Manchester)
- No shielding required
- Couples to wide variety of fibers
- Operation on single 5V supply
- Wide dynamic range (28 dB)
- Versatile mounting options
- TTL compatible output
- Matched to SPX 4140 Transmitter Module

SPX 4141 Receiver



Receiver

	Type	Input power P_i (μW) min.	max.	Connector type	Operating temperature range
	SPX 4141-001 SPX 4141-002 SPX 4141-201 SPX 4141-203	0.7 0.4 0.7 0.4	250 250 250 250	SMA SMA SMA SMA	0 to +95 °C 0 to +95 °C −55 to +125 °C −55 to +125 °C

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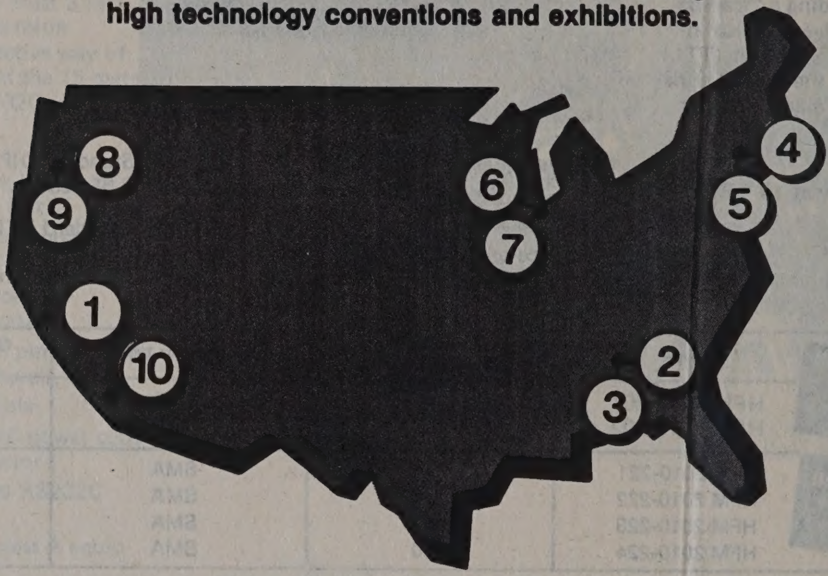

	Show	Dates	Location
1	**Mini/Micro West**	February 5, 6, 7, 1985	Anaheim Hilton Exposition Center Anaheim, California
2	**Southcon**	March 5, 6, 7, 1985	Georgia World Congress Center Atlanta, Georgia
3	**Mini/Micro Southeast**	March 5, 6, 7, 1985	Georgia World Congress Center Atlanta, Georgia
4	**Electro**	April 23, 24, 25, 1985	New York Coliseum New York
5	**Mini/Micro Northeast**	April 23, 24, 25, 1985	Albert Hall New York
6	**Midcon**	September 10, 11, 12, 1985	Rosemont Exposition Center Chicago, Illinois
7	**Mini/Micro Midwest**	September 10, 11, 12, 1985	Rosemont Exposition Center Chicago, Illinois
8	**Northcon**	October 22, 23, 24, 1985	Portland Memorial Coliseum Portland, Oregon
9	**Mini/Micro Northwest**	October 22, 23, 24, 1985	Portland Memorial Coliseum Portland, Oregon
10	**Wescon**	November 19, 20, 21, 22, 1985	Anaheim Convention Center Anaheim, California

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SILONEX inc

PHOTOCELLS • PHOTODIODES • PHOTOVOLTAIC CELLS, PANELS
AND POWER SYSTEMS • OPTICALLY COUPLED ISOLATORS •
OPTOELECTRONIC ARRAYS • UV SENSITIVE LDRs

CdS & CdSe PHOTOCELLS

Cell Type No.	Typical 1.0 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt.	Max. Power MW.	Description
NSL-3120	75	100	70	50	CdSe Photoconductive Cell in Hermetic Glass and Metal TO-18.
NSL-3130	30	100	70	50	
NSL-3140	14	100	70	50	
NSL-3150	550	1000	250	50	
NSL-3160	260	1000	250	50	
NSL-3170	110	1000	250	50	
NSL-3180	50	500	120	50	
NSL-3812	43	10	80	100	CdSe Photoconductive cell in TO-5 plastic coated "open pill" package.
NSL-3822	18.6	10	80	100	
NSL-3832	8	10	80	100	
NSL-3842	3.5	10	80	100	
NSL-3852	330	100	320	100	
NSL-3862	155	100	320	100	
NSL-3872	66	100	320	100	
NSL-4440	120	50	1000	1000	1" CdS Photoconductive Cell in Hermetic Glass and Metal case 1.25" diameter.
NSL-4450	26.0	15	1000	1000	
NSL-4460	11.4	5	1000	1000	
NSL-4470	5.5	0.5	1000	1000	
NSL-4442	120	10	1000	500	1" CdS Photoconductive Cell in plastic coated "open pill" package.
NSL-4452	26	1.5	1000	500	
NSL-4462	11.4	0.5	1000	500	
NSL-4472	5.5	0.2	1000	500	
NSL-4610	65	80	80	100	CdS Photoconductive Cell in Hermetic Glass and Metal ¼" dia. case. Hermetic CdSe versions also available.
NSL-4620	28	20	80	100	
NSL-4630	12	2.7	80	100	
NSL-4640	5.2	0.7	80	100	
NSL-4650	550	160	250	100	
NSL-4660	230	20	250	100	
NSL-4670	100	4	250	100	
NSL-4810	43.0	65	120	200	CdS Photoconductive Cell in Hermetic Glass and Metal TO-5. Plastic coated "open pill" versions also available.
NSL-4820	18.6	15	120	200	
NSL-4830	8	1.8	120	200	
NSL-4840	3.5	0.25	120	200	
NSL-4850	330	200	320	200	
NSL-4860	155	130	320	200	
NSL-4870	66	20	320	200	
NSL-2930	1.7	0.5	80	500	TO-8 Hermetic CdS/Se Photoconductive Cell.
NSL-2940	.75	0.1	80	500	
NSL-2970	7.5	5.0	250	500	
NSL-3921	4.0	2	80	200	TO-8 CdSe Photoconductive Cell in Plastic Case. Glass Lens and Plastic Coated "open pill" and CdS versions also available.
NSL-3931	1.7	2	80	200	
NSL-3941	0.75	2	80	200	
NSL-3951	40.0	5	320	200	
NSL-3961	17.0	5	320	200	
NSL-3971	7.5	5	320	200	
NSL-4920	4.0	2.0	80	500	CdS Photoconductive Cell in Hermetic Glass and Metal TO-8. Hermetic CdSe version also available.
NSL-4930	1.7	0.4	80	500	
NSL-4940	0.75	0.05	80	500	
NSL-4950	40	30	320	500	
NSL-4960	17	4.0	320	500	
NSL-4970	7.5	0.5	320	500	
NORP-11	20	2.5	320	250	CdS Photocell in 0.5" lensed Plastic case.
NORP-12	9	1	320	250	
NORP-13	4	0.5	320	250	

UV SENSITIVE LDRs

Cell Type No.	Typical 1.0 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt	Max. Power MW	Description
NSL-2129/3	1.7	0.2	80	200	0.5" Plastic Case with Phosphor-Coated Quartz Window
NSL-2129/6	17.0	1	320	200	

PIN PHOTODIODES

NSL Type No.	Light Current* MA	Dark Current nA	Rise Time nS	Fall Time nS	Description
NSL-530	0.3	10	3	6	TO-18 Package
NSL-580	1.5	30	5	8	TO-5

* At 500 Ftc (25 MW/cm²) 2870°K Source

PHOTOVOLTAIC MODULES

NSL Type No.	Typical Short Ct. Current	Typical Open Ct. Voltage	Peak Power	Mechanical Description
NSL-5925	2.2A	20.5V	32W	40.2" x 15.8" x 1.74"
NSL-5950	1.25A	19.5V	18W	21.2" x 17.6" x 1.74"
NSL-5978	680mA	19.5V	9W	17.56" x 12.32" x 1.74"

PHOTODETECTOR LAMP/LED ASSEMBLIES

CdSe Photodetector

	Emitter		Detector				
Module Type No.	Volts	Current MA	Max. ON Res. Ω	Min. OFF Res. MΩ	Max. Volts	Max. Power mW	Description
PL-1033-1	10	15	100	10	80	250	Phenolic .75" x .75" x 625" Pin Leads for P.C. Board Mounting, (Matched, Multi-Detector Configurations available.)
PL-1036-1	10	15	400	50	320	250	
PL-2H33-1	200	2	100	10	80	250	
PL-2H36-1	200	2	400	50	320	250	
PL-5S33-1		25	250	10	80	250	
PL-5S36-1		25	2000	50	320	250	
PLT-10384	10	15	250	10	80	100	Standard tube: Axial leads.
PLT-10387	10	15	3000	50	320	100	
PLT-2H384	200	2	500	10	80	100	
PLT-2H387	200	2	10000	50	320	100	
PLS-5S380		25	250	10	80	100	Small tube; Axial leads.
PLS-5S387		25	4000	100	320	100	
PLM-5S310		25	500	10	80	50	Miniature Tube; Axial leads.
PLM-5S317		25	5000	100	320	50	

SILICON PHOTODIODES

Cell Type No.	Min. Short Ct.* Curr. MA	Min. Open Ct.* Volt.	Dark Curr. μA @ IV @ 25°C	Reverse Voltage Recom. Max.	Description
NSL-701-1	0.30	0.35	3	5	.1" x .2" Chip. Wire Leads
NSL-801-1	0.325	0.275	1.5	10	
NSL-701-9	0.30	0.35	3	5	9 Element Cell, 0.1" Spacing
NSL-702	0.6	0.35	5	5	.2" x .2" Chip. Wire Leads
NSL-802	0.65	0.275	2.5	10	
NSL-703	1.4	0.35	15	5	.2" x .4" Chip. Wire Leads
NSL-803	1.5	0.275	7.5	10	
NSL-705	4.5	0.35	25	5	.76" x .354" Chip. Wire Leads
NSL-805	4.77	0.275	12.5	10	
NSL-706	2.9	0.35	20	5	.4" x .4" Chip. Wire Leads
NSL-806	3.0	0.275	10	10	
NSL-707	3.3	0.35	25	5	.2" x 1" Chip. Wire Leads
NSL-807	3.5	0.275	12.5	10	
NSL-708	1.3	0.35	15	5	.1" x 1" Chip. Wire Leads
NSL-808	1.4	0.275	7.5	10	
NSL-710	0.125	0.4	1	5	TO-18 Package
NSL-810	0.150	0.275	0.5	10	
NSL-751	1.4	0.35	2.0	5	0.5" dia. Epoxy Package
NSL-851	1.5	0.275	10	10	
NSL-781	0.28	0.35	5	5	Hermetic TO-5 Case
NSL-881	0.3	0.275	2.5	10	
NSL-782	0.42	0.35	5	5	
NSL-791	0.60	0.35	5	5	Hermetic TO-8 Case
NSL-792	1.1	0.35	15	5	
NSL-8932	0.65	0.275	0.5	10	0.5" dia. Ceramic

* At 500 Ftc (25 MW/cm²) 2870°K Source

SILICON PLANAR PHOTODETECTORS

Cell Type No.	Min. Short Ct.* Curr. μA	Min. Open Ct.* Volt.	Dark Curr. NA @ 5V @ 25°C	Break-down Voltage (V)	Description
NSL-811	100	0.4	5	40	TO-18, Flat Window
NSL-812	310	0.4	5	40	TO-18, Low Lens
NSL-813	220	0.4	5	40	TO-18, High Lens
NSL-814	90	0.4	5	40	TO-52, Flat Window
NSL-815	240	0.4	5	40	TO-52, Low Lens
NSL-883	360	0.4	10	20	TO-5, Flat Window
NSL-893	800	0.4	20	10	TO-8, Flat Window

* At 500 Ftc, 2870°K Source

SILICON BLUE SENSITIVE PHOTODIODES

Cell Type No.	Sensi-tivity @ 500 nM (A/W)	Min. Short Ct.* Curr. μA	Dark Curr. μA @ 1V @ 25°C	Break-down Voltage	Description
NSL-710BG	0.17	18	1.0	5	TO-18, BG Filter
NSL-810BG	0.17	18	0.5	10	TO-18, BG Filter
NSL-811BG	0.20	18	0.005	40	TO-18, BG Filter
NSL-780BG	0.17	35	5.0	5	TO-5, BG Filter
NSL-880BG	0.17	35	2.5	10	TO-5, BG Filter
NSL-883BG	0.20	40	0.01	20	TO-5, BG Filter

* At 500 Ftc, 2870°K Source

FOR *IMMEDIATE* ACTION
PLEASE USE RETURN CARD VOL 4
OR TELEPHONE # BELOW...

SILONEX inc

TWX 610-421-3362
TLX 51 669 663

331 CORNELIA ST., PLATTSBURGH, NY 12901 — TEL: (518) 561-3160
2150 WARD STREET, MONTREAL, QUE. H4M 1T7 — TEL: (514) 744-5507
ALTRINCHAM, CHESHIRE, WA14 4NX — TEL: (061) 928-3417

For More Information. Circle No. 294

OPTO
INFRARED, IMAGING, and VISIBLE PRODUCTS

TI OPTOELECTRONICS

- CCD IMAGE SENSORS
- SOURCE AND DETECTOR ASSEMBLIES (SDAs)
- INFRARED EMITTING DIODES (IREDS)
- PHOTODETECTORS (SENSORS)
- OPTOCOUPLERS (ISOLATORS)
- LED DISPLAYS

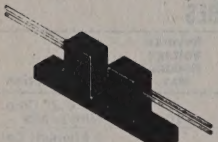
TEXAS INSTRUMENTS

OPTO DEPARTMENT
P.O. BOX 225012 MS12
DALLAS, TEXAS 75265
214/995-3821

INFRARED PRODUCTS

Source and Detector Assemblies/SDA's (Switches)

- Various Styles and Outputs Available
  - Phototransistor outputs
  - Photodarlington outputs
  - Reflective mode
  - Transmissive mode
  - Plastic components
  - Pill package (hermetic) components
  - Custom designs available upon request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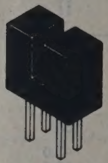
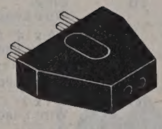

CL-81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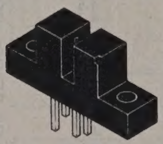
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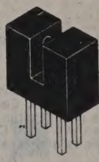
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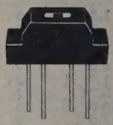

CL-33

DEVICE NUMBER	TYPE	ON-STATE COLLECTOR CURRENT			OFF-STATE COLLECTOR CURRENT		FEATURES	PACKAGE
		MIN $I_{C(on)}$	@ I_F	@ V_{CE}	MAX $I_{C(off)}$	@ V_{CE}		
TIL138	Transmissive Assembly with Mounting Tabs	1.6 mA 0.4 mA	35 mA 15 mA	0.5 V 0.5 V	100 nA	30 V	A TIL32 galluim arsenide IRED and a TIL78 phototransistor	CL-28
TIL139	Reflective Assembly	10 μA † 100 μA ‡	40 mA 40 mA	5 V 5 V	100 nA	30 V	A TIL32 galluim arsenide IRED and a TIL78 phototransistor	CL-29
TIL143	Transmissive Assembly with Mounting Tabs	600 μA	20 mA	5 V	100 nA	10 V	A TIL40 galluim arsenide IRED and a TIL11 silicon phototransistor	CL-31
TIL144		200 μA	20 mA	5 V	100 nA	10 V		
TIL145	Transmissive Assembly with Mounting Tabs	2 mA	16 mA	1 V	100 nA	5 V	A TIL 40 gallium arsenide IRED and a high-gain TIL412 silicon Darlington phototransistor	CL-31
TIL146		1.6 mA	50 mA	1 V	100 nA	5 V		
TIL147	Transmissive Assembly	4 mA	20 mA	5 V	100 nA	10 V	Hermetic pill devices mounted in dual-in-line package (TIL23/TIL601 Series)	CL-32
TIL148		1 mA	20 mA	5 V	100 nA	10 V		
TIL149	Reflective Assembly	25 μA ‡	40 mA	5 V	100 nA	15 V	A TIL32 and a TIL78	CL-33
TIL158	Transmissive Assembly	600 μA	20 mA	5 V	100 nA	10 V	A TIL40 gallium arsenide IRED and a TIL411 silicon phototransistor	CL-81
TIL159		200 μA	20 mA	5 V	100 nA	10 V		
TIL160	Transmissive Assembly	2 mA	10 mA	2 V	100 nA	5 V	A TIL40 gallium arsenide IRED and a high-gain TIL412 silicon Darlington phototransistor	CL-81
TIL161		0.5 mA	10 mA	2 V	100 nA	5 V		
TIL167-1	Transmissive Assembly with Mounting Tabs	200 μA	20 mA	5 V	100 nA	10 V	A TIL40 gallium arsenide IRED and a TIL415 silicon phototransistor	CL-31
TIL197-2		600 μA	20 mA	5 V	100 nA	10 V		
TIL168-1	Transmissive Assembly with Mounting Tabs	0.5 mA	10 mA	2 V	100 nA	5 V	A TIL40 gallium arsenide IRED and a high-gain TIL416 silicon Darlington photoransistor	CL-31
TIL168-2		2 mA	10 mA	2 V	100 nA	5 V		
TIL169-1	Transmissive Assembly	200 μA	20 mA	5 V	100 nA	10 V	A TIL40 gallium arsenide IRED and a TIL415 silicon phototransistor	CL-81
TIL169-2		600 μA	20 mA	5 V	100 nA	10 V		
TIL170-1	Transmissive Assembly	0.5 mA	10 mA	2 V	100 nA	5 V	A TIL40 gallium arsenide IRED and a TIL416 silicon Darlington photoransistor	CL-81
TIL170-2		2 mA	10 mA	2 V	100 nA	5 V		

For More Information. Circle No. 295

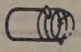
OPTO
INFRARED, IMAGING, and VISIBLE PRODUCTS

TI OPTOELECTRONICS

- CCD IMAGE SENSORS
- SOURCE AND DETECTOR ASSEMBLIES (SDAs)
- INFRARED EMITTING DIODES (IREDS)
- PHOTODETECTORS (SENSORS)
- OPTOCOUPLERS (ISOLATORS)
- LED DISPLAYS

TEXAS INSTRUMENTS

OPTO DEPARTMENT
P.O. BOX 225012 MS12
DALLAS, TEXAS 75265
214/995-3821


CL-1 and CL-2

CL-9

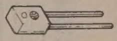
CL-10

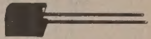
CL-18

INFRARED PRODUCTS

Infrared Emitters and Photodetectors

- Various packages and functions available
  - T-1, T-1¾, sidelookers, TO5 and pill packages
  - Gallium Arsenide IREDS
  - Gallium Aluminum Arsenide IREDS
  - Photodiodes, phototransistors, or photodarlingtons


CL-67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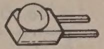
CL-68

Infrared-emitting diodes (IRED's)

DEVICE NUMBER	POWER OUTPUT MIN (mW)	POWER OUTPUT @ I_F (mA)	Θ_{HI} TYP	V_F MAX (V)	V_F @ I_F (mA)	λ TP TYP (NM)	FEATURES	PACKAGE
TIL23	0.4	50	35°	1.5	50	940	Pill package for mounting on double-sided circuit boards.	CL-1
TIL24 †	1	50	35°	1.5	50	940		
TIL25	0.75	50	35°	1.5	50	940		
TIL31B †	3.3	100	10°	1.75	100	940	Hermetic TO-18	CL-18
TIL32	0.5	20	35°	1.6	20	940	Plastic T-1 package	CL-9
TIL33B	2.5	100	80°	1.75	100	940	Hermetic TO-18	CL-18
TIL34B	2.0	100	10°	1.75	100	940	Hermetic TO-18	CL-18
TIL38	6	100	50°	1.75	100	940	Plastic T-1¾	CL-10
TIL39	6	100	20°	1.75	100	940	Plastic T-1¾	CL-10
TIL40	0.05	20	30°	1.6	20	940	Plastic side looker package	CL-67
TIL902-1	1.5	20	35°	1.6	20	880	Plastic T-1 package Similar to TIL32	CL-9
TIL902-2	2.5	20	35°	1.6	20	880		
TIL903-1	6	100	10°	2.1	100	880	Hermetic TO-18 Similar to TIL31B	CL-18
TIL903-2	9	100	10°	2.1	100	880		
TIL904-1	5	100	80°	2.1	100	880	Hermetic TO-18 Similar to TIL33B	CL-18
TIL904-2	9	100	80°	2.1	100	880		
TIL905-1	1.5	20	50°	1.6	20	880	Plastic T-1¾ Similar to TIL38	CL-10
TIL905-2	2.5	20	50°	1.6	20	880		
TIL906-1	1.5	20	20°	1.6	20	880	Plastic T-1¾ Similar to TIL39	CL-10
TIL906-2	2.5	20	20°	1.6	20	880		

† High-reliability versions (TIL24HR2 and TIL31BHR2) are also available.

Photodetectors (sensors)

DEVICE NUMBER	LIGHT CURRENT @5V MIN (mA)	LIGHT CURRENT @5V MAX (mA)	IRRADIANCE E_e	FEATURES	RECOMMENDED EMITTER	PACKAGE
1N5722	0.5	3.0	20 mW/cm²	Pill pkg, EIA-Registered Versions of TIL601-TIL604	TIL23 series	CL-2
1N5723	2.0	5.0	20 mW/cm²		TIL23 series	CL-2
1N5724	4.0	8.0	20 mW/cm²		TIL23 series	CL-2
1N5725	7.0	—	20 mW/cm²		TIL23 series	CL-2
LS600	0.8	—	20 mW/cm²	Pill pkg	TIL23 series	CL-2
TIL78	1.0		20 mW/cm²	Plastic pkg T1	TIL32, 902	CL-9
TIL81*	5.0	—	5 mW/cm²	Hermetic TO-18	TIL31B, 33B, 34B, TIL903, 904	CL-18
TIL99**	1.0	—	20 mW/cm²	Hermetic TO-18	TIL33B, 31B	CL-18
TIL100***	0.01	—	250 µW/cm²	Sidelooker pkg	TIL38, 39, 905, 906	CL-66
TIL411	0.1	—	500 µW/cm²	Sidelooker pkg Phototransistor	TIL40	CL-67
TIL412	0.5	—	100 µW/cm²	Sidelooker pkg Darlington	TIL40	CL-67
TIL413	0.01	—	250 µW/cm²	Sidelooker pkg Photodiode	TIL38/39/905/906	CL-68
TIL414	0.1	—	250 µW/cm²	Plastic pkg T-1¾ Phototransistor	TIL38/39/905/906	CL-10
TIL415	0.1		500 µW/cm²	Sidelooker pkg Phototransistor	TIL40	CL-67
TIL416	0.5		100 µW/cm²	Sidelooker pkg Darlington	TIL40	CL-67
TIL601	0.5	3.0	20 mW/cm²	Pill pkg	TIL23 series	CL-2
TIL602	2.0	5.0	20 mW/cm²	Pill pkg	TIL23 series	CL-2
TIL603	4.0	8.0	20 mW/cm²	Pill pkg	TIL23 series	CL-2
TIL604*	7.0	—	20 mW/cm²	Pill pkg	TIL23 series	CL-2

*High-reliability versions (TIL81HR2 an TIL604HR2) are also available.
**Flat Lens
***V_{CC} =10V

For More Information. Circle No. 295

OPTO
INFRARED, IMAGING, and VISIBLE PRODUCTS

TI OPTOELECTRONICS

- CCD IMAGE SENSORS
- SOURCE AND DETECTOR ASSEMBLIES (SDAs)
- INFRARED EMITTING DIODES (IREDS)
- PHOTODETECTORS (SENSORS)
- OPTOCOUPLERS (ISOLATORS)
- LED DISPLAYS

TEXAS INSTRUMENTS

OPTO DEPARTMENT
P.O. BOX 225012 MS12
DALLAS, TEXAS 75265
214/995-3821

INFRARED PRODUCTS

Optocouplers (isolators)

- P-DIP 6 pin, single channel
- Metal can (military) - Hi Reliability -JAN, JANTX, JANTXV
- "Supercouplers"
- Transistor or darlington outputs

CP-7

CM-14

TO-72

DEVICE NUMBER	ISOLATION VOLTAGE (kV)		MIN CTR %	FEATURES	PACKAGE TYPE	PACKAGE
	PEAK	RMS				
3N261	1.0	—	50	Hermetic JEDEC	Metal Can	TO-72
3N262	1.0	—	100-500	Hermetic JEDEC	Metal Can	TO-72
3N263	1.0	—	200-1000	Hermetic JEDEC	Metal Can	TO-72
4N22*	1.0	—	25	Hermetic JEDEC	Metal Can	CM-14
4N23*	1.0	—	60	Hermetic JEDEC	Metal Can	CM-14
4N24*	1.0	—	100	Hermetic JEDEC	Metal Can	CM-14
4N25	2.5	—	20	JEDEC	Plastic DIP	CP-7
4N26	1.5	—	20	JEDEC	Plastic DIP	CP-7
4N27	1.5	—	10	JEDEC	Plastic DIP	CP-7
4N28	0.5	—	10	JEDEC	Plastic DIP	CP-7
4N35	3.55	2.5	100	JEDEC-High Voltage UL File #E65085	Plastic DIP	CP-7
4N36	2.5	1.75	100	JEDEC	Plastic DIP	CP-7
4N37	1.5	1.05	100	JEDEC	Plastic DIP	CP-7
4N47**	1.0	—	50	Hermetic JEDEC	Metal Can	CM-14
4N48**	1.0	—	100	Hermetic JEDEC	Metal Can	CM-14
4N49**	1.0	—	200	Hermetic JEDEC	Metal Can	CM-14
MCT2	1.5	—	20		Plastic DIP	CP-7
MCT2E	2.5	—	20		Plastic DIP	CP-7
TIL102	1.0	—	25	Hermetic	Metal Can	CM-14
TIL103	1.0	—	100	Hermetic	Metal Can	CM-14
TIL111	1.5	—	13		Plastic DIP	CP-7
TIL112	1.5	—	2		Plastic Dip	CP-7
TIL113	1.5	—	300	Darlington	Plastic DIP	CP-7
TIL114	2.5	—	13		Plastic DIP	CP-7
TIL115	2.5	—	2		Plastic DIP	CP-7
TIL116	2.5	—	20		Plastic DIP	CP-7
TIL117	2.5	—	50		Plastic DIP	CP-7
TIL118	1.5	—	10		Plastic DIP	CP-7
TIL119‡	1.5	—	300	Darlington	Plastic DIP	CP-7
TIL119A	1.5	—	300	(A) No base connection	Plastic DIP	CP-7
TIL120	1.0	—	25	Hermetic TO-72	Metal Can	TO-72
TIL121	1.0	—	50	Hermetic TO-72	Metal Can	TO-72
TIL124	5.0	—	10	High voltage	Plastic DIP	CP-7
TIL125	5.0	—	20	High voltage	Plastic DIP	CP-7
TIL126	5.0	—	50	High voltage	Plastic DIP	CP-7
TIL127	5.0	—	300	High voltage, Darlington	Plastic DIP	CP-7
TIL128	5.0	—	300	High voltage, Darlington	Plastic DIP	CP-7
TIL128A	5.0	—	300	(A) No base connection	Plastic DIP	CP-7
TIL153	3.54	2.5	10	High voltage, UL File E-65085	Plastic DIP	CP-7
TIL154	3.54	2.5	20	High voltage, UL File E-65085	Plastic DIP	CP-7
TIL155	3.54	2.5	50	High voltage, UL File E-65085	Plastic DIP	CP-7
TIL156	3.54	2.5	300	High voltage, Darlington UL File E-65085	Plastic DIP	CP-7
TIL157	3.54	2.5	300	High voltage, Darlington UL File E-65085	Plastic DIP	CP-7
TIL157A	3.54	2.5	300	(A) No base connection		

*JAN, JANTX, TANTXV levels to MIL-S-19500/486A USAF are also available
**JAN, JANTX, JANTXV levels to MIL-S-19500/548A available
‡TIL119A also available with guaranteed unbonded base lead

For More Information. Circle No. 295

OPTO
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TI OPTOELECTRONICS

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- LED DISPLAYS

TEXAS INSTRUMENTS

OPTO DEPARTMENT
P.O. BOX 225012 MS12
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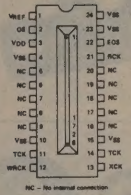
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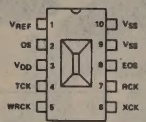
OS 2
VDD 3
VSS 4
NC 5
NC 6
NC 7
NC 8
NC 9
VSS 10
TCK 11
WRCK 12
24 VSS
23 VSS
22 EOS
21 RCK
20 NC
19 NC
18 NC
17 NC
16 NC
15 VSS
14 TCK
13 XCK
1728
NC – No internal connection

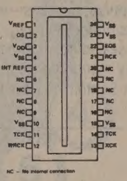
CL-75


VREF 1
OS 2
VDD 3
TCK 4
WRCK 5
10 VSS
9 VSS
8 EOS
7 RCK
6 XCK

CL-76

IMAGING PRODUCTS
CCD Image Sensors

- Virtual phase technology
- Linear arrays
- Evaluation kits available
- Standard ceramic DIPs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VSS 4
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NC 6
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NC 8
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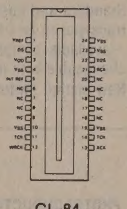
VSS 10
TCK 11
WRCK 12
24 VSS
23 VSS
22 EOS
21 RCK
20 NC
19 NC
18 NC
17 NC
16 NC
15 VSS
14 TCK
13 XCK
NC – No internal connection

CL-83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OS 2
VDD 3
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NC 6
NC 7
NC 8
NC 9
VSS 10
TCK 11
WRCK 12
24 VSS
23 VSS
22 EOS
21 RCK
20 NC
19 NC
18 NC
17 NC
16 NC
15 VSS
14 TCK
13 XCK

CL-84

DEVICE NUMBER	DYNAMIC * RANGE	CHARGE TRANSFER EFFICIENCY	PRNU** PEAK-TO-PEAK (TYP)	V_{SAT} (TYP)	SENSOR ELEMENT ORGANIZATION	PACKAGE
TC101	1000:1	0.99999	50 mV	1000 mV	1728X1	CL-75
TC102	1000:1	0.99999	50 mV	1000 mV	128X1	CL-76
TC103	1000:1	0.99999	50 mV	1000 mV	2048X1	CL-83
TC104	1000:1	0.99999	30 mV	600 mV	3456X1	CL-84

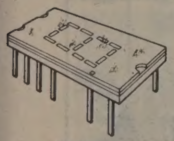
*Measured as V_{SAT} /Peak-To-Peak Noise
**Photo Response Non-Uniformity

CCD Image Sensor Evaluation Kits

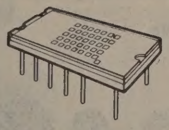
KIT NUMBER	EVALUATION KIT CONSISTS OF
TCK101	TC101 plus PC401 Evaluation Board with complete operating instructions
TCK102	TC102 plus PC402 Evaluation Board with complete operating instructions
TCK103	TC103 plus PC401 Evaluation Board with complete operating instructions
TCK104	TC104 plus PC401 Evaluation Board with complete operating instructions

VISIBLE PRODUCTS
LED Displays

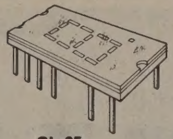
- Hi-Rel (military) LED Displays
- Hexidecimal, seven segment or alphanumeric



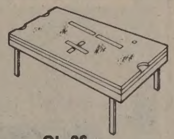
CL-34



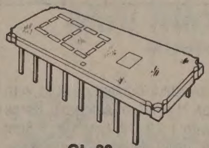
CL-37



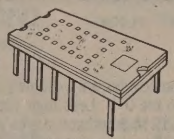
CL-35



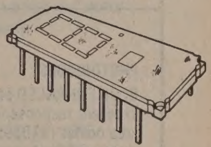
CL-36



CL-38



CL-40



CL-39

LED Displays

DEVICE NUMBER	CHARACTER HEIGHT	& COLOR	TYPE CHARACTERS	FEATURES	PACKAGE	RECOMMENDED DRIVERS
TIL302	0.27"	Red	7-segment, LHDP	High performance	CL-34	SN7447
TIL303	0.27"	Red	7-segment, RHDP	High performance	CL-35	SN7447
TIL304	0.27"	Red	±1, RHDP	High performance	CL-36	
TIL305	0.3"	Red	5x7, LHDP	Alphanumeric	CL-37	
TIL306	0.27"	Red	7-segment, LHDP	Logic with counter	CL-38	
TIL307	0.27"	Red	7-segment, RHDP	Logic with counter	CL-39	
TIL308	0.27"	Red	7-segment, LHDP	Logic with BCD input	CL-38	
TIL309	0.27"	Red	7-segment, RHDP	Logic with BCD input	CL-39	
TIL311	0.27"	Red	4x7, R & LHDP	Hexadecimal with logic	CL-40	

Hi-Rel (Military) LED Displays

DEVICE NUMBER	CHARACTER HEIGHT	& COLOR	TYPE CHARACTERS	PACKAGE	RECOMMENDED DRIVERS
4N41(TIL501)	0.27"	Red	7-segment, TIL302	CL -55	SN5447
4N56(TIL505)	0.3"	Red	4x7 Hexadecimal with logic similar to TIL311	CL -57	
4N57(TIL506)	0.3"	Red	7-segment, LHDP, with logic	CL -58	
4N58(TIL507	0.3"	Red	5x7 Alphanumeric with logic	CL -59	

**Electrical equivalent only

- Photoconductive Cells
- Interrupter Switches
- Phototransistors and Photodarlingtons
- Retroreflective Switches
- Light Activated Switches

VACTEC

- Selenium Photovoltaic Cells
- Vactrols (Opto-Isolators)
- Infrared Emitters

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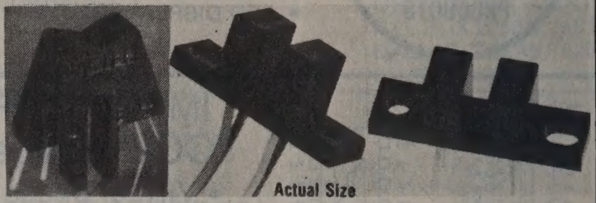
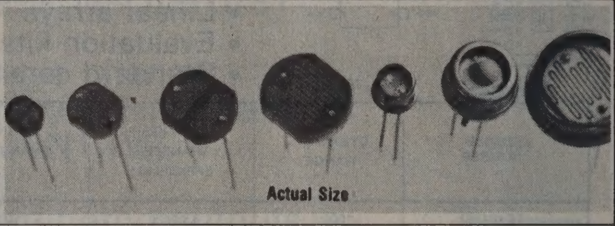


RETROREFLECTIVE & INTERRUPTER SWITCHES (Slotted)

Standard and custom optical switches—infrared GaAs LED and silicon phototransistor in an I-R transmitting housing. No openings or seams to collect dirt—available completely sealed for submersion during board cleaning—interchangeable with industry standard sizes. Request bulletins RPS-1 and SPS-1. New slotted switch with Schmitt Trigger output, bulletin SPS-2.



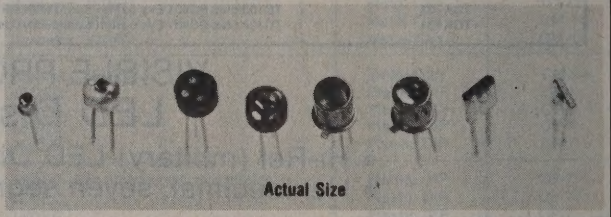
PHOTOCONDUCTIVE CELLS

Vactec light dependent resistors (LDR's) are available in three hermetic enclosures (TO-18, TO-5, TO-8) and 4 ceramic types. Ceramic types have automatically inserted wires which insure perfect contact integrity. Six materials of CdS, CdSe and CdSeS-CdS mixtures with spectral response peaks from 565-735 nm. Each material has a variety of sensitivities to satisfy all requirements. Request bulletin PCD-6.

Actual Size

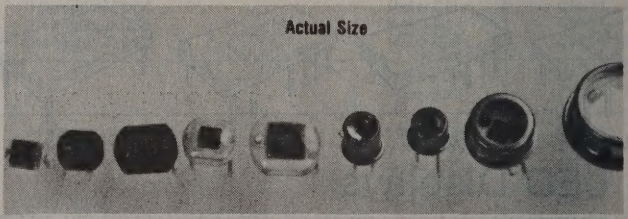
SILICON PHOTOVOLTAIC CELLS

Three processes: BLUE ENHANCED, LOW CAPACITANCE, STANDARD SOLAR. All available in a variety of hermetic, ceramic, as chips, or with flying leads. The BLUE ENHANCED cells are unique large area detectors with high U-V sensitivity to as low as 200 nm. Almost non-existent U-V enhancement effect with stability equivalent to high quality photodiodes. Request bulletin VTS3A. LOW CAPACITANCE cells have fast response less than 15μS with 10KΩ load. The high shunt impedance is desirable for driving amplifiers. Request bulletin VTS-2. SOLAR cells have high V_{OC} at low illumination (typ 200mV at .05mW/cm²). Linear over wide illumination range—request bulletin VTD-1.



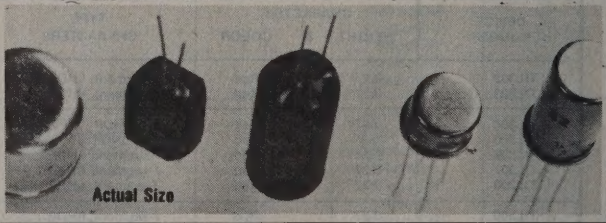
PHOTOTRANSISTORS — LED'S — PHOTODARLINGTONS — LIGHT ACTIVATED SWITCHES (LAS)

Phototransistors and photodarlingtons are NPN passivated—4 chip sizes of 25, 40, 50, and 60, mil square in TO-18, ceramic, coaxial, and lateral (side looking) packages. High light current at very low drive current ideal for instrumentation applications. Request bulletin VTTA-3A. GaAs I-R LED's with excellent stability in TO-18, T-1, T-1¾, lateral packages. Bulletin VTE-1. LAS (light activated switches) have high sensitivity with Schmitt Trigger output. Bulletin LAS-1, LAS-2.



PHOTODIODES

BLUE ENHANCED photodiodes are extremely low dark current devices with excellent response in the U-V. Less than 10pA (I_D) for small chips. Large area diodes (VTB5051) 14.8mm² active area with 1.2A/(W/cm²) at 365nm and I_D of 250pA max. Request bulletin VTB-1B. FAST photodiodes have low capacitance. Use with reverse bias for fast response time and excellent linearity. Ideal for remote I-R sensor digital controls. Request bulletin VTD-1.



VACTROLS

Optical couplers using LED's, neons, or incandescent lamps as the emitter and Vactec photoconductive cells (LDR's) as the detector. For noiseless switching and signal monitors for audio. Neon types to sense telephone ring. LED types for triac gate control. Incandescent types for low cost true RMS sensor as voltage regulator or control of constant wattage heater. Five package types include 2 hermetic. Request bulletins VTL1, VTL2C, VTL3, VTL5CA, VTL5C8 and VTL9.

40% Actual Size

SELENIUM PHOTOVOLTAIC CELLS

Large area detectors for direct meter drive or in conjunction with amplifier. Spectral response peaks at 575 nm and is close to visible response. Available with integral #102 filter to match standard observer curve (CIE). Available in many flat or round cells with or without leads—also in 9 package styles including 2 hermetic. Request bulletin SPV-5A.

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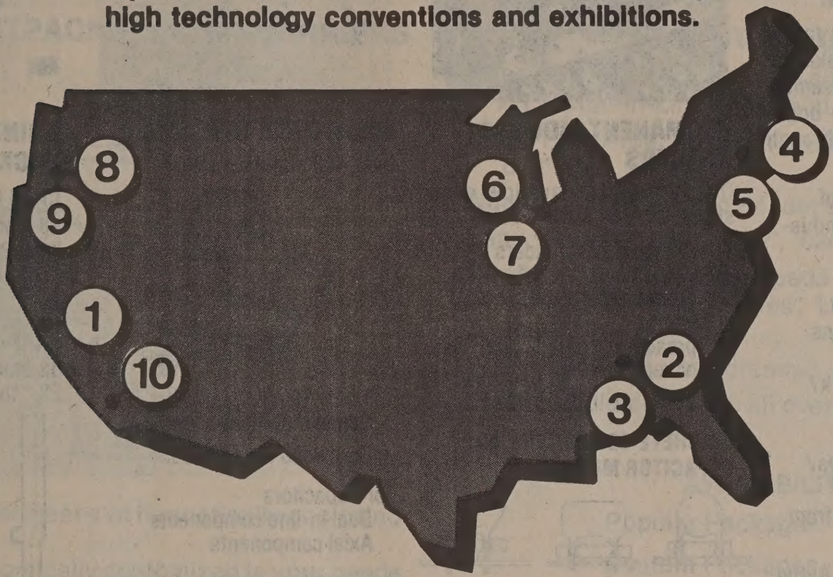

1	Mini/Micro West	February 5, 6, 7, 1985 Anaheim Hilton Exposition Center Anaheim, California
2	Southcon	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
3	Mini/Micro Southeast	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
4	Electro	April 23, 24, 25, 1985 New York Coliseum New York
5	Mini/Micro Northeast	April 23, 24, 25, 1985 Albert Hall New York
6	Midcon	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
7	Mini/Micro Midwest	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
8	Northcon	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
9	Mini/Micro Northwest	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
10	Wescon	November 19, 20, 21, 22, 1985 Anaheim Convention Center Anaheim, California

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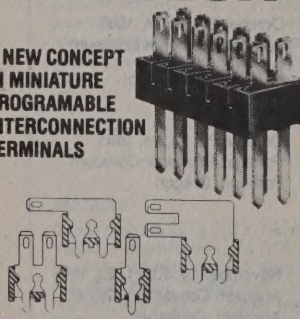

- Miniature Size for High-Density, Space Savings.
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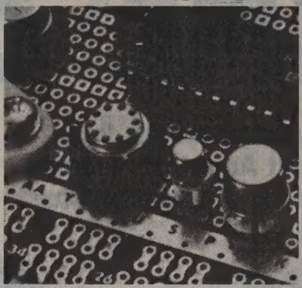
- .200" Pin Spacing Fits Standard .100" PCB Grid Patterns.
- Programable by PCB Circuitry, Jumpers, Bussing or Terminal Changes.
- Low Unit Cost; Even Greater Cost Savings with No Special Hardware or Tools Required for Quick Assembly.



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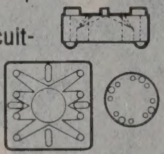
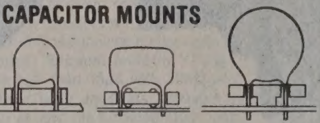
Over 3400 standard low cost styles and sizes from stock . . .

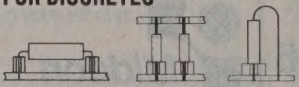
TO-18 mounts/spreaders
TO-5 mounts
Integrated circuit-
Mounts
Spreaders
Converters



DISCRETE COMPONENT AND CAPACITOR MOUNTS



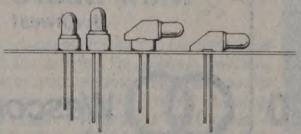
UNIVERSAL SPACERS FOR DISCRETES



Dual in-line mounts
TO-5/TO-18 covers and shields

NYLON L.E.D. MOUNTS/ 90° L.E.D. MOUNTS

984 standards in heights from .030" through 1.250" in .005" increments.



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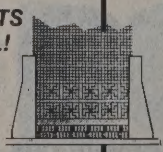
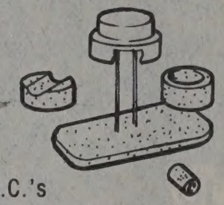


WASH-AWAY SPACERS

Over 400 standard sizes . . .



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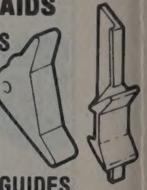
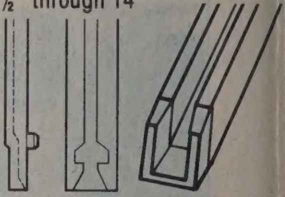
18 standard & locking styles
3 PCB Handles



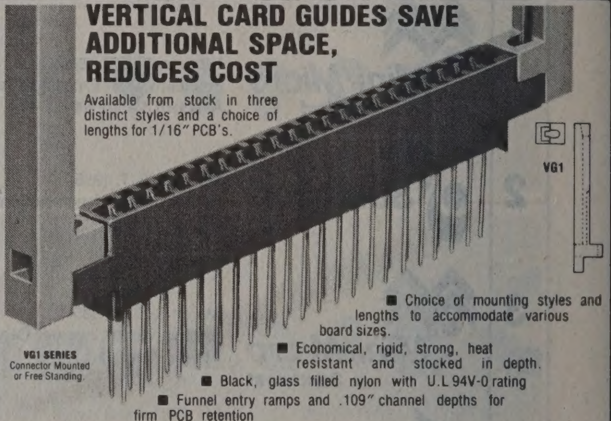
SNAP-IN CARD GUIDES
52 standard sizes; lengths from 2½" through 14"



DEEP CHANNEL CARD GUIDES

VERTICAL CARD GUIDES SAVE ADDITIONAL SPACE, REDUCES COST

Available from stock in three distinct styles and a choice of lengths for 1/16" PCB's.



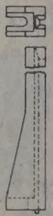
VG1 SERIES
Connector Mounted or Free Standing.

- Choice of mounting styles and lengths to accommodate various board sizes.
- Economical, rigid, strong, heat resistant and stocked in depth.
- Black, glass filled nylon with U.L 94V-0 rating
- Funnel entry ramps and .109" channel depths for firm PCB retention

VG2 SERIES

Available from stock in 7 lengths, the VG2 series is designed to be used in pairs and is easily mounted with standard #6 fasteners.

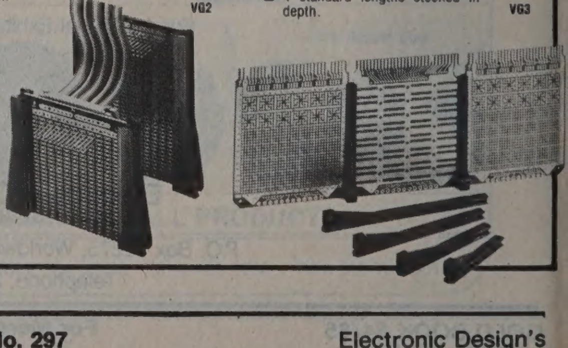
- Rigidly reinforced and heat resistant.
- Easily installed with standard #6 fasteners. Built-in anti-rotation device.
- Funnel entry ramps with .109" channel depths.
- 7 standard lengths stocked in depth.



VG3 SERIES

These double sided guides are available from stock, may be used in pairs or in tandem for maximum economy and are easily mounted with standard #6 fasteners.

- Can be used in tandem for maximum density and economy.
- Easily installed with standard #6 fasteners. Built-in anti-rotation device.
- Funnel entry ramps with .109" channel depths.
- 7 standard lengths stocked in depth.



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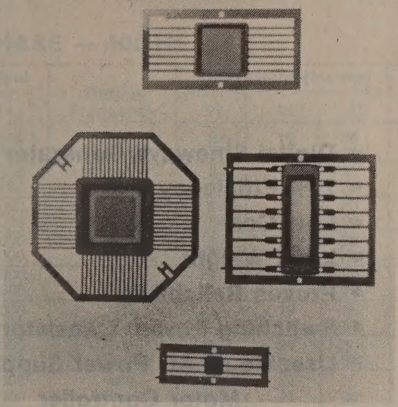
GLASS FLATPACKS & CHIP-CARRIERS



- Most economical means of hermetically enclosing small hybrids
- Easily and economically customized to your needs
- Meet MIL-M-38510 requirements
- Sealed by reflow soldering with combination lids

SELECTION GUIDE

Case Size: Flatpack — case sizes ⅛″ x ⅛″ to 1″ x 1″; Dual-In-Line — case size ¼″ x ¾″

Glass Free Area: Flatpack — .040″ x .070″ to .810″ x .810″

Number of Leads: 1 to 84, depending on case size

Lead Centers: .050″, .040″, .030″, or as specified

Configuration: Leads and pads on 2 sides; Leads on 2 sides; Pads on 4 sides; Leads and pads on 4 sides

Base Material: Metal, ceramic, or beryllia

Plating: Gold or Nickel, all over or selective

AVAILABILITY

Popular Packages — 2 weeks

Custom Packages — 8 weeks

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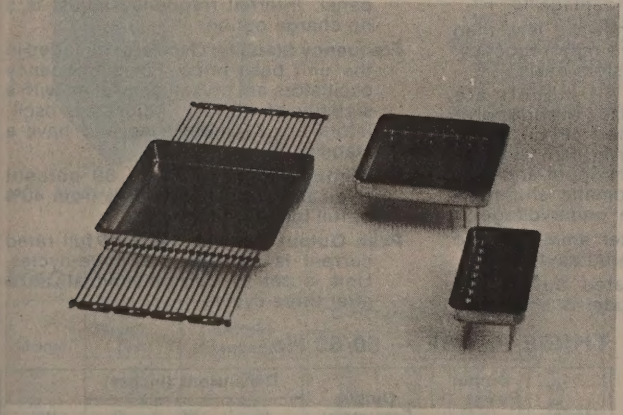
METAL PLUG-INS AND FLATPACKS



- Strongest and most reliable means of enclosing all size hybrids
- Package variations available built to your requirements
- Meet MIL-M-38510 Class S and all highest reliability requirements
- Sealed by seam welding with stepped lids or reflow combination lids

SELECTION GUIDE

Case Size: Plug-In and Flatpack case sizes ranging from .380″ x .625″ to 1.970″ x 2.970″

Number Pins/Leads: 1 to 188, depending on case size

Pin/Lead Centers: .100″ Plug-In; .050″ Flatpack

Configuration: Pins/Leads on 1, 2, 3, or 4 sides

Plating: Gold or Nickel, all over or selective

AVAILABILITY

Tooled Packages — 4 weeks

Custom Packages — 10 weeks

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- **POWER FREQUENCY CONVERTERS**
- **SOLID-STATE INVERTERS**
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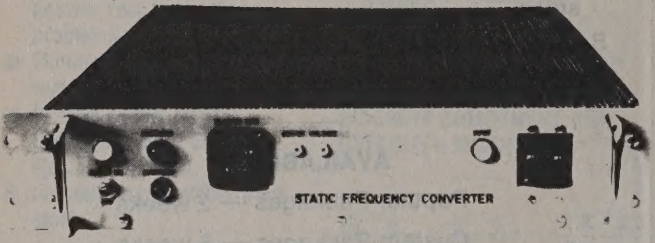


Model 152-1 (60Hz to 400Hz)

- **Digital Sinewave Generator**
- **77% Efficiency**
- **Low Cost**
- **Light Weight**
- **Proven Reliability**
- **Switching Power Transistors**
- **Useable as AC Power Supply**
  Motor Controller
  Power Oscillator
  Power Converter
  Lab AC Source

FREQUENCY CONVERTERS
50-60-400 Hz

Input Voltage: 115V AC, ±10% single-phase for units 1000VA and below. 208V AC, ± 10%, three-phase for units above 1000VA 220V. AC, ±10%, 50Hz is a no charge option. Other inputs available on a custom basis.

Input Frequency: 47 to 65Hz. 380 to 420Hz input is a no charge option.

Output Voltage: Adjustable 100 to 130 volts. Voltage adjust is internal for fixed frequency models, on the front panel for adjustable frequency models. (Other ranges available, consult factory.) 220 VAC at 50 Hz.

Voltage Regulation: Less than ±2% for combined no load to full load change and rated input voltage change.

Lead Power Factor: 0.7 lead to 0.7 lag. Continuous zero lead to zero lag at full rated output without damage.

Output Waveshape: Sinewave less than 4% THD, 3% max any single frequency. (Less than 1% on custom basis.)

Protective Circuits: All models are equipped with automatic overload protection, including short circuit. Automatic reset upon overload removal. Circuit breaker on the input and fuse on the output. Automatic shutdown for input overvoltage, undervoltage.

Meters: Output voltmeter ammeter, and frequency meter offered as options.

Output Frequency: Rated output frequency for each model is shown on chart. For adjustable frequency models, adjustment is on the front panel. Internal frequency adjust is a no charge option.

Frequency Stability: Oscillator included in the unit base price. Fixed frequency oscillators are crystal controlled with a stability of ±0.05%. Adjustable oscillators are RC controlled and have a stability of ±0.25%.

Efficiency: Between 70 to 80 percent (typical 75%). At least 70% from 40% of full load to full load.

Peak Output Current: 150% of full rated current is available for three-cycles. Unit is set to current limit at 120% after three cycles.

SINGLE PHASE — 50/60 Hz

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt.
			H	W	D	
152-3	500	50	3½	19	20	50
152-4	500	60	3½	19	20	50
152-5	500	45-65	8¾	19	20	50
113-3	1000	50	8¾	19	20	70
113-4	1000	60	8¾	19	20	70
113-5	1000	45-65	8¾	19	20	70
223-1	2000	50	12¼	19	20	130
223-4	2000	60	12¼	19	20	130
223-5	2000	45-65	12¼	19	20	130
243-3	4000	50	21	19	20	240
243-4	4000	60	21	19	20	240
243-5	4000	45-65	21	19	20	240
263-3	6000	50	63	24	30	590
263-4	6000	60	63	24	30	590
263-5	6000	45-65	63	24	30	590
283-3	8000	50	63	24	30	680
283-4	8000	60	63	24	30	680
283-5	8000	45-65	63	24	30	680
214-3	10000	50	63	24	30	775
214-4	10000	60	63	24	30	775
214-5	10000	45-65	63	24	30	775
224-3	20000	50	63	48	30	1500
224-4	20000	50	63	48	30	1500
224-5	20000	45-65	63	48	30	1500

THREE PHASE — 50/60 Hz

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt.
			H	W	D	
117-3	1000	50	8¾	19	20	75
117-4	1000	60	8¾	19	20	75
117-5	1000	45-65	8¾	19	20	75
118-3	1600	50	12¼	19	20	110
118-4	1600	60	12¼	19	20	110
118-5	1600	45-65	12¼	19	20	110
238-3	3000	60	17½	19	20	170
238-4	3000	60	17½	19	20	170
238-5	3000	45-65	17½	19	20	170
268-3	6000	60	63	24	30	410
268-4	6000	60	63	24	30	400
268-5	6000	45-65	63	24	30	410
288-3	8000	50	63	24	30	680
288-4	8000	60	63	24	30	680
288-5	8000	45-65	63	24	30	680
219-3	10000	50	63	24	30	640
219-4	10000	60	63	24	30	620
219-5	10000	45-65	63	24	30	650
229-4	20000	50	63	48	30	1500
229-4	20000	60	63	48	30	1500
229-5	20000	60	63	48	30	1500
239-3	30000	50	63	48	30	2250
239-4	30000	50	63	48	30	2250
239-5	30000	45-65	63	48	30	2250

For More Information Circle No. 299

abacus controls inc.

87 Readington Road
Somerville, N.J. 08876
201-526-6010

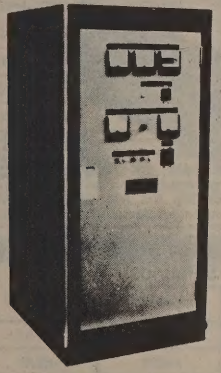
FREQUENCY CONVERTERS

SINGLE PHASE — 400 Hz

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt.
			H	W	D	
115-1	500	400	3½	19	20	40
152-2	500	350-450	3½	19	20	40
162-1	600	400	3½	19	20	45
162-2	600	350-450	3½	19	20	45
113-1	1000	400	8¾	19	20	70
113-2	1000	350-450	8¾	19	20	70
223-1	2000	400	12¼	19	20	130
223-2	2000	350-450	12¼	19	20	130
233-1	3000	400	21	19	20	180
233-2	3000	350-450	21	19	20	180
243-1	4000	400	21	19	20	210
243-2	4000	350-450	21	19	20	210
263-1	6000	400	63	24	30	550
263-2	6000	350-450	63	24	30	550
283-1	8000	400	63	24	30	680
283-2	8000	350-450	63	24	30	680
214-1	10000	400	63	24	30	775
214-2	10000	350-450	63	24	30	775
224-1	20000	400	63	48	30	1400
224-2	20000	350-450	63	48	30	1400

THREE PHASE — 400 Hz

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt.
			H	W	D	
117-1	1000	400	7	19	20	70
117-2	1000	350-450	7	19	20	70
118-1	1600	400	8¾	19	20	90
118-2	1600	350-450	8¾	19	20	90
218-1	1600	400	12¼	19	20	95
218-2	1600	350-450	12¼	19	20	95
228-1	2500	400	12¼	19	20	140
228-2	2500	350-450	12¼	19	20	140
238-1	3500	400	17½	19	20	180
238-1	3500	350-450	17½	19	20	180
268-1	6000	400	63	24	30	590
268-2	6000	350-450	63	24	30	590
278-1	7500	400	63	24	30	680
278-2	7500	350-450	63	24	30	680
219-1	10000	400	63	24	30	750
219-2	10000	350-450	63	24	30	750
229-1	20000	400	63	48	30	1400
229-2	20000	350-450	63	48	30	1400
239-1	30000	400	63	48	30	2100
239-2	30000	350-450	63	48	30	2100


Model 463-4-200 6KVA

STATIC INVERTERS DC TO 50-60-400 Hz

- **85% Efficiency**
- **Low Cost**
- **Light Weight**
- **Proven Reliability**

Input Voltage: 100 to 140 VDC. Other input voltage ranges, 28 VDC, 48 VDC and 200 VDC sunverter.®

Output Voltage: Set for 117V. Internal adjustment from 110V to 120V. 220 VAC for 50Hz models.

Voltage Regulation: Less than 2% for single phase units, less than 5% for three phase units, for combined load and input voltage changes.

Output Waveshape: Sinewave less than 4% THD, 3% max any single frequency. (Less than 1% on custom basis.)

Protective Circuits: All models are equipped with automatic overload protection, including short circuit. Automatic reset upon overload removal. Circuit breaker on the input and fuse on the output. Automatic shutdown for input overvoltage, undervoltage.

SINGLE PHASE

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt.
			H	W	D	
452-1	500	400	3½	19	20	35
452-3	500	50	3½	19	20	45
452-4	500	60	3½	19	20	45
413-1	1000	400	8¾	19	20	55
413-3	1000	50	8¾	19	20	65
413-4	1000	60	8¾	19	20	65
423-1	2000	400	12¼	19	20	90
423-3	2000	50	12¼	19	20	110
423-4	2000	60	12¼	19	20	110
433-1	3000	400	12¼	19	20	140
433-3	3000	50	12¼	19	20	160
433-4	3000	60	12¼	19	20	155
443-1	4000	400	12¼	19	20	170
443-3	4000	50	12¼	19	20	220
443-4	4000	60	12¼	19	20	210
463-1	6000	400	63	24	30	350
463-3	6000	50	63	24	30	400
463-4	6000	60	63	24	30	390
483-1	8000	400	63	24	30	400
483-3	8000	50	63	24	30	440
483-4	8000	60	63	24	30	430
414-1	10000	400	63	24	30	470
414-3	10000	50	63	24	30	540
414-4	10000	60	63	24	30	510
424-1	20000	400	63	48	30	969
424-3	20000	50	63	48	30	1080
424-4	20000	60	63	48	30	1020

THREE PHASE

Model	Output Power (VA)	Output Frequency	Dimensions (Inches)			Wt.
			H	W	D	
417-1	1000	400	8¾	19	20	60
417-3	1000	50	8¾	19	20	70
417-4	1000	60	8¾	19	20	70
418-1	1600	400	12¼	19	20	90
418-3	1600	50	12¼	19	20	100
418-4	1600	60	12¼	19	20	100
428-1	2500	400	12¼	19	20	130
428-3	2500	50	12¼	19	20	150
428-4	2500	60	12¼	19	20	140
438-1	3500	400	17½	19	20	160
438-3	3500	50	17½	19	20	180
438-4	3500	60	17½	19	20	170
468-1	6000	400	63	24	30	350
468-3	6000	50	63	24	30	400
468-4	6000	60	63	24	30	390
488-1	8000	400	63	24	30	395
488-3	8000	50	63	24	30	475
488-4	8000	60	63	24	30	430
419-1	10000	400	63	24	30	470
419-3	10000	50	63	24	30	540
419-4	10000	60	63	24	30	520
429-1	20000	400	63	48	30	990
429-3	20000	50	63	48	30	1090
429-4	20000	60	63	48	30	1090
439-1	30000	60	63	48	30	1310
439-3	30000	50	63	48	30	1490
439-4	30000	60	63	48	30	1490

For More Information. Circle No. 299

POWER CONVERSION FROM

AVIONIC INSTRUMENTS INC

"THE INVERTER PEOPLE"

DC TO AC STATIC INVERTERS

Avionic Instruments Inc. (AI²) specializes in the design and manufacture of DC to AC Static Inverters for applications which demand the highest levels of reliability and performance. Design ingenuity and the use of solid-state elements are the basic ingredients that qualify Avionic instruments Inverters to these high standards. Our complete family of sinewave inverters was developed to provide you with a wide selection of VA ratings, from 50 VA to 7.5 KVA, single and three phase, to serve fully your specific system requirements.

The features of our sophisticated, new design DC to AC Inverters are unique in contrast to older, classically designed inverters. **AI²'s new advanced technology Lightweight Hi-Performance Static Inverter series** feature a **patented high frequency power processing technique** that has virtually eliminated the inherent limitations traditionally associated with classical power conversion designs.

LIGHTWEIGHT HI-PERFORMANCE

This breakthrough in design and performance allows us to provide ultra lightweight 400 cycle and equipment, ultra light-weight 60 and 50 cycle inverters and frequency converters. Our 250-350 VA, 400 Hz, 60 Hz and 50 Hz designs weigh less than 5 pounds and provide **a 115 VAC pure sinewave with less than .5% total harmonic distortion, better than 1% voltage and frequency regulation.** All of our single and multi-phase inverter and frequency converter designs reflect this superb advanced state-of-the art performance which minimizes weight while achieving optimal performance, **spike free absolutely predictable voltage to all powered electronic and electrical systems.**

One feature not as obvious as the drastic reduction in size and weight relates to our 200 microsecond load response time, which is 10 times faster and static inverters employing conventional power conversion techniques. This feature enables our inverters to maintain superb voltage output stability even if the loads are dynamically unstable, and non-sinusoidal.

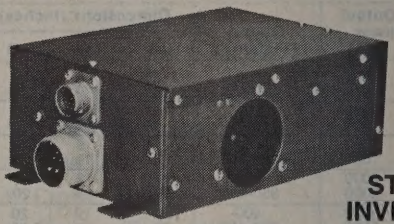
CUSTOM MAGNETICS

Avionic Instruments Inc. (AI)² also specializes in the manufacture of custom-built transformers and inductors designed to customer specifications for non-standard requirements in a range from 10 VA to 10KVA, single and three phase, high and low voltage and current, 25 Hz to 25KHz.

APPLICATIONS VERSATILITY—400/60/50 Hz

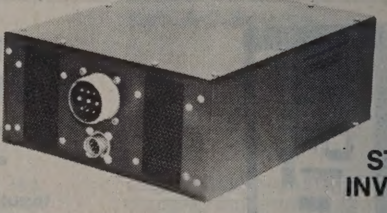
- Radio/Communications
- RPV/Drone Systems
- Robots
- Stability Augmentation
- Space Shuttle Systems
- Surveillance Equip.
- SATCOM Terminals
- Shelters, Portable
- Shipboard Communication
- Autopilots
- AGE
- Appliances
- Business Equip.
- CRT Displays
- Computers
- Environmental Sys.
- Fire Control Sys.
- Flight Test Equip.
- Aircraft Systems
- Vans/Jeep Systems
- Security Systems
- TV Systems
- Trainers/Simulators
- Telemetry
- Transponders
- UPS
- Underwater Systems
- Weather Radar
- X-Ray Systems
- Guidance & Gyros
- Laser Systems
- Laboratory Equip.
- MEDEVAC/EMS
- Microwave Relay
- NAV Systems (DME/ILS)
- OMEGA/VLF
- Radars
- Night Vision Devices
- Electronic Shelters

New Lightweight Hi-Performance
Static Inverters Frequency Converters
Commercial/Military Applications



STATIC INVERTER

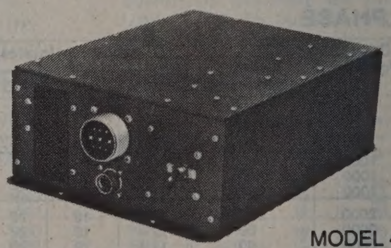
MODEL 2A350
350 VA, 60 Hz,, 4.8 Pounds



STATIC INVERTER

MODEL 2A/1000
1000 VA/60 Hz/13.75 Pounds

FREQUENCY CONVERTER



MODEL 4A1000

1000 VA
50/60 Hz Output
400 Hz Input
15.5 Pounds

AVIONIC INSTRUMENTS INC.

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For More Information. Circle No. 300

A Complete Family of DC to AC Static Inverters

Airborne • Aerospace • Marine • Ground • Mobile

To Meet Any Specific Need

LIGHTWEIGHT HI-PERFORMANCE DC to AC SERIES 400/60/50 Hz (SINGLE PHASE)

AI² MODEL	OUTPUT				INPUT		EFFICIENCY (%)	DIMENSIONS INCHES (mm)			WEIGHT LBS (KG)
	POWER	FREQUENCY	VOLTAGE	SHORT CIR. CURRENT	VOLTAGE RANGE	CURRENT @ 28 VDC		W	H	D	
1B 50 2A 50 3A 50	50VA	400 Hz 60 Hz 50 Hz	115/26 VAC 115 VAC 115 VAC	1.0 A	18 - 38 VDC	2.3 A	80	5.0 (127.0)	2.75 (69.9)	7.0 (177.8)	3.90 (1.77)
1B 125 2A 125 3A 125	125VA	400 Hz 60 Hz 50 Hz	115/26 VAC 115 VAC 115 VAC	2.2 A	18 - 38 VDC	5.6 A	82	5.0 (127.0)	2.75 (69.9)	7.0 (177.8)	4.25 (1.93)
1B 250 2A 250 3A 250	250VA	400 Hz 60 Hz 50 Hz	115/26 VAC 115 VAC 115 VAC	4.0 A	18 - 38 VDC	11.0 A	82	5.0 (127.0)	2.75 (69.9)	7.0 (177.8)	4.50 (2.04)
1B 350 2A 350 3A 350	350VA	400 Hz 60 Hz 50 Hz	115/26 VAC 115 VAC 115 VAC	5.0 A	18 - 38 VDC	16.0 A	78	5.0 (127.0)	2.75 (69.9)	7.0 (177.8)	4.80 (2.18)
1B 500 2A 500 3A 500	500VA	400 Hz 60 Hz 50 Hz	115/26 VAC 115 VAC 230 VAC	8.0 A	18 - 38 VDC	22.0 A	82	5.0 (127.0)	5.5 (139.7)	7.0 (177.8)	9.00 (4.09)
1B 800	800VA	400 Hz	115/26 VAC	14.0 A	18 - 38 VDC	36.0 A	80	8.5 (215.9)	4.0 (101.6)	12.0 (304.8)	13.50 (6.14)
1B 1000 2A 1000 3A 1000	1000VA	400 Hz 60 Hz 50 Hz	115/26 VAC 115 VAC 115 VAC	16.0 A	18 - 38 VDC	44.0 A	80	8.5 (215.9)	4.0 (101.6)	12.0 (304.8)	13.75 (6.25)
3A 2000	2000VA	50 Hz	230 VAC	28.0	18 - 38 VDC	90.0 A	80	8.5 (215.9)	8.0 (203.2)	12.0 (304.8)	25.00 (11.36)

LIGHTWEIGHT HI-PERFORMANCE to AC SERIES 400/60/50 Hz (3 PHASE)

AI² MODEL	OUTPUT				INPUT		EFFICIENCY (%)	VOLUME CUBIC INCHES	WEIGHT LBS (KG)
	POWER	FREQUENCY	VOLTAGE 3PH WYE Δ	SHORT CIR. CURRENT	VOLTAGE RANGE	CURRENT @ 28 VDC			
3PH-150	150VA	400/60/50 Hz	115/200 VAC	1A PER PH.	18 - 38 VDC	7 ADC	80	295 IN³	12.80 (5.80)
3PH-375	375VA	400/60/50 Hz	115/200 VAC	2.2A PER PH.	18 - 38 VDC	17 ADC	80	295 IN³	14.00 (6.40)
3PH-750	750VA	400/60/50 Hz	115/200 VAC	4A PER PH.	18 - 38 VDC	33 ADC	80	295 IN³	14.80 (6.70)
3PH-1050	1050VA	400/60/50 Hz	115/200 VAC	5A PER PH.	18 - 38 VDC	48 ADC	80	295 IN³	15.80 (7.70)
3PH-2400	2400VA	400/60/50 Hz	115/200 VAC	14A PER PH.	18 - 38 VDC	108 ADC	80	1251 IN³	41.25 (18.75)
3PH-3000	3000VA	400/60/50 Hz	115/200 VAC	16A PER PH.	18 - 38 VDC	132 ADC	80	1251 IN³	41.25 (18.95)
3PH-4800	4800VA	400/60/50 Hz	115/200 VAC	28A PER PH.	18 - 38 VDC	216 ADC	80	2502 IN³	82.50 (37.90)
3PH-6000	6000VA	400/60/50 Hz	115/200 VAC	32A PER PH.	18 - 38 VDC	270 ADC	80	2502 IN³	82.50 (37.90)

OUTPUT FREQUENCY: 400/60/50 Hz ±0.5% for all conditions of line, load and temperature; **OUTPUT VOLTAGE:** 115/26VAC ±2%, no load to full load, 200 microsecond response time; **OVERLOAD:** 110% rated output for 2 hours, 150% rated load current for 5 minutes; **WAVESHAPE:** sinewave, 0.5% THD typical, 1.0% THD maximum; **POWER FACTOR:** 0.7 Lead to 0.7 Lag, not damaged by any power factor; **ALTITUDE:** 55,000 feet, operating; **TEMPERATURE RANGE:** −55°C to +71°C operating; **ENVIRONMENTAL:** RTCA DO-160A; **EMI:** RTCA DO-160A, MIL STD 461 A(4); **QUALIFICATIONS (TYPICAL):** FAA TSO-C73, RTCA DO-160A; **PROTECTION:** Cannot be damaged by any short circuit, input under/over voltage, output overvoltage, output over/under frequency, thermal overheat, reverse polarity, fault light indicator. Δ 50Hz 3-Phase Voltage is 200/397 VAC

CONVENTIONAL DC to AC SERIES 400 Hz (SINGLE PHASE)

AI² MODEL	OUTPUT				INPUT		EFFICIENCY (%)	DIMENSIONS INCHES (mm)			WEIGHT LBS (KG)
	POWER	FREQUENCY	VOLTAGE	SHORT CIR. CURRENT	VOLTAGE RANGE	CURRENT @ 28 VDC		W	H	D	
1A100	100VA	400Hz	26 VAC	6.0A	20 - 37 VDC	12A	70	6.5 (165.1)	4.1 (104.1)	10.6 (269.2)	7.5 (3.4)
1A250	250VA	400Hz	115/26 VAC	3.4A	20 - 37 VDC	12A	75	6.5 (165.1)	4.1 (104.1)	10.6 (269.2)	9.3 (4.2)
1A350	350VA	400Hz	115/26 VAC	4.5A	20 - 37 VDC	18A	75	7.5 (190.5)	3.5 (88.9)	10.6 (269.2)	10.7 (4.9)
1A700	700VA	400Hz	115/26 VAC	9.4A	20 - 37 VDC	34A	75	8.5 (215.9)	6.6 (167.6)	11.6 (294.6)	19.0 (8.6)
1A1000	1000VA	400Hz	115/26 VAC	14.0A	20 - 37 VDC	48A	75	10.0 (254.0)	6.0 (152.4)	12.7 (322.6)	24.0 (10.9)
1A2500	2500VA	400Hz	115/26/203 VAC	33.0A	20 - 37 VDC	120A	75	7.0 (177.8)	9.9 (251.1)	15.0 (381.0)	47.5 (21.6)

CONVENTIONAL DC to AC SERIES 400 Hz (3 PHASE)

AI² MODEL	OUTPUT				INPUT		EFFICIENCY (%)	VOLUME CUBIC INCHES	WEIGHT LBS (KG)
	POWER	FREQUENCY	VOLTAGE	SHORT CIR. CURRENT	VOLTAGE RANGE	CURRENT @ 28 VDC			
3PH - 750	750VA	400Hz	115/200 VAC	3.4A	20 - 37 VDC	36A	75	930 IN³	29.0 (13.2)
3PH - 1050	1050VA	400Hz	115/200 VAC	4.5A	20 - 37 VDC	54A	75	917 IN³	34.0 (15.5)
3PH - 2100	2100VA	400Hz	115/200 VAC	9.4A	20 - 37 VDC	102A	75	1866 IN³	59.0 (26.8)
3PH - 3000	3000VA	400Hz	115/200 VAC	14.0A	20 - 37 VDC	144A	75	2362 IN³	74.0 (33.6)
3PH - 7500	7500VA	400Hz	115/200 VAC	33.0A	20 - 37 VDC	360A	75	3152 IN³	143 (65.0)

OUTPUT FREQUENCY: 400Hz ±1% for all conditions of line, load and temperature; **OUTPUT VOLTAGE:** 115/26 VAC RMS ±2.5%, no load to full load; **OVERLOAD:** 110% rated output for 2 hours, 150% rated output for 5 minutes; **WAVESHAPE:** Sinewave, 3% THD typical, 5% THD maximum; **POWER FACTOR:** 0.9 lead to 0.7 lag, not damaged by any power factor; **ALTITUDE:** 55,000 ft. operating; **TEMPERATURE RANGE:** −55°C to +71°C operating; **ENVIRONMENTAL:** RTCA DO-138; **EMI:** RTCA DO-138 Cat Z or DO-160 Cat Z; **QUALIFICATION (TYPICAL):** FAA TSO-C73 RTCA DO-138 or DO-160A, MIL-E-5400 Class 2; **PROTECTION:** Reverse polarity, internal self-resetting breaker, output overvoltage, output over/under frequency.

AVIONIC INSTRUMENTS INC.

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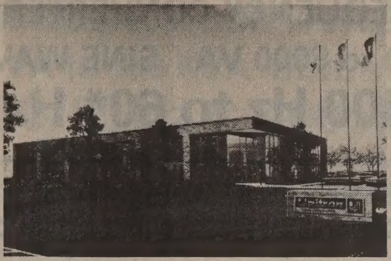
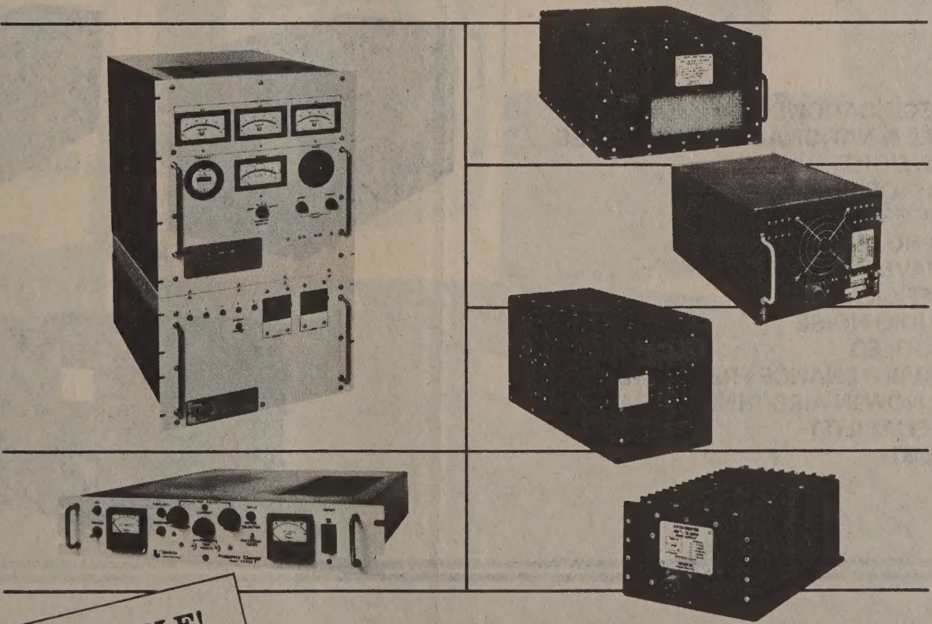
For More Information, Circle No. 326



25 Years of Service

25 Years of Experience.

Beginning in 1960, Unitron, Incorporated has concentrated on the design and development of solid state static power conversion equipment. As a result, Unitron is able to produce equipment of high reliability and superior performance within practical economic limits. This single point concentration has resulted in Unitron's becoming the supplier of the largest variety of products to both the defense aerospace and industrial markets. With the world-wide desire to conserve natural resources Unitron has expanded its product line to include 400 Hz converters that operate from 50 Hz or 60 Hz sources. This expansion includes a series of new ultra-lightweight high efficiency units. We invite your inquiries.



NOW AVAILABLE!
New ultra-lightweight highly efficient units. Selectable output voltage and frequency. Parallelable for high power applications.

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TELEX 882511

For More Information. Circle No. 301

AVTEL

FREQUENCY CONVERTERS
400 to 8000 VA SINE WAVE
400 Hz to 60* Hz

Unitron

GENERAL SPECIFICATIONS

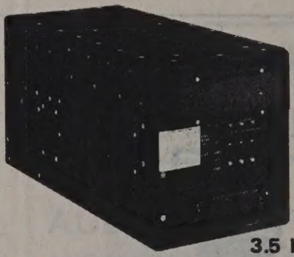
POWER RATING	INPUT PHASE	INPUT VOLTAGE	OUTPUT PHASE	OUTPUT VOLTAGE
400 VA	3ϕ	115/200 VRMS	1ϕ	115 VRMS
750 VA	3ϕ	115/200 VRMS	1ϕ	115 VRMS
*2000 VA	3ϕ	115/200 VRMS	1ϕ	115 VRMS
*3000 VA	3ϕ	115/200 VRMS	1ϕ	115 VRMS
3500 VA	3ϕ	115/200 VRMS	1ϕ	115 VRMS
8000 VA	3ϕ	115/200 VRMS	1ϕ	115 VRMS

*Also available in 50 Hz output

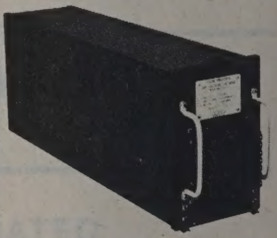
UNITRON IS THE LEADING MFG. OF 400 TO 60 Hz FREQUENCY CONVERTERS, WITH EXPERIENCE EXCEEDING 18,000,000 HOURS OF FIELD OPERATION IN AIRBORNE ■ SHIPBOARD ■ TRANSPORTABLE SHELTERS & GROUND POWER ENVIRONMENTS.

FEATURES:

- ■ MIL SPECIFICATIONS (Standard power)
- ■ FEDERAL & NATIONAL STOCK LISTINGS
- ■ LIGHT WEIGHT
- ■ LOW DISTORTION
- ■ PRECISE FREQUENCY
- ■ FULLY PROTECTED
- ■ SINE WAVE OUTPUT
- ■ HIGH EFFICIENCY
- ■ LOW AUDIO NOISE
- ■ SELF-COOLED
- ■ LONG MAINTENANCE FREE OPERATION
- ■ 6000 + NOW IN AIRBORNE OPERATION
- ■ HIGH RELIABILITY
- ■ LOW COST



3.5 KVA



400 VA

8.0 KVA

APPLICATIONS: AIRBORNE ■ COMPUTERS ■ VIDEO SYS. ■ TELETYPE ■ CONVENIENCE ITEMS ■ MOVIE PROJECTOR ■ RECORDERS ■ TRASH COMPACTORS ■ TEST EQUIPMENT ■ DATA ACQUISITION ■ ETC. ■ SHIPBOARD ■ GROUND & AIR TRANSPORTABLE SHELTERS ■ FLYING LABORATORIES ■ MEDICAL EVACUATION ■ THERMAL BLANKETS ■ EKG'S ■ BREATHING APPARATUS ■ LIFE SUPPORT ■

Unitron Incorporated
10925 Miller Rd. • Dept. GB • Dallas, Texas 75238 • P. O. Box 38902 • 800/527-1279 • In Texas 800/442-1652 • TELEX 882511

For More Information. Circle No. 301

AVTEL

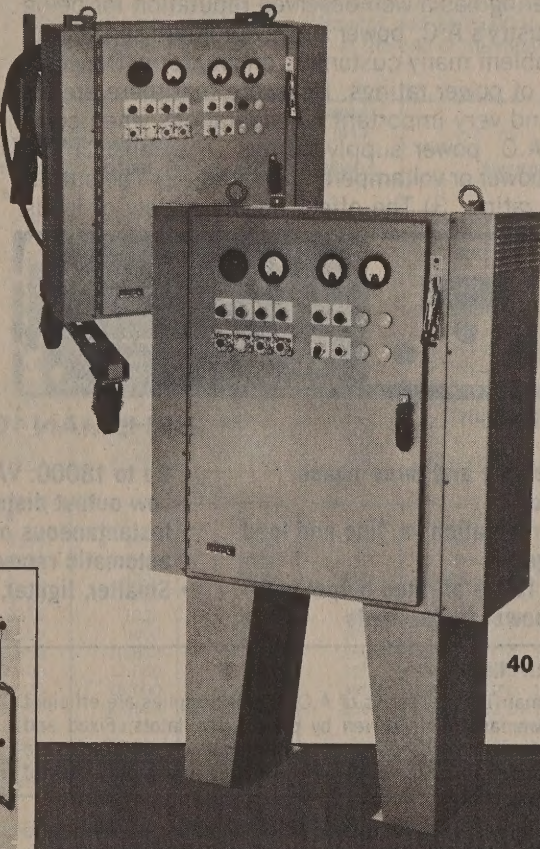
FREQUENCY CONVERTERS
500 VA to 160 KVA SINE WAVE
50/60 Hz to 400 Hz

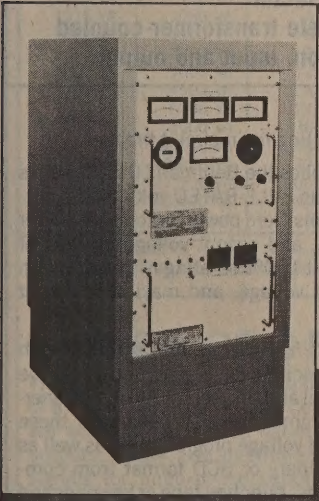
Unitron

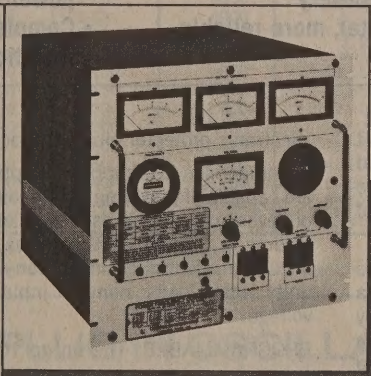
Unitron has supplied its products and services to meet the requirements of virtually every type of power application existing in today's world of modern technology, from commercial applications to the most exacting military requirements.

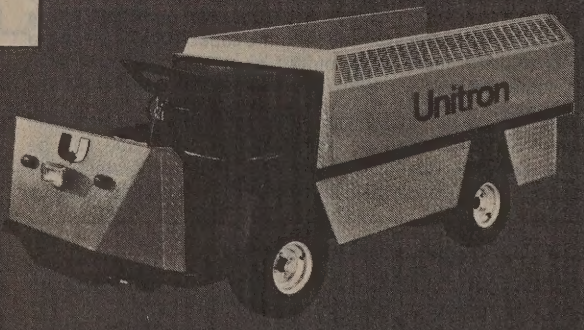
FEATURES:

- MIL SPECIFICATIONS (Standard power)
- FEDERAL & NATIONAL STOCK LISTINGS
- LIGHT WEIGHT
- RFI PROTECTION
- HIGH EFFICIENCY
- LOW DISTORTION
- LOW AUDIO NOISE
- LONG MAINTENANCE FREE OPERATION
- SHORT CIRCUIT & OVERLOAD PROTECTION
- PARALLELABLE


40 KVA


15.0 KVA


5.0 KVA



40 KVA

APPLICATIONS:
SHIPBOARD ■ SHELTERS ■ GROUND SUPPORT ■ SIMULATORS ■ AVIONICS TEST & REPAIR ■ LABORTORIES ■ HANGARS ■ Wherever precision power is required.

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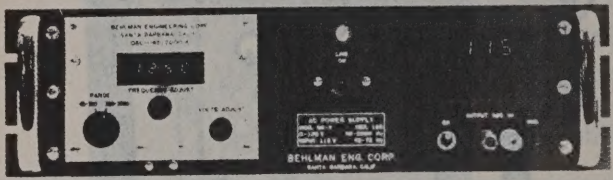
Behlman Engineering Corporation

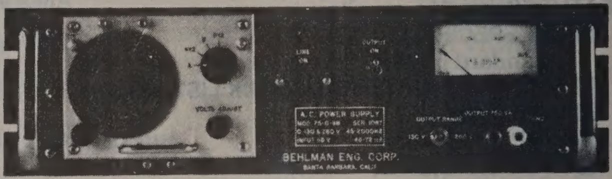
1142 MARK AVENUE • CARPINTERIA, CALIFORNIA 93013 • (805) 684-8311

A.C. POWER SOURCES

A.C. POWER SUPPLY PROBLEM SOLVERS. Behlman Engineering has a well deserved reputation for being the industry's A.C. power supply problem solver. The first problem many customers encounter is the comparison of power ratings. Be aware that there are six major and very important considerations when comparing A.C. power supply ratings. They are: 1) The output power or voltampere (VA) rating, 2) The output current rating, 3) The effect on the supply of loads having high inrush or high peak recurrent currents, 4) How the ratings are affected by low input line voltages, 5) How the ratings are affected by low power factor loads, 6) Is the supply fully isolated, both input and output, for reasons of safety and flexibility? For FREE fact sheets on power supply rating comparisons, contact Behlman Engineering. Consider (805) 684-8311 your problem solving HOT LINE.



Digital Readouts



Analog Readouts

BEHLMAN 10/500 SERIES

- **Single, two and three phase outputs**
- **Tight regulation vs. line and load changes**
- **Up to 150% of rated output with high power factor loads**
- **Up to 18000. VA per phase**
- **Low output distortion**
- **Instantaneous overload protection, automatic recovery**
- **Smaller, lighter, more reliable**
- **Fixed or variable output frequencies, 45 Hz–10 kHz**
- **Full rated output into loads of any power factor**
- **Complete transformer-coupled isolation, input and output**

DESCRIPTION

The Behlman 10/500 series of A.C. Power Supplies are efficient linear power amplifiers driven by plug-in oscillators. Fixed and variable frequency oscillators, with frequency accuracies to 0.001% and 0.1% respectively, are available in a wide variety of standard models.

For single-phase power output, a power amplifier is driven by a single-phase oscillator. Two separate power amplifiers driven by a two-phase oscillator, and three separate power amplifiers driven by a three-phase oscillator, are used to provide two and three phase power outputs. Units are available with the capability of providing a choice of single or multi-phase output by means of a front panel mode selector switch.

Both input and output are transformer coupled providing complete isolation. The output can be left floating or one side can be grounded. Complete overload, short circuit and fault protection is provided by a combination of an instantaneous, automatic-recovery electronic protector plus a fast acting main circuit breaker.

In comparison to other power supplies the Behlman 10/500 Series are capable of providing continuous FULL-RATED volt ampere output even under worst case conditions: zero power factor loads either leading or lagging, 10% low line, and output voltage at 77% of maximum. Continuous operation at 150% of rating is possible with unity factor loads, nominal input voltage, and maximum output voltage.

PROGRAMMABLE. The entire 10/500 Series are available with optional programmable plug-in oscillators. These units may be programmed for output voltage level and frequency. All of the generally accepted methods of programming can be used with these units. This includes resistance and voltage programming as well as digital programming and either binary or BCD format from computers, micro-processors, keyboards, punched tape or key punched cards. Please contact the factory for further information.

SPECIFICATIONS 10/500 SERIES

Input Voltage: 115/230 VAC ± 10% single phase on models up through 1500 VA output. Three phase inputs available.

120/208 or 230 VAC ± 10% three phase on models over 1500 VA output.

Input Frequency: 48-72 Hz. (400 Hz available.)

Efficiency: 50-65%, depending on operating conditions.

Various input voltage, frequency and power options are available, many at no extra charge.

Output Voltage: 0-130 for single phase and 0-130 line to neutral for 2 or 3 phase units. Other ranges or combinations of ranges available.

Load Regulation: ±0.5% no load to full load. Adjustable through zero for specific loads.

Line Regulation: ±0.1% for ±10% line change.

Power Factor: Full rated VA into any power factor load down to zero, lead or lag.

Distortion: 0.5% max. harmonic distortion at frequency extremes. Less at mid-band. (Unity power factor load.)

Overload and Fault Protection: Instantaneous, automatic recovery short circuit and overload protection. Fast acting main circuit breaker for fault protection.

Metering: Output voltmeter. Digital readout optional.

External Input: Via optional plug-in. 9.2 volts RMS. 15K ohms input impedance. (Replaces plug-in oscillator)

Operating Temperature: 0° to 55° Celsius (32° to 131°F.).

Front Panel Color: Dark grey, white engraved lettering.

Options: Many options are available such as input power, output voltage, frequency, etc. Please consult the factory.

Behlman Engineering Corporation
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10/500 SERIES AC POWER SOURCES

MAIN FRAME AMPLIFIERS

TO ORDER: Use model number corresponding to output power level and number of phases required. Add letter corresponding to desired frequency range. All units are in rack mounting enclosure. Cabinet enclosed versions of any of these units are available.

Order plug-in oscillators as listed below. For digital LED voltage readout in place of the analog voltmeter, add $105.00 to the prices listed below and designate with D at the end of the model number. (Example, 3-10-CD).

OUTPUT POWER		MAXIMUM AMPERES (Per Phase 0-130V)	MODEL NUMBER	OUTPUT FREQUENCY RANGE (Hz)				WEIGHT (lbs.) A MODELS	DIMENSIONS
MAXIMUM	RATED			150-2000	150-10,000	45-2000	45-10,000		
SINGLE PHASE				A	B	C	D		
150 VA	100 VA	1.2	10-	$ 1075	$ 1450	$ 1125	$ 1525	26	5¼"H × 15"D × 19"W
375 VA	250 VA	3.0	25-	1425	1925	1500	2025	38	5¼"H × 15"D × 19"W
525 VA	350 VA	4.2	35-	1650	2225	1750	2350	50	5¼"H × 15"D × 19"W
750 VA	500 VA	6.0	50-	1900	2575	2000	2700	60	5¼"H × 19"D × 19"W
1125 VA	750 VA	9.0	75-	2500	3375	2625	3550	65	5¼"H × 19"D × 19"W
1500 VA	1000 VA	12.0	100-	2850	3850	3000	4050	95	8¾"H × 19"D × 19"W
2250 VA	1500 VA	18.0	150-	3550	4800	3750	5050	120	14"H × 19"D × 19"W
3000 VA	2000 VA	24.0	200-	4475	6025	4700	6350	135	14"H × 19"D × 19"W
4500 VA	3000 VA	36.0	300-	5550	7500	5850	7900	180	21"H × 19"D × 19"W
7500 VA	5000 VA	60.0	500-	9250	12,500	9750	13,175	290	31½"H × 22"D × 19"W
9000 VA	6000 VA	72.0	600-	11,125	15,000	11,700	15,800	315	31½"H × 22"D × 19"W
[2]13,500 VA	9000 VA	108.0	900-	16,675	22,525	17,550	23,700	390	42"H × 22"D × 19"W
18,000 VA	12,000 VA	144.0	1200-	22,250	30,025	23,400	31,600	570	57¾"H × 22"D × 19"W
[2]27,000 VA	18,000 VA	216.0	1800-	33,350	45,025	35,100	47,400	780	42"H × 22"D × 19"W (2) Ea.
TWO PHASE—PLEASE CONSULT FACTORY									
THREE PHASE				A	B	C	D		
450 VA	300 VA	1.2	3-10-	$ 2625	$ 3550	$ 2775	$ 3750	42	5¼"H × 19"D × 19"W
1125 VA	750 VA	3.0	3-25-	3550	4800	3750	5050	72	7"H × 19"D × 19"W
1575 VA	1050 VA	4.2	3-35-	4000	5375	4200	5670	110	8¾"H × 22"D × 19"W
2250 VA	1500 VA	6.0	3-50-	4975	6725	5250	7075	145	14"H × 19"D × 19"W
3375 VA	2250 VA	9.0	3-75-	6950	9375	7325	9875	155	14"H × 19"D × 19"W
4500 VA	3000 VA	12.0	3-100-	8550	11,550	9000	12,150	200	21"H × 19"D × 19"W
6750 VA	4500 VA	18.0	3-150-	10,250	13,850	10,800	14,575	280	28"H × 19"D × 19"W
9000 VA	6000 VA	24.0	3-200-	11,400	15,400	12,000	16,200	325	29¾"H × 19"D × 19"W[1]
[2]13,500 VA	9000 VA	36.0	3-300-	17,100	23,075	18,000	24,300	390	42"H × 22"D × 19"W
18,000 VA	12,000 VA	48.0	3-400-	21,375	28,850	22,500	30,375	650	64¾"H × 22"D × 19"W
[2]27,000 VA	18,000 VA	72.0	3-600-	32,050	43,275	33,750	45,550	780	42"H × 22"D × 19"W (2) Ea.
[2]40,500 VA	27,000 VA	106.0	3-400-	48,100	64,925	50,625	68,350	1170	42"H × 22"D × 19"W (3) Ea.
54,000 VA	36,000 VA	144.0	3-1200-	64,125	85,575	67,500	91,125	1660	57¾"H × 22"D × 19"W (3) Ea.
[2]81,000 VA	54,000 VA	216.0	3-1800-	96,176	129,850	101,250	136,675	2340	42"H × 22"D × 19"W (6) Ea.

[1] 1—Size for "A" and "B" Models. The height is 35" for "C" and "D" Models.

[2] 2—Available only as a complete cabinet enclosed unit. Price does not include cabinet which will vary depending upon type and cabinet manufacturer desired.

SERIES OSC PLUG-IN OSCILLATORS

The OSC series oscillators are designed to plug into the front panel of all Behlman Engineering Corporation AC Power Supplies. They are available in a wide variety of fixed and variable frequency outputs. Single, two and three phase models provide suitable drive signals for multi-phase supplies. These oscillators readily synchronize with external signals. In addition to the standard units shown below virtually any combination of fixed or variable frequencies to any practical degree of accuracy can be provided. Many special features, including provisions for external sync or drive, can be supplied.

FIXED FREQUENCY	MODEL	FREQUENCY ACCURACY					
		1%	0.5%	0.25%	0.1%	0.01%	0.001%
		E	F	G	H	J	K
SINGLE PHASE	OSC-1-XXX*—	$145	$175	$195	$225	$380	$515
TWO PHASE	OSC-2-XXX*—	200	230	250	280	435	570
THREE PHASE Y	OSC-3-XXX*—	235	265	285	315	450	585
*Insert desired frequency in place of XXX. Add code letter for desired frequency accuracy to model number.							
VARIABLE FREQUENCY	MODEL	1%	0.5%	0.25%	0.1%		
SINGLE PHASE	OSC-1-380/420—	$325	$370	$410	$485	"For digital LED frequency readout in place of the circular dial, add $150.00 to the variable frequency model prices and designate with OSCD in place of OSC in the model number."	
	OSC-1-350/450—	350	395	430			
	OSC-1-300/500—	375	410	450			
	OSC-1-44/66—	375	410	450			
	OSC-1-44/66—320/480—	440	475	515			
	OSC-1-45/2000—	460					
	OSC-1-150/2000—	450					
	OSC-1-45/10000—	510					
	OSC-1-150/10000—	490					
TWO PHASE	-2-	ADD 25% TO SINGLE PHASE PRICE (APPROX.)					
THREE PHASE Y	-3-	ADD 35% TO SINGLE PHASE PRICE (APPROX.)					
EXTERNAL INPUT PLUG-IN	EIP-1	$75 For one phase external input					
	EIP-2	85 For two phase external input					
	EIP-3	95 For three phase external input					
EXTERNAL SYNC	-SN	55 May be added to all fixed or variable frequency oscillators					

Behlman Engineering Corporation

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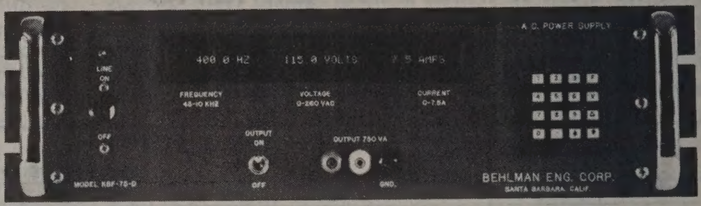
KB SERIES AC POWER SOURCES

PROGRAMMABLE AND INTELLIGENT



- **Manual or computer controlled**
- **Reduces ATE system complexity**
- **Built-in measurement system**
- **Single command incrementing or decrementing of output voltage and frequency**
- **Microcomputer based crystal referenced, synthesized sinewave**
- **Cuts development time**
- **Reduces support equipment**
- **Variety of host interface options—IEEE 488, RS 232, and others**
- **Virtually no EMI/RFI emissions generated**
- **Standard programming languages—CIIL, AIE, Ada, and others**
- **Increases test reliability**
- **Versatile and efficient**
- **Self-test capability and diagnostic reports**
- **Front panel, alphanumeric display and keyboard**
- **Complete input/output electrical isolation**

DESCRIPTION

The combination of a high quality AC power source, a precision measurement system, and a system performance monitor makes the Behlman KB Series a total AC power test tool. No other single AC test instrument available can equal this capability. Whether required for repetitive production testing, general laboratory support, or Automatic Test Equipment (ATE) applications, the KB Series AC power sources provide a single, cost effective, performance oriented solution to AC power testing.

Designed for high-reliability in both stand-alone and computer-controlled applications, the KB Series is programmable and reduces the necessity of costly support equipment and test hardware. Each KB Series model features a microcomputer control and measurement system that provides independent verification of operating output voltages, frequencies, currents, and phase relationships—not programmed values. On command the measurements are reported on a front panel, forty character, alpha numeric, fluorescent display and/or a variety of optional host interfaces such as IEEE 488, RS 232, and others. Watchdog functions are carried out by self-diagnostic circuits that make reports via the display and/or host interface.

Programming of the KB Series is accomplished by the front panel keyboard or a host computer and allows for incrementing and decrementing of the output values with user definable resolution. Military progamming requirements, such as the United States Air Force's Modular Automatic Test Equipment (MATE), are met by the KB Series. This allows for full use of the Control Interface Intermediate Language (CIIL) without supplementary hardware or software.

KB Series power configurations range from 100 VA to 54 KVA with less than 1% total harmonic distortion in single and multi-phase models. Frequency configurations range from 45 to 10,000 Hz with .001% accuracy. As with all Behlman products, the KB Series generates extremely low EMI and RFI emissions.

Among the specialized requirements Behlman Engineering can meet are unique designs which incorporate Field Effect Transistors (FET). These models are designated KB"F" Series and are for applications requiring the extended performance and high reliability of power FET Amplifier designs. Consult the factory for further information on the Behlman KBF Series.

FREE SOURCE OF A.C. POWER CONSULTATION. Behlman Engineering has the resources and versatility which enable us to solve the most difficult A.C. power problem. Because we listen and learn from our customers, our A.C. power products are the leading edge of A.C. power supply technology. Get the straight facts without the high-powered sales pitch from Behlman's consultants by calling (805) 684-8311.

For More Information. Circle No. 302

Behlman Engineering Corporation
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KB SERIES AC POWER SOURCES:

TO ORDER: Use model number corresponding to output power level and number of phases required. Add letter corresponding to desired frequency range. For example KBT 3-10-D. All units are in rack mounting enclosure except as noted below. Cabinet enclosed versions for any of these units are available. (KBT designates standard KB Series models. The "T" stands for transistor.)

Rated Output Power	Maximum Amperes[2] (Per Phase) (0-130 V.)	Model Number	Output Frequency Range (Hz)				Weight (lbs.) B Models	Dimensions
			150-2000	150-10,000	45-2000	45-10,000		
SINGLE PHASE			A	B	C	D		
100 VA	1.2	KBT-10	$ 3075	$ 3475	$ 3125	$ 3550	26	5¼"H × 19"D × 19"W
250 VA	3.0	KBT-25	3450	3975	3525	4075	38	5¼"H × 19"D × 19"W
350 VA	4.2	KBT-35	3675	4275	3775	4400	50	5¼"H × 19"D × 19"W
500 VA	6.0	KBT-50	3950	4650	4050	4775	60	5¼"H × 19"D × 19"W
750 VA	9.0	KBT-75	4575	5475	4700	5675	65	7"H × 12"D × 19"W
1000 VA	12.0	KBT-100	4950	5975	5100	6200	95	8¾"H × 22"D × 19"W
1500 VA	18.0	KBT-150	5675	6975	5875	7250	120	14"H × 19"D × 19"W
2000 VA	24.0	KBT-200	6650	8275	6875	8600	135	14"H × 19"D × 19"W
3000 VA	36.0	KBT-300	7775	9825	8075	10250	180	21"H × 19"D × 19"W
5000 VA	60.0	KBT-500	11650	15075	12175	15772	280	31½"H × 22"D × 19"W
6000 VA	72.0	KBT-600	13625	17700	14225	18525	290	31½"H × 22"D × 19"W
*9000 VA	108.0	KBT-900	19450	25600	20375	26825	390	42"H × 22"D × 19"W
12000 VA	144.0	KBT-1200	25950	34150	27175	35775	570	57¾"H × 22"D × 19"W
*18000 VA	216.0	KBT-1800	38900	51200	40750	53650	780	42"H × 22"D × 19"W (2) Ea.
TWO PHASE—PLEASE CONSULT FACTORY								
THREE PHASE-Y			A	B	C	D		
300 VA	1.2	KBT3-10	$ 5075	$ 6050	$ 5225	$ 6275	42	5¼"H × 22"D × 19"W
500 VA	2.0	KBT3-17	5650	6800	5850	7025	65	7"H × 22"D × 19"W
750 VA	3.0	KBT3-25	6050	7400	6275	7675	72	7"H × 22"D × 19"W
1050 VA	4.2	KBT3-35	6550	8025	6750	8350	110	8¾"H × 22"D × 19"W
1500 VA	6.0	KBT3-50	7600	9475	7875	9850	145	14"H × 19"D × 19"W
2250 VA	9.0	KBT3-75	9725	12325	10125	12850	155	14"H × 19"D × 19"W
3000 VA	12.0	KBT3-100	11425	14650	11925	15300	200	21"H × 19"D × 19"W
4500 VA	18.0	KBT3-150	13275	17125	13850	17925	280	28"H × 19"D × 19"W
6000 VA	24.0	KBT3-200	14500	18800	15150	19650	325	29¾"H × 19"D × 19"W[3]
*9000 VA	36.0	KBT3-300	20625	27050	21600	28375	390	42"H × 22"D × 19"W
12000 VA	60.0	KBT3-400	25235	33250	26425	34900	625	64¾"H × 22"D × 19"W
*18000 VA	72.0	KBT3-600	36700	48775	38525	51200	780	42"H × 22"D × 19"W (2) Ea.
*27000 VA	108.0	KBT3-900	55050	73175	57800	76800	1170	42"H × 22"D × 19"W (3) Ea.
36000 VA	144.0	KBT3-1200	73400	97550	77050	102400	1680	57¾"H × 22"D × 19"W (3) Ea.
*54000 VA	216.0	KBT3-1800	110100	146325	115575	153600	2340	42"H × 22"D × 19"W (6) Ea.

Notes: Height for "C" and "D" models is 35". *Available only as a complete cabinet—price not included.

SPECIFICATIONS*

INPUT

Voltage: 115/230 VAC ±10% single phase on models up through 1500 VA output. Three phase inputs available.
120/208 or 230 VAC ±10% three phase on models over 1500 VA output and up through 18000 output.
460 VAC ±10% three phase on models over 18000 VA output.

Frequency: 48-72Hz (400Hz available).
Various input voltage, frequency and power options are available, many at no extra charge.

Efficiency: 50-65% depending on operating conditions.

OUTPUT

Voltage: Single phase: 0-270 with auto range change at 135 volts. Two or three phase: 0-135 line to neutral. (0-270 with auto range change at 135 volts is optional.)

Frequency: 45-10,000Hz; See Selection Guide for frequency range of specific models.

Frequency Accuracy: ±0.001%

Load Regulation: ±0.2%, no load to full load.

Line Regulation: ±0.1% for ±10% line change.

Distortion: Less than 1% total harmonic distortion.

Rated Power Output: Obtainable from 100-135 volts and 200-270 volts, down to 10% low line.

Maximum Rated Power: Up to 150% of nominal rating available depending on operating conditions.

Power Factor: 100% VA rating available into any power factor load (utility to zero, leading or lagging).

Overload Protection: Electronic overload and short circuit protection with automatic, instantaneous recovery when overload is removed.

Over Voltage Protection (OVP): Continuously tracking within 5% of operating value.

Fault Protection: Fast-acting, main circuit breaker.

Output Sensing: Individual remote sensing for each phase.

OPTIONAL HOST INTERFACES

IEEE-488 (GPIB), 1978
RS-232C
Parallel Binary
Parallel BCD
0-10 VDC
A front panel LOCAL/REMOTE key lock is included with the host interface.

GENERAL

Operating Temperature: 0° to 55° Celsius (32° to 131° F.)

Front Panel: Dark grey, with white engraved lettering

*All specifications are based on unity power factor loads and may be changed without notice.

For More Information. Circle No. 302

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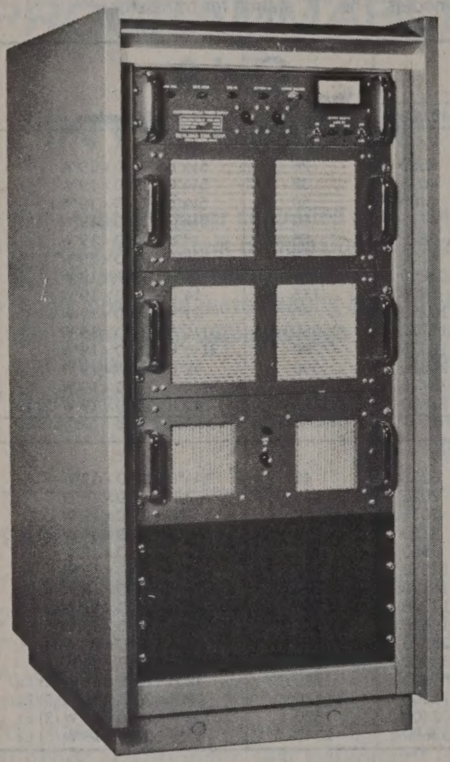
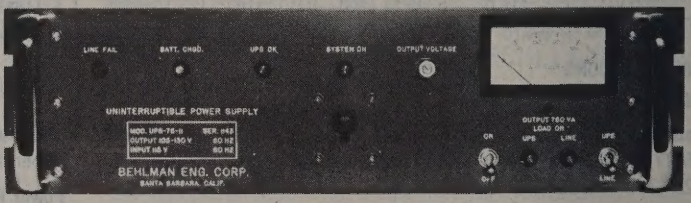
UNINTERRUPTIBLE POWER SYSTEMS



6KVA, SINGLE PHASE, UPS

VERY LOW EMI/RFI UPS

- High input/output isolation
- High noise reduction
- Low EMI/RFI
- Low output distortion
- Load power factor independence
- Outstanding MTBF
- Tight output regulation
- Small size and weight



750VA, SINGLE PHASE, UPS

DESCRIPTION

BEHLMAN Uninterruptible Power Systems provide a source of high quality AC power to critical electrical loads regardless of the input AC power line condition. UPS configurations range from 100 VA to 7.5 KVA in single-phase models and 3 KVA to 20 KVA in three-phase models.

A BEHLMAN UPS protects the load from all types of power line disturbances and from complete loss of line power. When normal AC line power is available, the UPS isolates the load from line anomalies such as voltage variations, frequency variations, and transient noise. If a complete failure of the line occurs or line anomalies exceed tolerable limits, the load is automatically switched to a battery supply allowing the UPS to maintain an uninterrupted output of high quality AC power.

These UPS systems are unique in that they are linear transistorized power amplifiers which inherently do not generate EMI or RFI either conducted or radiated and have lower distortion (under ±1.0%), and tighter line and load regulation (under ±1.0%).

All Behlman UPS models include a battery charger, solid state bypass switch, appropriate indicating lights and power line failue alarm provisions. The output frequency of the UPS is phase locked to the input power line frequency under conditions of normal operation. In the event the A.C. power line fails, the UPS continues to furnish the load with A.C. power by operating from the battery bank. The output frequency of the UPS is then determined by the highly stable internal oscillator.

Battery banks can be furnished for relay rack mounting or to the customer's specific requirements. Battery interconnect cables are provided with all standard UPS configurations.

PROBLEM SOLVER HOT LINE (805) 684-8311. Do you have a special A.C. power problem? Behlman Engineering's consultants can solve it. A variety of options provide solutions to many special requirements. We listen and learn with a desire to provide straight forward answers and solutions.

For More Information. Circle No. 302

Behlman Engineering Corporation

1142 MARK AVENUE • CARPINTERIA, CALIFORNIA 93013 • (805) 684-8311

UPS MODEL INFORMATION

1. To develop a complete model number, use the model number of this table (example UPS-10-) followed by the dash number for the Input/Output combination desired. Example: UPS-10-11 is a 100 VA unit with single phase, 115 VAC, 60 Hz input and output.
2. All models listed are rack mount type.
3. Battery packs listed are only suggestions for 15 minutes back-up using Gel-Cel batteries except where noted. Contact the factory for complete battery selection guide or for selection assistance.

MODEL[1]	TOTAL POWER OUTPUT	CURRENT OUTPUT PER PHASE (AMPERES)	WEIGHT (lbs)	DIMENSIONS[2] (In) (Not Including External Batteries)	RECOMMENDED BATTERY PACK[3] (Gel Cell)
SINGLE PHASE MODELS					
UPS-10-	100 VA, 1Ø	1	28	5¼"H × 19"D × 19"W	Internal (60 min)
UPS-25-	250 VA, 1Ø	2.5	41	5¼"H × 19"D × 19"W	Internal (20 min)
UPS-35-	350 VA, 1Ø	3.5	54	5¼"H × 22"D × 19"W	Internal (15 min)
UPS-50-	500 VA, 1Ø	5.0	65	5¼"H × 19"D × 19"W	BAT 6020-20
UPS-75-	750 VA, 1Ø	7.5	70	5¼"H × 19"D × 19"W	BAT 6020-20
UPS-100-	1 KVA, 1Ø	10	102	8¾"H × 22"D × 19"W	BAT 6040-05
UPS-150-	1.5 KVA, 1Ø	15	129	14"H × 19"D × 19"W	BAT 6040-05
UPS-200-	2.0 KVA, 1Ø	20	145	14"H × 19"D × 19"W	BAT 6040-05 (2) Ea.
UPS-300-	3.0 KVA, 1Ø	30	194	22¾"H × 22"D × 19"W	BAT 6040-05 (2) Ea.
UPS-500-	5.0 KVA, 1Ø	42	308	28"H × 22"D × 19"W	BAT 6040-05 (3) Ea.
UPS-750-	7.5 KVA, 1Ø	63	318	33¼"H × 22"D × 19"W	BAT 6040-05 (4) Ea.
THREE PHASE MODELS					
UPS3-100-	3 KVA, 3Ø	10	215	33¼"H × 22"D × 19"W	BAT 6040-05 (2) Ea.
UPS3-150-	5 KVA, 3Ø	15	301	33¼"H × 22"D × 19"W	BAT 6040-05 (3) Ea.
UPS3-200-	7.5 KVA, 3Ø	21	349	36¾"H × 22"D × 19"W	BAT 6040-05 (4) Ea.
UPS3-300-	10 KVA, 3Ø	30	420	45½"H × 22"D × 19"W	BAT 6040-05 (5) Ea.
UPS3-500-	15 KVA, 3Ø	42	650	68¼"H × 22"D × 19"W	BAT 6040-05 (8) Ea.
UPS3-600-	20 KVA, 3Ø	60	810	45½"H × 22"D × 19"W (2) Ea.	BAT 6040-05 (11) Ea.

Lower power three phase units available; contact factory.

INPUT/OUTPUT COMBINATIONS AVAILABLE

Dash No.	INPUT			OUTPUT		
	Voltage	Phase	Frequency	Voltage	Phase	Frequency
11	115 VAC	1	60	115 VAC	1	60
12	230 VAC	1	60	230 VAC	1	60
13	220/230 VAC	1	50	220/230 VAC	1	50
15	100 VAC	1	50	100 VAC	1	50
31	120/208 VAC	3	60	120/208 VAC	3	60
32	230 VAC	3	60	230 VAC	3	60
33	460 VAC	3	60	460 VAC	3	60
34	220/380 VAC	3	50	220/380 VAC	3	50
35	380 VAC	3	50	380 VAC	3	50
36	120/208 VAC	3	60	120 VAC	1	60
37	120/208 VAC	3	60	230 VAC	1	60
38	230 VAC	3	60	115 VAC	1	60
39	230 VAC	3	60	230 VAC	1	60
40	460 VAC	3	60	115 VAC	1	60
41	460 VAC	3	60	230 VAC	1	60
42	220/380 VAC	3	50	220/380 VAC	1	50
43	380 VAC	3	50	220/230 VAC	1	50

GENERAL SPECIFICATIONS

INPUT

Voltage: See Selection Guide

Voltage Range: ±10%

Frequency: See Selection Guide

Frequency Range: ± 3 Hz

Power Factor (worst case): 0.8 lagging

OUTPUT

Voltage: See Selection Guide

Voltage Regulation: ±1% line and load

Voltage Adjustment: ±10% (i.e. 105-130 volts on 115 volt model)

Frequency: See Selection Guide

Frequency Accuracy (Freerunning): ±0.1% (0.01% and 0.001% available)

Frequency Stability (Freerunning); ±0.01% (short term), ±0.1% (long term)

Line Synchronization: Capture range ±3 Hz at a 1 Hz per second slew rate

Waveform: Sinewave

Distortion: 1% maximum total harmonic distortion

Load Power Factor Range: Unity to zero, leading or lagging

Overload Rating: 125% for 10 minutes, 150% for 30 seconds, 200% for 1 second

MISCELLANEOUS

Controls: System "On-Off" circuit breaker, Output Voltage Adjustment, Manual Bypass Switch "UPS-Line," Output to load "On-Off"

Indicators: Line Failure, Battery Charged, UPS OK, System On, Load On UPS, Load On Line

Contact Closure Outputs: Line Failure, UPS Output Off, Low Battery; Single Pole, Normally Open

Meter: Output Voltage

Static Transfer Switch: 4ms transfer to bypass line for inverter failure or overload, automatic re-transfer to inverter after removal of overload

Manual Bypass Switch: Front Panel Control for transfer of load to bypass line during UPS maintenance or checkout

Battery Chargers: Designed for rapid recharge. Rate and current depend on battery selection

Operating Temperature: 0°C to 40°C (32° to 104° F.)

Operating Humidity: 0 to 95% relative humidity; noncondensing

MTBF: 20,000 hours maximum 100,000 hours for AC output failure including static transfer switch

MTTR: 30 minutes

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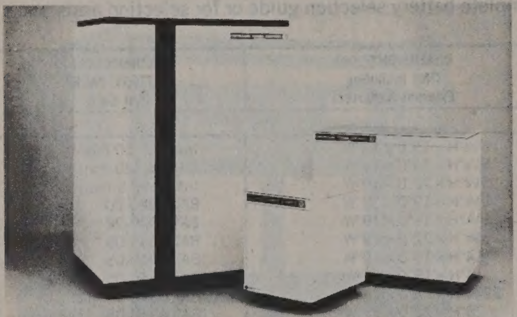
SERIES 200 POWER TRANSFORMERS



GENERAL

Controlled Power has established an enviable reputation by offering the highest quality products. The quality is reflected in the design, material, workmanship and ultimately in the performance of the products.

Series 200 includes: Single phase, double wound, **Power Transformers;** 600V, 2 KVA-1000 KVA.
Three phase, double wound, **Power Transformers;** 600V, 3 KVA-1000 KVA.
Single phase **Auto Transformers;** 600V, 3 KVA-50 KVA.
Three phase **Auto Transformers;** 600V, 3 KVA-1000 KVA.
Three phase **Controlled Power Testing Transformer** with combined standard auto winding and a multitapped auxiliary winding; 600V, 5 KVA-50 KVA.
Single phase, double wound **Power Transformers**; 5000V, 10 KVA-333 KVA.
Three phase, double wound **Power Transformers**; 5000V, 10 KVA-750 KVA.
All of these transformers are 60 Hertz and utilize Class H insulation. 50 Hertz units available.
Complete specifications available from factory. Ask for Bulletin 200-80A.

The quality features listed below exemplify the quality found in Controlled Power Systems:

- Heavy gauge sheet steel or aluminum enclosures.
- Enclosure is phosphated (sheet steel) and finished with a baked on enamel.
- Drip-proof construction with baffled openings for ventilation.
- Enclosure, core, shield and coil assembly are visibly grounded.
- Floor or wall mounting for industrial units through 50 KVA without accessory brackets (industrial enclosures).
- Commercial units attractively styled and color co-ordinated for computer room application or office placement are available.
- Dry Nitrogen Annealed electric steel cores retain the high magnetic properties after shearing and forming operations through the Controlled Power Annealing Process.
- Higher efficiency and power factor results from stress relieving the steel and restoring the electrical grade silicon steel magnetic characteristics.
- Quiet operation on all systems.

ENCLOSURES

Phosphatized sheet metal cabinets are completely rust proof and corrosion resistant. Baked on enamel ensures long life.
Formed and flanged from extra heavy gauge steel or aluminum.
Removable or hinged panels for excellent accessability.
Thermally designed vented openings offer optimum cooling for long life.
Solid top covering shields units from foreign matter and liquids entry.
Commercial enclosure suitable for computer room or office environment available.
Prominent non-corrosive diagrammatic data nameplate attached.

TRANSFORMER TAPS

Taps are added to the high voltage or low voltage windings of transformers to compensate for changing voltage conditions at the input transformer. They are rated at a fixed percentage of the nominal input. The correct way to check for the best tap to be used is to ascertain the present incoming voltage and also check the output voltage of the secondary with the load connected to see if it is within one or two percent of the desired output voltage. Frequently voltage is correct when first installed but when other loads are added, voltage to or from the transformer drops. This will require a change of taps to compensate for this drop.

ELECTRICAL AND MECHANICAL ASSEMBLY

Extra strong and flexible core and coil support materials used for bracing result in high mechanical strength to withstand surges.
Terminal connections marked and easily accessible through removable panels.
10 KV BIL certifications for 600 Volt Class, High BIL ratings available.

CORE AND COIL CONSTRUCTION

Computer assisted design for optimum results. Windings are in tight, even layers keeping core losses and noise to a minimum.
Silicon grain-oriented low magnetostriction steel is precisely cut, interleaved, formed, rigidly clamped and firmly bonded.
Completed steel cores retain the high magnetic properties after shearing and blanking operations through the Controlled Power Dry Nitrogen Annealing Process. Higher efficiency and power factor results from stress relieving the steel and restoring the electrical grade silicon steel magnetic characteristics.
Coil insulating blocks create tunnel cooling effect increasing safety factor against overloads and excessive temperature rise.
Low losses through use of optimum conductor to core loss ratios.
Electrical silicon steel offers high efficiency, long life and complete reliability.
Temperature and noise levels equal to or below NEMA, CSA, U.L., and ASA standards.
Insulators are selected for best thermal properties and high dielectric strength.

SHIELDING

Single shielded transformers are available in most of the sizes listed below.

CALL OR WRITE FACTORY FOR COMPLETE DETAILED BROCHURE OF OUR POWER TRANSFORMERS

SOUND LEVELS

Controlled Power's quiet performance transformers start with quality steel. By using an electrical grade steel having a high rating of withstanding magnetostriction vibrations caused by magnetic force fields and proper varnish impregnation, quiet operation is insured.
Further minimization of any transmitted pulsation is reduced by rigid mechanical bracing. By utilizing grades of insulation that allow forming tighter, smaller coils with closer air gaps the sound level is lowered.

SINGLE PHASE DOUBLE WOUND POWER TRANSFORMERS 600V CLASS 2 KVA-500 KVA	2 KVA THRU 5 KVA — SINGLE PHASE POWER TRANSFORMERS — 600V CLASS 7.5 KVA THRU 25 KVA — SINGLE PHASE POWER TRANSFORMERS — 600V CLASS 37.5 KVA THRU 100 KVA — SINGLE PHASE POWER TRANSFORMERS — 600V CLASS 167 KVA THRU 500 KVA — SINGLE PHASE POWER TRANSFORMERS — 600V CLASS
THREE PHASE DOUBLE WOUND POWER TRANSFORMERS 600 VOLT CLASS 3 KVA-1000 KVA	3 KVA THRU 15 KVA — THREE PHASE POWER TRANSFORMERS — 600V CLASS 30 KVA THRU 1125 KVA — THREE PHASE POWER TRANSFORMERS — 600V CLASS 150 KVA THRU 450 KVA — THREE PHASE POWER TRANSFOMERS — 600V CLASS 500 KVA THRU 1000 KVA — THREE PHASE POWER TRANSFORMERS — 600V CLASS
AUTO TRANSFORMERS SINGLE & THREE PHASE 600 VOLT CLASS 3 KVA-1000 KVA	3 KVA THRU 50 KVA — SINGLE PHASE AUTO TRANSFORMERS — 600V CLASS 3 KVA THRU 1000 KVA — THREE PHASE AUTO TRANSFORMERS — 600V CLASS 5 KVA THRU 50 KVA — TESTING THREE PHASE AUTO TRANSFORMERS
SINGLE PHASE DOUBLE WOUND POWER TRANSFORMERS 5000 VOLT CLASS 10 KVA-333 KVA	10 KVA THRU 37.5 KVA — SINGLE PHASE POWER TRANSFORMERS — 5 KV CLASS 50 KVA THRU 150 KVA — SINGLE PHASE POWER TRANSFORMERS — 5 KV CLASS 167 KVA THRU 333 KVA — SINGLE PHASE POWER TRANSFORMERS — 5 KV CLASS
THREE PHASE DOUBLE WOUND POWER TRANSFORMERS 5000 VOLT CLASS 10 KVA-750 KVA	10 KVA THRU 45 KVA — THREE PHASE POWER TRANSFORMERS — 5 KV CLASS 75 KVA THRU 225 KVA — THREE PHASE POWER TRANSFORMERS — 5 KV CLASS 300 KVA THRU 750 KVA — THREE PHASE POWER TRANSFORMERS — 5 KV CLASS

For More Information. Circle No. 303

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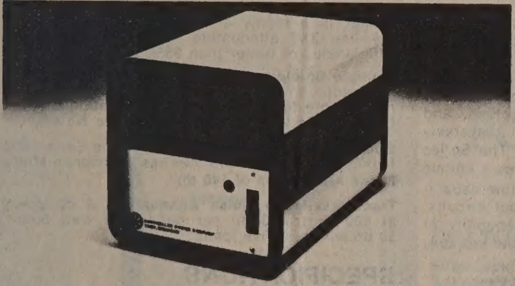

SERIES 500 POWER LINE REGULATOR

GENERAL

The Series 500 Power Line Régulator is a light weight, efficient, distortion free method of regulating line voltage. It utilizes a tapped auto-transformer with either triacs or inverse-parallel silicon controlled rectifiers to automatically change taps and regulate the output voltage. It is an excellent low cost method of correcting for high or low line voltage conditions automatically. An auto-transformer does not isolate the incoming from outgoing lines, and does not eliminate noise or transients.

APPLICATIONS

The Series 500 utilizes an auto-transformer. Hence, it does not isolate the incoming and outgoing lines. This unit should be applied where brownouts or surges are the main power line problem. It does not protect against noise, transients, or distortions.

FEATURES AND BENEFITS

Lower Cost: The Series 500 Power Line Regulator is one of the lowest cost methods of regulating line voltage. This is especially true in the larger KVA sizes.

Efficient: Because the Series 500 is an auto-transformer regulator with a limited regulating range, it is one of the most efficient means of regulating line voltage. Efficiency in the order of 98% and higher can be expected.

Fast Response: The Series 500 Line Voltage Regulator will respond to line voltage changes within one cycle of the operating frequency.

Low Distortion: The Series 500 Line Voltage Regulator will add less than 1.0% distortion to the incoming waveform.

Wide Input Frequency Range: The Series 500 operates over a wide input frequency range (+5%, −5%) which enables it to supply constant voltage to the load even with a fluctuating input frequency.

SPECIFICATIONS

Line Voltage Regulation: The output of the Series 500 is held constant ±5% of the nominal with input voltage variation of +10%, −20%. (±3% available)

Input Voltage Range: Input voltage may vary from +10% to −20% from nominal and still maintain regulation specifications.

Efficiency: Efficiency in the order of 98% or better can be expected.

Operating Temperature: The normal operating temperature range is 0°C to 40°C.

Output Distortion: Adds less than 1.0% total harmonic distortion to the input waveform.

Response Time: 1 cycle maximum.

Load Regulation: Less than ±2% from no load to full load.

SINGLE PHASE — 60 HERTZ

Power Rating V.A.*	(1) Nominal Input Voltage and Plug Type x	Input Voltage Range	(2) Output Voltage and Receptacle	(2) No. of Standard Outputs	(3) Weight Pounds	(4) Basic Model Number
1000	120V, 5-15P	95-132	120V 5-20R	4	61	5AAX-1K-5
1500	120V, 5-20P	95-132	120V 5-20R	4	66	5AAX-1.5K-5
2000	120V, 5-30P	95-132	120V 5-20R	4	68	5AAX-2K-5
2500	120V, 5-30P	95-132	120V 5-20R	4	70	5AAX-2.5K-5
3000	208 H.W.	166-228	208 H.W.	0	74	5BBX-3K-5
3000	240 H.W.	192-264	240 H.W.	0	74	5CCX-3K-5
5000	208 H.W.	165-228	208 H.W.	0	78	5BBX-5K-5
5000	240 H.W.	192-264	240 H.W.	0	78	5CCX-5K-5
8000	208 H.W.	185-228	208 H.W.	0	165	5BBX-8K-5
8000	240 H.W.	192-264	240 H.W.	0	165	5CCX-8K-5
10,000	208 H.W.	165-228	208 H.W.	0	176	5BBX-10K-5
10,000	240 H.W.	192-264	240 H.W.	0	176	5CCX-10K-5
15,000	208 H.W.	165-228	208 H.W.	0	195	5BBX-15K-5
15,000	240 H.W.	192-264	240 H.W.	0	195	5CCX-15K-5
20,000	208 H.W.	165-228	208 H.W.	0	230	5BBX-20K-5
20,000	240 H.W.	192-264	240 H.W.	0	230	5CCX-20K-5
25,000	208 H.W.	165-228	208 H.W.	0	250	5BBX-25K-5
25,000	240 H.W.	192-264	240 H.W.	0	250	5CCX-25K-5

All transformers above are 60 Hertz and utilize Class H Insulation. 50 Hertz models available on request.

(1) Commercial Enclosures have plugs noted with 8 ft. cord and circuit breaker input. Inputs are hard wired. H.W. denotes hard wiring.

(2) Commercial Enclosures have receptacles noted. When applicable, they are circuit breaker protected. Outputs are hard wired.

(3) Shipping weights are approximate. Actual weights may be higher due to packing and crating.

* Other KVA sizes, input and output voltages are available on request.

- Open type systems are available for OEM utilization.

THREE PHASE — 60 HERTZ

Power Rating V.A.*	(1) Nominal Input Voltage	(2) Input Voltage Range	Output Voltage	(3) Weight Pounds	(4) Basic Model + Number
9 KVA	600	480-660	600 Hard Wired	245	8EEX-9K-5
9 KVA	480	384-528	480y/277 Hard Wired	245	8DDX-9K-5
9 KVA	240	192-264	240 Hard Wired	245	8CCX-9K-5
9 KVA	208	166-228	208y/120 Hard Wired	245	8BBX-9K-5
15 KVA	600	480-660	600 Hard Wired	375	8EEX-15K-5
15 KVA	480	384-528	480y/277 Hard Wired	375	8DDX-15K-5
15 KVA	240	192-264	240 Hard Wired	375	8CCX-15K-5
15 KVA	208	166-228	208y/120 Hard Wired	375	8BBX-15K-5
25 KVA	600	480-660	600 Hard Wired	450	8EEX-25K-5
25 KVA	480	384-528	480y/277 Hard Wired	450	8DDX-25K-5
25 KVA	240	192-264	240 Hard Wired	450	8CCX-25K-5
25 KVA	208	166-228	208y/120 Hard Wired	450	8BBX-25K-5
50 KVA	600	480-660	600 Hard Wired	650	8EEX-50K-5
50 KVA	480	384-528	480y/277 Hard Wired	650	8DDX-50K-5
50 KVA	240	192-264	240 Hard Wired	650	8CCX-50K-5
50 KVA	208	166-228	208y/120 Hard Wired	650	8BBX-50K-5
75 KVA	600	480-660	600 Hard Wired	950	8EEX-75K-5
75 KVA	480	384-523	480y/277 Hard Wired	950	8DDX-75K-5
75 KVA	240	192-264	240 Hard Wired	1250	8CCX-75K-5
75 KVA	208	166-228	208y/120 Hard Wired	1250	8BBX-75K-5
112.5 KVA	600	480-660	600 Hard Wired	1450	8EEX-112K-5
112.5 KVA	480	384-528	480y/277 Hard Wired	1450	8DDX-112K-5
112.5 KVA	240	192-264	240 Hard Wired	1450	8CCX-112K-5
112.5 KVA	208	166-228	208y/120 Hard Wired	1450	8BBX-112K-5
150 KVA	600	480-660	600 Hard Wired	1700	8EEX-150K-5
150 KVA	480	384-528	480y/277 Hard Wired	1700	8DDX-150K-5
150 KVA	240	192-264	240 Hard Wired	1700	8CCX-150K-5
150 KVA	208	166-228	208y/120 Hard Wired	1700	8BBX-150K-5

All transformers above are 60 Hertz and utilize Class H Insulation. 50 Hertz models available on request.

(1) All units have a hard wired input. Other voltages available on request.

(2) Commercial Enclosures have receptacles noted. When applicable they are circuit breaker protected. Outputs are hard wired.

(3) Shipping weights are approximate. Actual weights may be higher due to packing and crating.

* Other KVA sizes, input and output voltages are available on request.

- Open type systems are available for OEM utilization.

CONTROLLED POWER COMPANY

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CALL TOLL FREE
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SERIES 600 MAX-E-ISOLATION TRANSFORMER

GENERAL

The Series 600 Max-E-Isolation Transformers are used to protect sensitive equipment from power line noise and transients. There are common disturbances on the line caused by lighting, motor starting-stopping, utility network switching, and general electrical noise which will adversely affect sensitive electronic equipment. The Series 600 Max-E-Isolation Transformer utilizes a unique method of shielding which provides low capacitive coupling between input and output circuits. The Series 600 does not have the capability of regulating long duration changes of input voltage.

FEATURES AND BENEFITS

Lowest Cost: The Series 600 Max-E-Isolation Transformer is one of the lowest cost methods of protecting sensitive electronic equipment from line noise and transients.

Efficient: The Series 600 Max-E-Isolation Transformer is a highly efficient means of isolating the line and attenuating noise and transients. Efficiencies of better than 95% can be expected.

Multiple Shielding: A unique method of shielding and isolation of the primary and secondary is responsible for the excellent attenuation of both Common Mode Noise and Transverse Noise.

Common-Mode Noise Attenuation: The Series 600 Max-E-Isolation Transformer has a Common Mode Noise Attenuation of 140 db.

Transverse-Mode Noise Attenuation: 3 db down at 600 Hertz, 40 db per decade to well below 50 db with resistive loads.

SPECIFICATIONS

Line Voltage Regulation: No regulating means incorporated. Output voltage will vary with input voltage.

Load Regulation: ±2% No load to full load.

Efficiency: 95% minimum.

Operating Temperature: 0°C to 40°C.

Distortion: 0.1% total harmonic distortion.

Operating Frequency: 47-53 Hertz for 50 Hertz Models. 57-63 Hertz for 60 Hertz Models.

SINGLE PHASE — 60 HERTZ

Power Rating V.A.*	(1) Nominal Input Voltage and Plug Type	(2) Output Voltage and Receptacle	(2) No. of Standard Outputs	(3) Weight Pounds	MODEL NUMBER Basic Model + Number
125	120V, 5-15P	120V 5-20R	2	18	5AAX-125-6
250	120V, 5-15P	120V 5-20R	2	21	5AAX-250-6
500	120V, 5-15P	120V 5-20R	4	26	5AAX-500-6
750	120V, 5-15P	120V 5-20R	4	36	5AAX-750-6
1000	120V, 5-15P	120V 5-20R	4	46	5AAX-1K-6
1500	120V, 5-20P	120V 5-20R	4	68	5AAX-1.5K-6
2000	120V, 5-30P	120V 5-20R	4	72	5AAX-2K-6
2500	120V, 5-30P	120V 5-20R	4	83	5AAX-2.5K-6
3000	208/240 6-30P	120V 5-20R 240V H.W.	4	85	5MGX-3K-6
5000	208/240 6-30P	120V 5-20R 240V H.W.	4	125	5MGX-5K-6
8000	208/240 H.W.	120V 5-20R 240V H.W.	4	160	5MGX-8K-6
10,000	208/240 H.W.	120V 5-20R 240V H.W.	4	200	5MGX-10K-6
15,000	208/240 H.W.	120V 5-20R 240V H.W.	4	275	5MGX-15K-6
20,000	208/240 H.W.	120V 5-20R 240V H.W.	4	340	5MGX-20K-6
25,000	208/240 H.W.	120V 5-20R 240V H.W.	4	450	5MGX-25K-6

THREE PHASE — 60 HERTZ

Power Rating V.A.*	(1) Nominal Input Voltage	(2) Output Voltage and Receptacle	No. of Standard Outputs	(3) Weight Pounds	MODEL NUMBER Basic Model + Number	Power Rating V.A.*	(1) Nominal Input Voltage	(2) Output Voltage and Receptacle	No. of Standard Outputs	(3) Weight Pounds	MODEL NUMBER Basic Model + Number
3 KVA	240	208y/120 H.W. +5-20R	4	120	8CLX-3K-6	112 KVA	600	208y/120 H.W. +5-20R	4	1300	8ELX-112K-6
3 KVA	208	208y/120 H.W. +5-20R	4	120	8BLX-3K-6	112 KVA	480	208y/120 H.W. +5-20R	4	1300	8DLX-112K-6
6 KVA	240	208y/120 H.W. +5-20R	4	210	8CLX-6K-6	112 KVA	240	208y/120 H.W. +5-20R	4	1300	8CLX-112K-6
6 KVA	208	208y/120 H.W. +5-20R	4	210	8BLX-6K-6	112 KVA	208	208y/120 H.W. +5-20R	4	1300	8BLX-112K-6
9 KVA	600	208y/120 H.W. +5-20R	4	260	8ELX-9K-6	150 KVA	600	208y/120 H.W. +5-20R	4	1500	8ELX-150K-6
9 KVA	480	208y/120 H.W. +5-20R	4	260	8DLX-9K-6	150 KVA	480	208y/120 H.W. +5-20R	4	1500	8DLX-150K-6
9 KVA	240	208y/120 H.W. +5-20R	4	260	8CLX-9K-6	150 KVA	240	208y/120 H.W. +5-20R	4	1500	8CLX-150K-6
9 KVA	208	208y/120 H.W. +5-20R	4	260	8BLX-9K-6	150 KVA	208	208y/120 H.W. +5-20R	4	1500	8BLX-150K-6
15 KVA	600	208y/120 H.W. +5-20R	4	360	6ELX-15K-6	225 KVA	600	208y/120 H.W.	0	1850	8ELX-225K-6
15 KVA	480	208y/120 H.W. +5-20R	4	360	8DLX-15K-6	225 KVA	480	208y/120 H.W.	0	1850	8DLX-225K-6
15 KVA	240	208y/120 H.W. +5-20R	4	360	8CLX-15K-6	225 KVA	240	208y/120 H.W.	0	1850	8CLX-225K-6
15 KVA	208	208y/120 H.W. +5-20R	4	360	8BLX-15K-6	225 KVA	208	208y/120 H.W.	0	1850	8BLX-225K-6
30 KVA	600	208y/120 H.W. +5-20R	4	540	8ELX-30K-6	300 KVA	600	208y/120 H.W.	0	2500	8ELX-300K-6
30 KVA	480	208y/120 H.W. +5-20R	4	540	8DLX-30K-6	300 KVA	480	208y/120 H.W.	0	2500	8DLX-300K-6
30 KVA	240	208y/120 H.W. +5-20R	4	540	8CLX-30K-6	300 KVA	240	208y/120 H.W.	0	2500	8CLX-300K-6
30 KVA	208	208y/120 H.W. +5-20R	4	540	8BLX-30K-6	300 KVA	208	208y/120 H.W.	0	2500	8BLX-300K-6
45 KVA	600	208y/120 H.W. +5-20R	4	750	8ELX-45K-6	450 KVA	600	208y/120 H.W.	0	3200	8ELX-450K-6
45 KVA	480	208y/120 H.W. +5-20R	4	750	8DLX-45K-6	450 KVA	480	208y/120 H.W.	0	3200	8DLX-450K-6
45 KVA	240	208y/120 H.W. +5-20R	4	750	8CLX-45K-6	450 KVA	240	208y/120 H.W.	0	3200	8CLX-450K-6
45 KVA	208	208y/120 H.W. +5-20R	4	750	8BLX-45K-6	450 KVA	208	208y/120 H.W.	0	3200	8BLX-450K-6
75 KVA	600	208y/120 H.W. +5-20R	4	950	8ELX-75K-6	500 KVA	600	208y/120 H.W.	0	3500	8ELX-500K-6
75 KVA	480	208y/120 H.W. +5-20R	4	950	8DLX-75K-6	500 KVA	480	208y/120 H.W.	0	3500	8DLX-500K-6
75 KVA	240	208y/120 H.W. +5-20R	4	950	8CLX-75K-6	500 KVA	240	208y/120 H.W.	0	3500	8CLX-500K-6
75 KVA	208	208y/120 H.W. +5-20R	4	950	8BLX-75K-6	500 KVA	208	208y/120 H.W.	0	3500	8BLX-500K-6

All transformers above are 60 Hertz and utilize Class H Insulation. 50 Hertz models available on request.

(1) Commercial Enclosures have plugs noted with 8 ft. cord and circuit breaker input. Inputs are hard wired. Other inputs and outputs available on request.

* Other KVA sizes, input and output voltages are available on request.

(2) Commercial Enclosures have receptacles noted. When applicable they are circuit breaker protected. Outputs are hard wired.

(3) Shipping weights are approximate. Actual weights may be higher due to packing and crating.

- Open type systems are available for OEM utilization.

For More Information. Circle No. 303

CONTROLLED POWER COMPANY

1955 STEPHENSON HWY., TROY, MI 48083, (313) 528-3700, TWX: 810-232-3401

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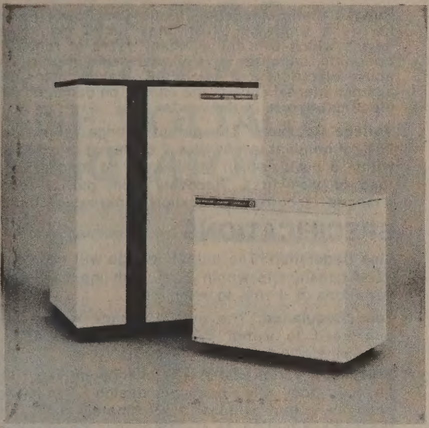

SERIES 700
POWER LINE CONDITIONER

GENERAL

The Series 700 Power Line Regulator and Conditioner combine the characteristics of the Series 500 and Series 600. The Series 700 will regulate the input voltage in the event of line voltage brownouts or surges in addition to having Max-E-Isolation capability to protect the load from line voltage noise and transients. The unit should be applied where line voltage sags, surges, noise or transients are a problem.

APPLICATIONS

The Series 700 Power Line Conditioner should be applied where isolation, regulation, noise and transients are the predominant power line problem. The units does not correct for power line outages or distortion.

FEATURES AND BENEFITS

Wide Input Range: The input voltage range of the Series 700 Power Line Conditioner is +10%, −20%. With input voltage covering this range, the output voltage is held to a very narrow band.

Narrow Output Regulation Band: The output is held to within ±5%. (±3% available)

Multiple Shielding: A unique method of multiple shielding and isolation of the primary and secondary is responsible for the excellent attenuation of both Common-Mode Noise and Transverse-Mode Noise.

Excellent Response Time: The Series 700 Power Line Conditioner has a response time of 1 cycle or less to input voltage change beyond the threshold voltage band.

High Efficiency. Overall efficiency of 95% or better can be expected.

Low Output Impedance: Output impedance ranging from 2% to 5% (depending on size of unit.)

Common-Mode Noise Attenuation: The Series 700 Power Line Conditioner has a Common-Mode Noise Attenuation of 140 db.

Transverse-Mode Noise Attenuation: The Transverse-Mode Noise Attenuation of the Series 700 is 3 db down at 600 Hertz; 40 db down per decade to well below 50 db with resistive load.

Low-Audible Noise Level: All Series 700 Power Line Conditioners are vacuum impregnated with a special epoxy resin to deliver the lowest possible sound level.

SPECIFICATIONS

Input Voltage Range: +10%, −20% of Nominal Input.

Line Voltage Regulation: The output of the Series 700 is held constant ±5% of nominal with input voltage variation of +10%, −20%, (±3% Regulation available)

Load Regulation: Less than ±2% from no load to full load.

Response Time: Typically 1 cycle for 100% correction.

Impedance: 2% to 5% depending on size of unit.

Efficiency: 95% minimum.

Operating Temperature: 0°C to 40°C.

Operating Frequency: 47-53 Hertz (50 Hertz Models). 57-63 Hertz (60 Hertz Models).

Transverse-Mode Noise Attenuation: 3 db down at 600 Hertz: 40 db per decade to well below 50 db with resistive load.

Common-Mode Noise Attenuation: 140 db.

Output Distortion: No spikes; adds less than 1.0% total harmonic distortion.

Audible Noise: 40 db to 50 db depending on size.

Overvoltage Protection: Automatically turns off if output exceeds +10% of nominal. (On units with company provided circuit breaker input and where shut off option is selected).

SINGLE PHASE — 60 HERTZ

Power Rating V.A.*	(1) Nominal Input Voltage and Plug Type	Input Voltage Range	(2) Output Voltage and Receptacle	(2) No. of Standard Outputs	(3) Weight Pounds	MODEL NUMBER + Basic Model + Number	Power Rating V.A.*	(1) Nominal Input Voltage and Plug Type	Input Voltage Range	(2) Output Voltage and Receptacle	(2) No. of Standard Outputs	(3) Weight Pounds	MODEL NUMBER + Basic Model + Number
1000	120V, 5-15P	95-132	120V 5-20R	4	54	5AAX-1K-7	8000	240 H.W.	192-264	240/120 H.W.	4	246	5CGX-8K-7
1500	120V, 5-20P	95-132	120V 5-20R	4	92	5AAX-1.5K-7	10,000	208 H.W.	165-228	208 H.W.	0	300	5BBX-10K-7
2000	120V, 5-30P	95-132	120V 5-20R	4	98	5AAX-2K-7	10,000	240 H.W.	192-264	240/120 H.W.	4	300	5CGX-10K-7
2500	120V, 5-50P	95-132	120V 5-20R	4	112	5AAX-2.5K-7	15,000	208 H.W.	165-228	208 H.W.	0	370	5BBX-15K-7
3000	208 H.W.	165-228	208 H.W.	0	115	5BBX-3K-7	15,000	240 H.W.	192-264	240/120 H.W.	4	370	5CGX-15K-7
3000	240 H.W.	192-264	240/120 H.W.	4	115	5CGX-3K-7	20,000	208 H.W.	165-228	208 H.W.	0	450	5BBX-20K-7
5000	208 H.W.	165-228	208 H.W.	0	169	5CCX-5K-7	20,000	240 H.W.	192-264	240/120 H.W.	4	450	5CGX-20K-7
5000	240 H.W.	192-264	240/120 H.W.	4	169	5CGX-5K-7	25,000	208 H.W.	165-228	208 H.W.	0	600	5BBX-25K-7
8000	208 H.W.	165-228	208 H.W.	0	246	5BBK-8K-7	25,000	240 H.W.	192-264	240/120 H.W.	4	600	5CGX-25K-7

THREE PHASE — 60 HERTZ

Power Rating V.A.*	(1) Nom. Input Volt.	Input Voltage Range	(2) Output Voltage and Receptacle	(2) No. of Standard Outputs	(3) Wt. Lbs.	MODEL NO. (4) Basic Model + Number	Power Rating V.A.*	(1) Nom. Input Volt.	Input Voltage Range	(2) Output Voltage and Receptacle	(2) No. of Standard Outputs	(3) Wt. Lbs.	MODEL NO. (4) Basic Model + Number
3 KVA	240	192-264	208y/120 H.W. +5-20R	4	220	8CLX-3K-7	45 KVA	600	480-660	208y/120 H.W. +5-20R	4	1180	8ELX-45K-7
3 KVA	208	166-228	208y/120 H.W. +5-20R	4	220	8BLX-3K-7	45 KVA	480	384-528	208y/120 H.W. +5-20R	4	1180	8DLX-45K-7
6 KVA	240	192-264	208y/120 H.W. +5-20R	4	300	8CLX-6K-7	45 KVA	240	192-264	208y/120 H.W. +5-20R	4	1180	8CLX-45K-7
6 KVA	208	166-228	208y/120 H.W. +5-20R	4	300	8BLX-6K-7	45 KVA	208	166-228	208y/120 H.W. +5-20R	4	1180	8BLX-45K-7
9 KVA	600	480-660	208y/120 H.W. +5-20R	4	410	8ELX-9K-7	75 KVA	600	480-660	208y/120 H.W.	0	1720	8ELX-75K-7
9 KVA	480	384-528	208y/120 H.W. +5-20R	4	410	8DLX-9K-7	75 KVA	480	384-528	208y/120 H.W.	0	1720	8DLX-75K-7
9 KVA	240	192-264	208y/120 H.W. +5-20R	4	410	8CLX-9K-7	75 KVA	240	192-264	208y/120 H.W.	0	2020	8CLX-75K-7
9 KVA	208	166-228	208y/120 H.W. +5-20R	4	410	8BLX-9K-7	75 KVA	208	166-228	208y/120 H.W.	0	2020	8BLX-75K-7
15 KVA	600	480-660	208y/120 H.W. +5-20R	4	620	8ELX-15K-7	112.5 KVA	600	480-660	208y/120 H.W.	0	2450	8ELX-112K-7
15 KVA	480	348-528	208y/120 H.W. +5-20R	4	620	8DLX-15K-7	112.5 KVA	480	384-528	208y/120 H.W.	0	2450	8DLX-112K-7
15 KVA	240	192-264	208y/120 H.W. +5-20R	4	620	8CLX-15K-7	112.5 KVA	240	192-264	208y/120 H.W.	0	2450	8CLX-112K-7
15 KVA	208	166-228	208y/120 H.W. +5-20R	4	620	8BLX-15K-7	112.5 KVA	208	166-228	208y/120 H.W.	0	2450	8BLX-112K-7
30 KVA	600	480-660	208y/120 H.W. +5-20R	4	850	8ELX-30K-7	150 KVA	600	480-660	208y/120 H.W.	0	3100	8ELX-150K-7
30 KVA	480	384-528	208y/120 H.W. +5-20R	4	850	8DLX-30K-7	150 KVA	480	384-528	208y/120 H.W.	0	3100	8DLX-150K-7
30 KVA	240	192-264	208y/120 H.W. +5-20R	4	850	8CLX-30K-7	150 KVA	240	192-264	208y/120 H.W.	0	3100	8CLX-150K-7
30 KVA	208	166-228	208y/120 H.W. +5-20R	4	850	8BLX-30K-7	150 KVA	208	166-228	208y/120 H.W.	0	3100	8BLX-150K-7

All transformers above are 60 Hertz and utilize Class H Insulation. 50 Hertz models available on request.

(1) Commercial Enclosures have plugs noted with 8 ft. cord and circuit breaker input. H.W. denotes hard wiring.

* Other KVA sizes, Input and Output voltages are available on request.

(2) Commercial Enclosures have receptacles noted. When applicable, they are circuit breaker protected. Outputs are hard wired.

(3) Shipping weights are approximate. Actual weights may be higher due to packing and crating.

- Open type systems are available for OEM utilization.

CONTROLLED POWER COMPANY

1955 STEPHENSON HWY., TROY, MI 48083, (313) 528-3700, TWX: 810-232-3401

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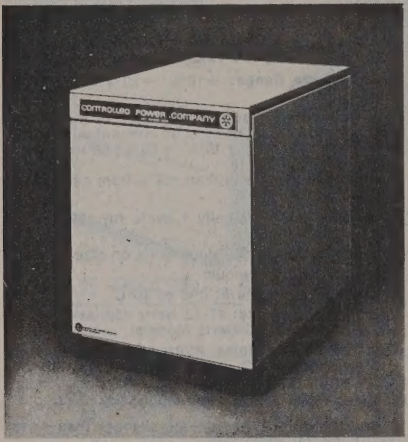
SERIES 800 POWER PURIFICATION SYSTEMS



FEATURES AND BENEFITS

Regulation Bandwidth: One of the major benefits of a Power Purification System is its ability to regulate the output voltage to within −3%, +3% with an input variation of −20% to +10% and even wider depending on the load of the system.

Regulation and Isolation: The Power Purification System combines the common mode noise rejection capabilities of a multi-shielded transformer with a voltage regulating capability. In addition to rejecting common mode noise it virtually eliminates transverse noise and distortion coming in on the power line. The unique capability of the Power Purifier to eliminate almost any power malady is what makes it an essential addition to power sensitive electronic equipment.

Unique "Ride Through" Capability: The output of the Power Purifier does not go to zero with the loss of input power for a ¼ cycle (4 msec), a ½ cycle (8 msec) or even for a complete cycle (16.6 msec. — depending on load). The voltage from the Power Purifier is generated essentially by a circuit operating as a powerful oscillator with energy stored in the unit. For this reason, the output is much more immune to the input than other regulating systems.

Voltage Transformation: The Series 800 Power Purification System, in addition to conditioning, regulating, and purifying power, can also be used to step voltage up or down.

Transformation of Square Wave to Sine Wave: The output of the Series 800 Power Purification System is a near perfect sine wave even when the supply voltage is a square wave. A battery supplied power, chopped into a square wave, is converted into an excellent sine wave by the Power Purifier.

Rugged Static Magnetic Circuit: The Power Purifier is a ruggedly constructed static magnetic device which will deliver many years of reliable operation because it is virtually impossible to abuse electrically. It is circuit breaker protected against internal shorts, and cannot be damaged by electrical shorts in the load.

Voltage Recovery: The output voltage returns to 95% of nominal level within 2 cycles and to 100% within 3 cycles when going from no load to full load or visa-versa. Recovery from partial load changes is correct in a shorter period of time.

SPECIFICATIONS

Line Regulation: The output voltage will maintain itself constant to within ±3% with input voltage variations of +10% to −20%.

Load Regulation: The output voltage will maintain itself to within ±0.5% with output loads variations of 0 to 100%.

Frequency Variations: A 1% change in line frequency from the nominal design frequency changes output voltage approximately 1.5% in the same direction as the frequency change.

Efficiency: Full load efficiency is in the order of 90% for standard input and output voltage levels.

Operating Temperature: Power Purifiers are designed to operate within specifications in an ambient temperature range from −20°C to +50°C.

Effect of Load Power Factor: The regulation specifications stated above is for unity power factor. Regulation will improve with a leading power factor and become wide with a lagging power factor.

Distortion: On Harmonically Neutralized Systems harmonic content is 3% or less.

SINGLE PHASE — 60 HERTZ

Power Rating V.A.*	(1) Nominal Input Voltage and Plug Type X	Input Volt. Range	(2) Output Volt. and Receptacle	(2) No. of Stand. Out-puts	Input V.A.	Audi-ble Noise Level	(3) Wt. Lbs.	(4)(5) Basic Model + Number
60	120V, 5-15P	95-130	120V 5-20R	2	80	45db	12	5AAX-60-8
120	120V, 5-15P	95-130	120V 5-20R	2	160	45db	18	5AAX-120-8
200	120V, 5-15P	95-130	120V 5-20R	4	265	45db	25	5AAX-200-8
250	120V, 5-15P	95-130	120V 5-20R	4	295	45db	28	5AAX-250-8
500	120V, 5-15P	95-130	120V 5-20R	4	590	45db	58	5AAX-500-8
750	120V, 5-15P	95-130	120V 5-20R	4	880	45db	68	5AAX-750-8
1000	120V, 5-15P	95-130	120V 5-20R	4	1250	45db	83	5AAX-1K-8
1500	120V, 5-20P	95-130	120V 5-20R	4	1760	45db	110	5AAX-1.5K-8
2000	120V, 5-30P	95-130	120V 5-20R	4	2350	45db	125	5AAX-2K-8
2500	120V, 5-30P	95-130	120V 5-20R	4	2770	50db	163	5AAX-2.5K-8
3000	208/240 6-30P	165-225 (208 tap) 190-260 (240 tap)	120V 5-20R 240V Hard Wire	4	3330	50db	180	5MGX-3K-8

Power Rating V.A.*	(1) Nominal Input Voltage and Plug Type X	Input Voltage Range	(2) Output Voltage and Receptacle	(2) No. of Stand. Out-puts	Input V.A.	Audible Noise Level	(3) Wt. Lbs.	(4)(5) Basic Model + Number
5000	208/240 6-50P	165-225 (208 tap) 190-260 (240 tap)	120V 5-20R 240V Hard Wire	4	5550	55db	336	5MGX-5K-8
8000	208/240 H.W.	165-225 (208 tap) 190-260 (240 tap)	120V 5-20R 240V Hard Wire	4	8880	55db	460	5MGX-8K-8
10,000	208/240 H.W.	165-225 (208 tap) 190-260 (240 tap)	120V 5-20R 240V Hard Wire	4	11,100	60db	536	5MGX-10K-8
15,000	208/240 H.W.	165-225 (208 tap) 190-260 (240 tap)	120V 5-20R 240V Hard Wire	4	16,600	60db	920	5MGX-15K-8
20,000	208/240 H.W.	165-225 (208 tap) 190-260 (240 tap)	120V 5-20R 240V Hard Wire	4	22,200	60db	1100	5MGX-20K-8
25,000	208/240 H.W.	165-225 (208 tap) 190-260 (240 tap)	120V 5-20R 240V Hard Wire	4	27,700	60db	1425	5MGX-25K-8

(1) Commercial enclosures have plugs noted with 8 ft. cord and circuit breaker or fused input. Industrial and Panel Mount enclosures do not have plug, or circuit breaker or fused input. Inputs are hard wired. Dual input voltages of 240/480 available (input range 190-260 x 380-520). Other Inputs and Outputs available on request.

(2) Commercial enclosures have receptacles noted. When applicable, they are circuit breaker protected. Industrial and Panel Mount enclosures do not have receptacles. Outputs are hard wired.

(3) Panel Mount enclosures up to 3 KVA can be wall mounted.

(4) For Commercial Cabinet model number consult factory.

(5) For Industrial or Panel Mount Cabinet model number consult factory.

+ When ordering specify basic model number plus either the Commercial Cabinet model number or the Industrial Cabinet model number.

* Other KVA sizes, input and output voltages are available on request.

° Open type and uncompensated power purification systems are available for OEM utilization.

THREE PHASE — 60 HERTZ

Power Rating V.A.	(1) Nom. Input Volt.	Input Voltage Range	(2) Output Voltage and Receptacle	No. of Stand. Out-puts	Input V.A.	Audible Noise Level	(3) Wt. Lbs.	(4) Basic Model + Number
3 KVA	600	480-660	208/120 Hard Wired	0	3.5 KVA	45db	255	8ELX-3K-8
3 KVA	480	384-528	208y/120 H.W.	0	3.5 KVA	45db	255	8DLX-3K-8
3 KVA	240	192-264	208y/120 H.W.	0	3.5 KVA	45db	255	8CLX-3K-8
3 KVA	208	166-228	208y/120 H.W.	0	3.5 KVA	45db	255	8BLX-3K-8
6 KVA	600	480-660	208/120 Hard Wired	0	7.1 KVA	50db	480	8ELX-6K-8
6 KVA	480	384-528	208y/120 H.W.	0	7.1 KVA	50db	480	8DLX-6K-8
6 KVA	240	192-264	208y/120 H.W.	0	7.1 KVA	50db	480	8CLX-6K-8
6 KVA	208	166-228	208y/120 H.W.	0	7.1 KVA	50db	480	8BLX-6K-8
7.5 KVA	600	480-660	208/120 Hard Wired	0	8.3 KVA	50db	550	8ELX-7.5K-8
7.5 KVA	480	384-528	208y/120 H.W.	0	8.3 KVA	50db	550	8DLX-7.5K-8
7.5 KVA	240	192-264	208y/120 H.W.	0	8.3 KVA	50db	550	8CLX-7.5K-8
7.5 KVA	208	166-228	208y/120 H.W.	0	8.3 KVA	50db	550	8BLX-7.5K-8
9 KVA	600	480-660	208/120 Hard Wired	0	10 KVA	55db	630	8ELX-9K-8
9 KVA	480	348-528	208y/120 H.W.	0	10 KVA	55db	630	8DLX-9K-8
9 KVA	240	192-264	208y/120 H.W.	0	10 KVA	55db	630	8CLX-9K-8
9 KVA	208	166-228	208y/120 H.W.	0	10 KVA	55db	630	8BLX-9K-8
15 KVA	600	480-660	208/120 Hard Wired	0	16.6 KVA	55db	1160	8ELX-15K-8
15 KVA	480	384-528	208y/120 H.W.	0	16.6 KVA	55db	1160	8DLX-15K-8
15 KVA	240	192-264	208y/120 H.W.	0	16.6 KVA	55db	1160	8CLX-15K-8
15 KVA	208	166-228	208y/120 H.W.	0	16.6 KVA	55db	1160	8BLX-15K-8
24 KVA	600	480-660	208/120 Hard Wired	0	26.6 KVA	60db	1860	8ELX-24K-8
24 KVA	480	384-528	208y/120 H.W.	0	26.6 KVA	60db	1860	8DLX-24K-8
24 KVA	240	192-264	208y/120 H.W.	0	26.6 KVA	60db	1860	8CLX-24K-8
24 KVA	208	166-228	208y/120 H.W.	0	26.6 KVA	60db	1860	8BLX-24K-8
30 KVA	600	480-660	208/120 Hard Wired	0	33.3 KVA	65db	2000	8ELX-30K-8
30 KVA	480	384-528	208y/120 H.W.	0	33.3 KVA	65db	2000	8DLX-30K-8
30 KVA	240	192-264	208y/120 H.W.	0	33.3 KVA	65db	2000	8CLX-30K-8
30 KVA	208	166-228	208y/120 H.W.	0	33.3 KVA	65db	2000	8BLX-30K-8

(1) All units have a hard wired input.

(2) Commercial enclosures have no receptacles. Industrial enclosures do not have receptacles. Outputs are hard wired.

(3) Industrial enclosures are not circuit breaker protected.

(4) For Commercial or Industrial Cabinet model number consult factory.

+ When ordering specify basic model number plus either the commercial cabinet model number or the industrial model number.

NOTE: With unbalanced loads, there is a phase shift with a Series 800 Power Purification System that can result in poor voltage regulation. If unbalanced loading is expected, use a Series 700 or Series 900 regulator.

+ Open Type and Uncompensated Type of Power Purification Systems are available for OEM utilization.

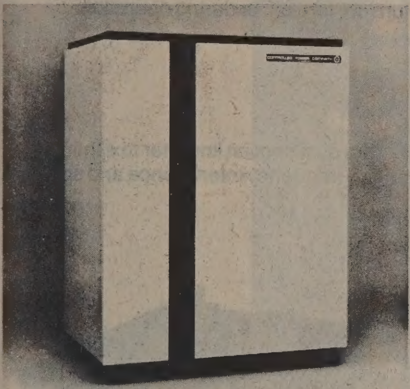
For More Information. Circle No. 303

CONTROLLED POWER COMPANY

1955 STEPHENSON HWY., TROY, MI 48083, (313) 528-3700, TWX: 810-232-3401

CALL TOLL FREE
1-800-521-4792

SERIES 900 ELECTRONIC LINE VOLTAGE REGULATORS



GENERAL

The Series 900 Electronic Line Voltage Regulator delivers the most accurate regulated line voltage available to industry.

The Series 900 when used with a Series 600 Max-E-Isolation Transformer will allow sensitive electronic equipment to operate with poorly regulated and noisy power lines.

Series 900 Electronic Line Voltage Regulators provide solutions to electrical power — or disturbance problems. They are available in single phase models, 60 Hertz with output power ratings from 25 KVA to 150 KVA. The three phase models are 60 Hertz with output ratings from 1.5 KVA to 500 KVA.

All units are hard wired to terminals at both input and output and all units utilize Class H insulation. Complete specifications are available from the factory. Ask for Bulletin 900-80A.

FEATURES AND BENEFITS

Adjustable Output: The output voltage is adjustable over a range of ±10% from nominal with an internal potentiometer.

Remote Sensing: The voltage to be regulated can be sensed at the load to automatically compensate for line and wire losses to the load.

Excellent Load Regulation: Output voltage is regulated to within ±0.5%.

Wide Input Voltage Range: The output is regulated to within ±1% with input voltage excursion of +10% to −20% from nominal on small sizes and ±10% on larger sizes.

Filtered Output: The output of the Series 900 is filtered to free the waveform of noise and excessive harmonic content.

No Moving Parts: The Series 900 is electronically and magnetically regulated. There are no moving parts and virtually no preventative maintenance required.

Fast Response: Response starts immediately and is complete in 5 cycles (under worst case conditions).

Enclosures: Available in either industrial, commercial (computer type).

Wide Range Of Types Available: The Series 900 Electronic Line Voltage Regulator is available in single phase and three phase configurations and in 50 Hertz or 60 Hertz models. In addition a wide range of KVA sizes are available.

SPECIFICATIONS

Input Voltage: See sizing charts on subsequent pages.

Output Voltage: See sizing charts on subsequent pages.

Regulation: ±1% for any combination of line variation, load variation, thermal drift, and warm-up.

Remote Sensing: Remote sensing available to compensate for series drop to the load.

Frequency Range: 57 to 63 Hertz on 60 Hertz Models. 48 to 52 Hertz on 50 Hertz Models.

Output Voltage Adjustment Range: +10%, −10% Adjustable with internally located potentiometer.

Response Time: Starts immediately and complete within 5 cycles under worst case conditions.

Efficiency: 95% Typical.

Power Factor: Approximately 95% at full load.

Harmonic Content: See sizing chart.

SINGLE PHASE — 60 HERTZ — 25 KVA TO 150 KVA

Output Power Rating V.A.	(1) Nom. Input and Output Volt.	(2) Input Voltage Range	Output Voltage Adjust-ability	Max. Har-monic Content	(3) Wt. Lbs.	MODEL NUMBER (4)(5)(6) Model + Number
25 KVA	120	+10%, −20%	108-132	5%	830	3AAX-25K-9
25 KVA	208	+10%, −20%	187-228	5%	830	3BBX-25K-9
25 KVA	240	+10%, −20%	216-264	5%	830	3CCX-25K-9
25 KVA	480	+10%, −20%	432-528	5%	830	3DDX-25K-9
25 KVA	600	+10%, −20%	540-660	5%	830	3EEX-25K-9
37.5 KVA	120	±10%	108-132	8%	940	3AAX-37.5K-9
37.5 KVA	208	±10%	187-228	8%	940	3BBX-37.5K-9
37.5 KVA	240	±10%	216-264	8%	940	3CCX-37.5K-9
37.5 KVA	480	±10%	432-528	8%	940	3DDX-37.5K-9
37.5 KVA	600	±10%	540-660	8%	940	3EEX-37.5K-9
50 KVA	120	±10%	108-132	9%	1800	3AAX-50K-9
50 KVA	208	±10%	187-228	9%	1800	3BBX-50K-9
50 KVA	240	±10%	216-264	9%	1800	3CCX-50K-9
50 KVA	480	±10%	432-528	9%	1800	3DDX-50K-9
50 KVA	600	±10%	540-660	9%	1800	3EEX-50K-9
75 KVA	120	±10%	108-132	9%	2700	3AAX-75K-9
75 KVA	208	±10%	187-228	9%	2700	3BBX-75K-9
75 KVA	240	±10%	216-264	9%	2700	3CCX-75K-9
75 KVA	480	±10%	432-528	9%	2700	3DDX-75K-9
75 KVA	600	±10%	540-660	9%	2700	3EEX-75K-9
100 KVA	120	±10%	108-132	9%	3200	3AAX-100K-9
100 KVA	208	±10%	187-228	9%	3200	3BBX-100K-9
100 KVA	240	±10%	216-264	9%	3200	3CCX-100K-9
100 KVA	480	±10%	432-528	9%	3200	3DDX-100K-9
100 KVA	600	±10%	540-660	9%	3200	3EEK-100K-9
150 KVA	120	±10%	108-132	9%	3700	3AAX-150K-9
150 KVA	208	±10%	187-228	9%	3700	3BBX-150K-9
150 KVA	240	±10%	216-264	9%	3700	3CCX-150K-9
150 KVA	480	±10%	432-528	9%	3700	3DDX-150K-9
150 KVA	600	±10%	540-660	9%	3700	3EEX-150K-9

THREE PHASE — 60 HERTZ — 1.5 KVA TO 75 KVA

Output Rating V.A.	(1) Nominal Input and Output Voltage	(2) Input Voltage Range	Output Voltage Adjust-ability (Line-to Neutral)	Maxi-mum Har-monic Content	(3) Wt. Lbs.	MODEL NUMBER Basic Model + Number
1.5 KVA	208/120Y	−10%, +20%	108-132	5%	180	3LLX-1.5K-9
3 KVA	208/120Y		108-132	5%	370	3LLX-3K.9
6 KVA	208/120Y		108-132	5%	370	3LLX-6K-9
6 KVA	480/277Y		250-304	5%	370	3NNX-6K-9
6 KVA	600/347Y		312-381	5%	370	3EEX-6K-9
9 KVA	208/120Y		108-132	5%	430	3LLX-9K-9
9 KVA	480/277Y		250-304	5%	430	3NNX-9K-9
9 KVA	600/347Y		312-381	5%	430	3EEX-9K-9
15 KVA	208/120Y.		108-132	5%	600	3LLX-15K-9
15 KVA	480/277Y		250-304	5%	600	3NNX-15K-9
15 KVA	600/347Y		312-381	5%	600	3EEX-15K-9
22.5 KVA	208/120Y		108-132	5%	750	3LLX-22K-9
22.5 KVA	480/277Y		250-304	5%	750	3NNX-22K-9
22.5 KVA	600/347Y		312-381	5%	750	3EEK-22K-9
30 KVA	208/120Y		108-132	5%	900	3LLX-30K-9
30 KVA	480/277Y		250-304	5%	900	3NNX-30K-9
30 KVA	600/347Y		312-381	5%	900	3EEX-30K-9
45 KVA	208/120Y		108-132	5%	1700	3LLX-45K-9
45 KVA	480/277Y		250-304	5%	1700	3NNX-45K-9
45 KVA	600/347Y	−10%, +20%	312-381	5%	1700	3EEX-45K-9
75 KVA	208/120Y		108-132	5%	2200	3LLX-75K-9
75 KVA	480/277Y		250-304	5%	2200	3NNX-75K-9
75 KVA	600/347Y		312-381	5%	2200	3EEK-75K-9
112.5 KVA	208/120Y		108-132	5%	2900	3LLX-112K-9
112.5 KVA	480/277Y		250-304	9%	2900	3NNX-112K-9
112.5 KVA	600/347Y		312-381	9%	2900	3EEX-112K-9
150 KVA	208/120Y		108-132	9%	5000	3LLX-150K-9
150 KVA	480/277Y		250-304	9%	5000	3NNX-150K-9
150 KVA	600/347Y		312-381	9%	5000	3EEX-150K-9
225 KVA	208/120Y		108-132	9%	8000	3LLX-225K-9
225 KVA	480/277Y		250-304	9%	8000	3NNX-225K-9
225 KVA	600/347Y		312-381	.9%	9200	3EEX-225K-9
300 KVA	208/120Y	±10%	108-132	9%	9200	3LLX-300K-9
300 KVA	480/277Y		250-304	9%	9200	3NNX-300K-9
300 KVA	600/347Y		312-381	9%	9200	3EEX-300K-9
500 KVA	208/120Y		108-132	9%	Consult	3LLX-500K-9
500 KVA	480/277Y		250-304	9%	Factory	3NNX-500K-9
500 KVA	600/347Y		312-381	9%		3EEX-500K-9

All regulators listed above are 60 Hertz and utilize Class H insulation. 50 Hertz units are available on request.

(1) All units are hard wired to terminals at both the input and output.

(2) The input voltage range is based on the output voltage setting. The output voltage is adjustable ±10% of the rated nominal output by means of an internal potentiometer.

(3) Shipping weights are approximate. Actual weights may be higher due to packing, crating or design.

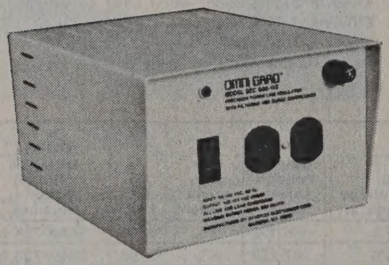
For More Information. Circle No. 303

SEC SERIES AUTOMATIC LINE REGULATORS & FILTERS

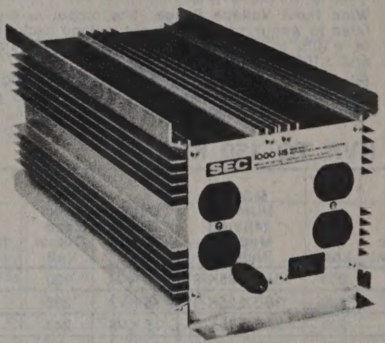
"Value Engineered" is the term that best describes the SEC Series of Line Voltage Regulators. These models are designed to solve the AC power line problems of the most critical applications where line voltage stabilization and E.M.I. suppression are required, such as digital equipment, computers, peripherals, terminals, etc.

Stabylex's SEC series rates highly among the most economically priced equipment suitable for powering complex, sensitive data processing systems. The totally solid state circuitry incorporated in these designs ensures high reliability.

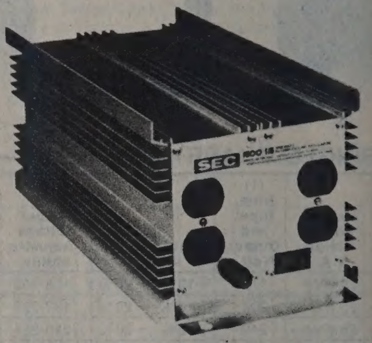
AC INPUT:	90-125 VAC, 47-63 Hz.
LINE REGULATION:	±3% over input range 90-125 VAC.
LOAD REGULATION:	2% for no load to full load.
MINIMUM LOAD:	Zero.
RESPONSE TIME:	Max. 8 mSec.
EFFICIENCY:	96%
DISTORTION:	Line input does not distort more than 0.2%.
SPIKES:	No spikes on turn on, turn off, or during operation.
NOMINAL OUTPUT:	115 VAC.
OPERATING TEMPERATURE RANGE:	0-70° C.
OVERLOAD PROTECTION:	Fused Output.
FILTER:	Each unit contains a dual section line filter to eliminate line-conducted high frequency interference and spikes.



SEC 500
500 WATTS



SEC 1000
1000 WATTS



SEC 1500
1500 WATTS

APPLICATIONS

- AC line transient removal and voltage stabilization for operating computer systems' peripherals and terminals
- Power sources to maintain accuracy and stability of sensitive test apparatus
- Stable operation of refrigerators and air conditioners under varying power line conditions
- Powering television sets and video cassette recorders
- Regulation of varying line voltages which could interfere with normal operation of electrical and electronic equipment.

FEATURES

- Integral line filters for transient removal (SEC series only)
- Simple plug & cord connection to power line
- 3-prong grounded receptacles for connecting equipment
- Fully automatic regulation of line voltage over an input range of 90 to 125 VAC.
- Models available to handle from 500 to 2,000 watts
- Rugged, precision construction using top quality U.S. made components
- Lowest cost-per-watt in line voltage regulators
- Available in 220 VAC, 50 Hz models.

Stabylex Electronics Corporation

146 CENTER STREET, MASSENA, NEW YORK, 13662
1-315-769-5453

For More Information. Circle No. 350

Blackouts, Brownouts or Up-and-Downouts.

General Power Systems is the solution to costly power problems.

The unpredictable—a blackout has hit the city.

Thanks to General Power's uninterruptible power system (UPS), many businesses and vital emergency services continue to operate. The UPS provides conditioned power when changes occur in utility power caused by adverse weather conditions or any other unpredictable occurrences.

With a full range of systems, from 90 watts to 375 KVA, General Power can deliver clean power to any computer-based installation, all of the time.

Each General Power UPS is available in single or 3 phase versions and contains a battery, automatic battery charger, solid state power inverter, overload and short circuit protection, alarm annunciator, indicators and more.

Attractive to the eye as well as the pocketbook, it's easy to guard against down time and costly errors. Protect against blackouts and brownouts and insure that valuable data is never lost by including a General Power UPS in your system.

Put an end to your input power problems. Call General Power Systems today for the representative in your area, and ask for details on our full range of products.

GENERAL POWER SYSTEMS

1400 N. Baxter, Anaheim, CA 92806 (714) 956-9321 (800) 854-3469 TELEX 182283

NOBRUSH® FREQUENCY
GEORATOR T.M. CORPORATION

Celebrating our 33rd anniversary

PERMANENT MAGNET GENERATOR DESIGN

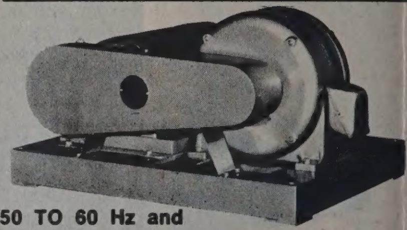
"NoBrush" Motor Generators and Frequency Converters are efficient, compact, dependable, quiet running units for powering all types of electronic systems and electrical equipment. The heart of each "NoBrush" power system is a "NoBrush" permanent magnet generator which features a cast aluminum rotor designed to give superior voltage stability. • A typical "NoBrush" generator is mounted with a high quality induction or synduction motor within a single aluminum alloy shell. • Oversize lubricated for life ball bearings, coupled with the absence of brushes, commutators or slip rings, insure long-term maintenance-free operation.

• Georator brushless permanent magnet generators are noted for their compact construction, ruggedness, ability to withstand short circuits, an excellent wave form.

• All Georator power systems whether utilized for frequency conversion or basic power requirements, provide true "line isolation and stabilization" for protecting sensitive electronic systems from momentary power interruptions, switching transients, brown outs, or voltage spikes.

PERMANENT MAGNET FEATURES:

- ☐ *Line Isolation and Stabilization*
- ☐ *Stable Output Voltage*
- ☐ *High Overload Capacity*
- ☐ *Withstands Short Circuits*
- ☐ *Extremely Low R. F. Noise*
- ☐ *Minimum Maintenance*
- ☐ *Lightweight*
- ☐ *Low Audible Noise*
- ☐ *Cool Operation*
- ☐ *Operates in Adverse Environments*



50 TO 60 Hz and 60 TO 50 Hz FREQUENCY CONVERTERS

These ruggedly built, belt driven, motor-generator sets are mounted on a sturdy steel frame base. Units in the 0.5 to 5 KVA power range are designed around the highly efficient NoBrush Permanent Magnet Generator. Units in the 6.25 to 125 KVA power range have brushless rotating rectifier type generators with voltage regulators, to provide ±1% output voltage regulation. These motor-generators provide frequency conversion, basic power, and superior line isolation and stabilization for exported and imported electrical and electronic equipment. Other standard and non-standard input and output voltages available upon request.

50 to 60 Hz

			Voltage Output	Approx. Wt. lbs.
37-097	0.5	1/1	115/230	230
37-044	1.5	1/1	115/230	400
37-151	2.5	3/1	115/230	420
37-177	6.25	3/1	115/230	650
37-144	12.5	3/3	120/208	1,050
37-218	12.5	3/1	115/230	1,050
37-272	18.75	3/1	115/230	1,250
37-334	25.0	3/3	120/208	1,600
37-311	37.5	3/3	120/208	1,600

60 to 50 Hz

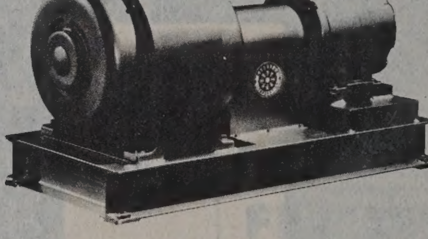
Model No.	KVA Rating	Phase In/Out	Voltage Output	Approx. Wt. lbs.
37-105	0.5	1/1	115/230	230
37-102	1.5	1/1	115/220	400
37-111	1.5	3/1	115/230	400
37-095	2.5	3/1	115/230	440
37-210	6.25	3/1	115/230	750
37-284	6.25	3/3	220/380	650
37-186	12.5	3/1	115/230	1220
37-180	12.5	3/3	220/380	1000
37-283	18.75	3/1	115/230	1560
37-164	25.0	3/3	220/380	1580
37-306	31.3	3/3	220/380	1485
37-276	37.5	3/3	220/380	1700
37-298	50.0	3/3	220/380	1810
37-301	50.0	3/1	115/230	2315
37-335	75.0	3/3	220/380	2708
37-288	100.0	3/3	220/380	3337

60 TO 60 Hz LINE ISOLATOR SERIES 30 UNIT SHELL

This small isolator stabilizer Motor-Generator offers full line isolation for small power requirements up to 1 KVA. Permanent magnet field generator coupled with the high inertia of the rotating system assures maximum electrical isolation between line and load. The rugged unit shell construction gives long, maintenance-free operation.

Model No.	KVA Rating	Phase In/Out	Output Voltage	Input Voltage	Dimensions H"/L"/Weight
30-194	0.5	3/1	115/230	230/460	14.8"/16.1"/120 lbs.
30-198	0.5	1/1	115/230	115/230	14.8"/16.1"/120 lbs.
30-195	1.0	3/3	120/208	230/460	14.8"/16.1"/130 lbs.
30-199	1.0	1/3	120/208	115/230	14.8"/16.1"/130 lbs.

These 60 to 60 Hz brushless generators, including those in the next column are designed to accept long term input variation of up to ±15% from nominal with no change in output. Inertia stabilization allows these units to absorb input line transients of as much as 30% for as long as 500 milliseconds with less than 1% change in output.



60 TO 60 Hz ISOLATOR STABILIZER SERIES 37 IN LINE

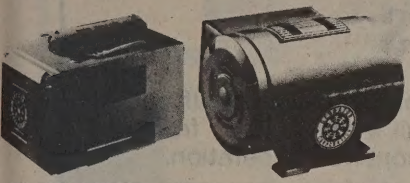
Larger Motor Generators in ratings up to 125 KVA are also available to provide full line isolation and distortion free power to protect electronic equipment from power line excursions and momentary power loss.

Model No.	KVA Rating	Phase In/Out	Output Voltage	Input Voltage	Dimensions H"/L"/Weight
37-015	1.5	3/1	115/230	220/440	18.3"/34"/300 lbs.
37-118	1.5	1/1	115/230	230	18.3"/34"/315 lbs.
37/130	2.5	3/3	120/208	220/440	18.3"/34"/215 lbs.
37-133	2.5	1/3	120/208	230	18.3"/34"/400 lbs.
37-070	2.5	3/1	115/230	220/440	18.3"/34"/335 lbs.
37-134	2.5	1/1	115/230	230	18.3"/34"/400 lbs.
37-123	5.0	3/3	120/208	220/440	18.3"/38"/410 lbs.
37-227	6.25	3/1	120/240	220/440	26.0"/48"/650 lbs.
37-312	6.25	3/3	120/208	220/440	33.0"/48"/650 lbs.
37-285	12.5	3/1	120/240	230/460	29.0"/62"/910 lbs.
37-135	12.5	3/3	120/208	230/460	29.0"/62"/910 lbs.
37-136	18.75	3/3	120/240	230/460	37.5"/70"/1300 lbs.
37-137	18.75	3/1	120/208	230/460	29.0"/63"/1000 lbs.
37-138	25	3/3	120/240	230/460	37.5"/72"/1550 lbs.
37-139	25	3/1	120/208	230/460	29.0"/65"/1230 lbs.
37-278	37.5	3/3	120/208	230/460	30.8"/65.5"/1550 lbs.
37-327	50	3/3	120/208	230/460	30.8"/66.5"/1595 lbs.
37-xxx	75	3/3	120/208	230/460	49.0"/80.1"/2350 lbs.
37-317	100	3/3	120/208	460	49.0"/80.1"/2550 lbs.

For More Information. Circle No. 305

CONVERTERS & GENERATORS

The simplest, most rugged, most dependable power source.

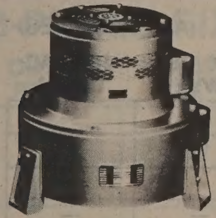


60 TO 400 Hz FREQUENCY CONVERTERS SERIES 30 UNIT SHELL

A highly compact, brushless, Motor Generator Set for conversion of 50 or 60 Hz power to 400 Hz or higher frequencies. Generator and Motor Rotors are pressed on a common shaft, with shielded ball bearing at ends of shaft, all contained within an aluminum alloy shell.

Model No.	KVA Rating	Phase In/Out	Output Voltages Full Load *	Input Voltage **	Dimensions H"/L"/Weight
30-021	0.15	1/1	115/200	115/230	8"/11"/40 lbs.
30-001	0.25	1/1	115	115/230	8"/11"/43 lbs.
30-004	0.25	1/3	115/200	115/230	8"/11"/43 lbs.
30-002	0.5	1/1	115	115/230	8"/11"/51 lbs.
30-005	0.5	1/3	115/200	115/230	8"/11"/51 lbs.
30-016	0.5	3/3	115/200	208-220/440	8"/11"/51 lbs.
30-006	0.75	3/3	115/200	208-220/440	8"/11"/51 lbs.
30-003	1.0	1/1	115	115/230	12¼"/15¼"/118 lbs.
30-025	1.0	1/3	115/200	115/230	12¼"/15¼"/107 lbs.
30-007	2.0	1/3	115/200	115/230	12¼"/15¼"/137 lbs.
30-020	2.0	3/3	115/200	208-220/440	12¼"/15¼"/121 lbs.
30-029	2.5	3/3	115/200	208-220/440	12¼"/15¼"/153 lbs.

- ☐ Other Generator Outputs Available: 120, 180, 280, 360, and 840 Hz
- ☐ Other Standard and Non-Standard Voltages.
- ☐ Exact 400 Hz Output.
- ☐ DC Outputs at Low or High Voltage.



60 to 400 Hz FREQUENCY CONVERTER SERIES 33 VERTICAL

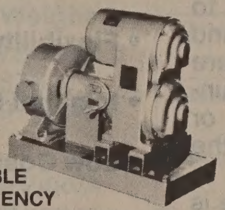
High quality induction motor is close coupled to a "NOBRUSH" generator providing a very compact high power to weight and size ratio. Available variations include: 50 Hz input; multiple standard and non-standard AC output voltages; Dual AC and DC outputs; and militarized construction.

MODEL NO.	KVA RATING	PHASE IN/OUT	OUTPUT VOLTAGES FULL LOAD	DIMENSIONS DIAMETER"/H"/Lbs.
33-001	2.5	3/3	115	16.8"/18.3/173
33-002	3.5	3/1	115	16.8"/18.3"/178
33-003	5.0	3/1	115	16.8"/18.3"/273
33-004	5.0	3/3	115/200	16.8"/18.3"/250
33-005	7.5	3/3	115/200	16.8"/19.5"/259
33-006	10.0	3/3	115/200	16.8"/19.5"/280
33-103	10.0	3/1	115	20.6"/21.8"/405
33-124	12.5	3/3	115/200	20.6"/21.6"/410
33-102	15.0	3/3	115/200	20.6"/24.2"/485
33-154	20.0	3/3	115/200	20.6"/26.6"/491
30-120	25.0	3/3	115/200	23.0"/26.5"/1213

EXACT 400 Hz FREQUENCY CONVERTERS SYNCHRONOUS DRIVEN SERIES 35 IN LINE

60 Hz to exact 400 Hz frequency conversion. Low rotational speed (1200 RPM) provides long life and minimum audible noise (65db). High/low AC and DC outputs available.

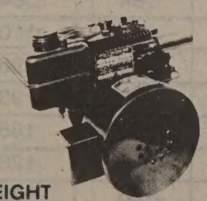
MODEL NO.	KVA RATING	PHASE IN/OUT	OUTPUT VOLTAGE FULL LOAD	OUTPUT FREQUENCY EXACT	DIMENSIONS H"/L"/WEIGHT
35-001	2.5	3/1	115	400 Hz	16.5/26/470 Lbs.
35-003	3.0	3/3	115/200	400 Hz	16.5/26/472 Lbs.
35-002	5.0	3/1	115	400 Hz	16.5/30/620 Lbs.
35-004	5.0	3/3	115/200	400 Hz	16.5/28/586 Lbs.
35-005	10.0	3/3	115/200	400 Hz	16.5/30/665 Lbs.



VARIABLE FREQUENCY CONVERTERS SERIES 32

Available both in standard designs and to customer specifications—in ratings from 0.5 to 15 KVA. Variacs supplied with unit for voltage adjustment. Other frequency variations available.

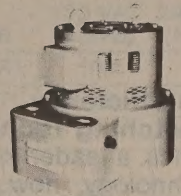
MODEL NO.	KVA RATING	PHASE OUT	VARIABLE FREQUENCY	OUTPUT VOLTAGE
32-037	2.5	1	45-65 Hz	100-140/180-240
32-040	5	3	45-65 Hz	105-125/183-217
32-002	1	3	380-420 Hz	105-125/183-217
32-022	1	1	380-420 Hz	105/127
32-016	5	3	380-420 Hz	105-125/183-127
32-038	5	1	380-420 Hz	100-140/180-240
32-035	10	3	380-420 Hz	105-125/183-217
32-043	15	3	380-420 Hz	105-125/183-217



LIGHTWEIGHT 400 Hz ENGINE-GENERATORS

Lightweight 400 Hz permanent magnet engine-generators are available with 1Ø, or 3Ø, or DC, or dual AC/DC outputs. Applications include: geophysical, navigation, and communication systems; also fish conservation.

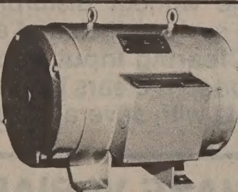
MODEL NO.	KVA RATING	DC/PHASE OUT	OUTPUT VOLTAGE	WEIGHT
31-001	0.5	1Ø AC	115/230	43
31-002	0.5	DC/1Ø AC	115/230	44
31-008	0.75	3Ø AC	115/200	50
31-014	0.5	DC	250/500	44



VOLTAGE REGULATED 60 TO 400 Hz FREQUENCY CONVERTERS

This new, Series 39, Regulated, Vertical Frequency Converter combines the "No-Brush" permanent magnet generator together with control windings and simplified sensing electronics, to provide both the traditional "Brushless" rugged design and a closely regulated 400 Hz power system. Voltage regulation is ± 1.5% no load to full load, 0.8 to 1.0 power factor, with a voltage adjustment feature of ± 5%.

MODEL NO.	KVA RATING	VOLTAGE OUTPUT	VOLTAGE REGULATION	PHASE IN/OUT
39-001	5	120/208	±1.5%	3/3
39-002	5	115/230	±1.5%	3/1
39-004	6.5	120/208	±1.5%	3/3



60 TO 180 Hz, 360 Hz, 840 Hz FREQUENCY CONVERTERS FOR HIGH FREQUENCY TOOLS, MOTORS, AND LIGHTING

These frequency converters are available for powering high frequency metal-working tools, wood-working tools, motors, and lighting systems. The highly dependable, minimum maintenance, PERMANENT MAGNET BRUSHLESS DESIGNS are available in many ratings up to: 5 KVA for 180 Hz applications; 10 KVA for 360 Hz applications; and 30 KVA for 840 Hz applications.

GEORATOR™ CORPORATION

Makers of NOBRUSH® power systems

9617 Center Street • P.O. Box 70
Manassas, Virginia 22110
Telephone (703) 368-2101

For More Information. Circle No. 305

HELIONETICS, INC.

AC Power Sources • Frequency Changers • Power Conditioners

85-90% Efficiency
With Switching Technology:
Helionetics, a leader in Pulse Width Modulation technology, now offers this standard product line of 12kVA to 72kVA AC Power Sources. Efficiency of 85-90% is typical.

Benefits of this switching technology include cool quiet operation, light system weight in a cabinet on casters, and a minimum of floor space for installation.

Quality You Can Count On:
Helionetics' experience in high-rel military and photovoltaic/utility power products is demonstrated in eight key patents in power switching technology. This experience is passed on to you in the form of conservative design and careful derating of all components to insure high reliability. Self-healing circuits and redundant features allow failure of a device or module without disturbing or derating the entire system. Included are:

Self-Clearing Input Rectifiers: If a diode is shorted it clears itself. Operation can continue with several diodes missing.

Self-clearing Output Transistors: If output device should fail it clears itself from the circuit allowing continued operation.

Module Disconnect: Auto-disconnect also exists at the module level allowing operation to continue derated by one module's capacity.

A Modular Design You Can Grow With:
Our modular approach makes it easy to configure a system to your specific power requirements now — and easy to modify your system in the future. These benefits include:

- **Expandability** – Allows modular field upgrading to maximum mainframe rating.
- **Flexibility** – Variable or fixed frequency, single- or three-phase output.
- **Minimal Spares** – A few modules "spare" the system.
- **Low Cost Redundancy** – Just an extra module for standby.
- **Plug-in Modules** – Reduce the MTTR (mean time to repair).

3-PHASE VARIABLE

			USER SELECTABLE OUTPUT CONFIGURATIONS (AMPS PER LEG)					
OUTPUT POWER	FRAME SIZE	MODEL NUMBER	120/208 WYE	230 DELTA	120 VAC DELTA	240 VAC DELTA	220/380 WYE	480 VAC DELTA
12kVA	6 MF	3031-AVR3	32	32	32	—	—	—
		3031-AVT2	32	32	32	27	16	14
		3031-AVT3	32	32	55	—	—	—
24kVA	6 MF	3061-AVR3	64	64	64	—	—	—
		3061-AVT2	64	64	64	54	32	28
		3061-AVT3	64	64	110	—	—	—
36kVA	12 MF	3091-AVR3	96	96	96	—	—	—
		3091-AVT2*	96	96	96	81	48	40
		3091-AVT3*	96	96	166	—	—	—
48kVA	12 MF	3121-AVR3	128	128	128	—	—	—
		3121-AVT2*	128	128	128	108	64	54
		3121-AVT3*	128	128	221	—	—	—
72kVA	18 MF	3181-AVR3	192	192	192	—	—	—
		3181-AVT2*	192	192	192	162	96	81
		3181-AVT3*	192	192	332	—	—	—

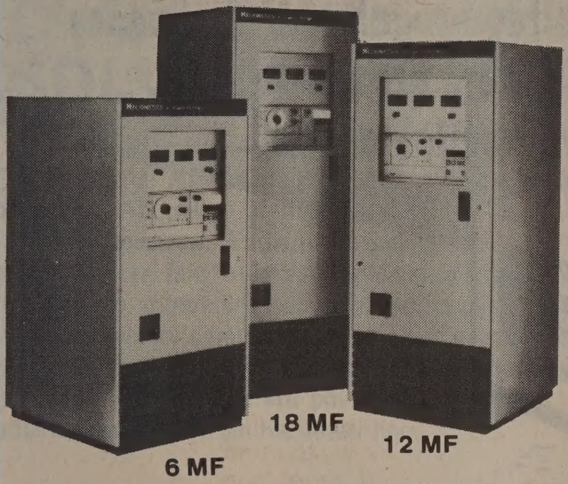
HELIONETICS, INC.

Ask for Steve Tullock

Helionetics, Inc./DECC Division
17312 Eastman St., Irvine, CA 92714
(714) 261-8313 inside Calif.
(800) 421-7915 toll-free outside Calif.

For More Information. Circle No. 306

HELIONETICS, INC.



Frame Size	Dimensions	Weight
6 MF	29″ W x 34″ D x 59″ H	750 lbs.
12 MF	29″ W x 34″ D x 72″ H	875 lbs.
18 MF	29″ W x 34″ D x 78″ H	975 lbs.

*Models with "T" designations above 24kVA utilize an external output transformer mounted in its own enclosure. All others are single cabinet systems.

1-PHASE FIXED

			USER SELECTABLE OUTPUT	
OUTPUT POWER	FRAME SIZE	MODEL NUMBER	120 VAC (AMPS)	240 VAC (AMPS)
12kVA	6 MF	1031-AFR1	96	—
		1031-AFT1	96	46
24kVA	6 MF	1061-AFR1	192	—
		1061-AFT1	192	96
36kVA	12 MF	1091-AFR1	279	—
		1091-AFT1*	279	140
48kVA	12 MF	1121-AFR1	380	—
		1121-AFT1*	380	190
72kVA	18 MF	1181-AFR1	576	—
		1181-AFT1*	576	288

1-PHASE VARIABLE

12kVA	6 MF	1031-AVR1	96	—
		1031-AVT1	96	46
24kVA	6 MF	1061-AVR1	192	—
		1061-AVT1	192	96
36kVA	12 MF	1091-AVR1	279	—
		1091-AVT1*	279	140
48kVA	12 MF	1121-AVR1	380	—
		1121-AVT1*	380	190
72kVA	18 MF	1181-AVR1	576	—
		1181-AVT1*	576	288

3-PHASE FIXED

			USER SELECTABLE OUTPUT CONFIGURATIONS (AMPS PER LEG)					
OUTPUT POWER	FRAME SIZE	MODEL NUMBER	120/208 WYE	230 DELTA	120 VAC DELTA	240 VAC DELTA	220/380 WYE	480 VAC DELTA
12kVA	6 MF	3031-AFR3	32	32	32	—	—	—
		3031-AFT2	32	32	32	27	16	14
		3031-AFT3	32	32	55	—	—	—
24kVA	6 MF	3061-AFR3	64	64	64	—	—	—
		3061-AFT2	64	64	64	54	32	28
		3061-AFT3	64	64	110	—	—	—
36kVA	12 MF	3091-AFR3	96	96	96	—	—	—
		3091-AFT2*	96	96	96	81	48	40
		3091-AFT3*	96	96	166	—	—	—
48kVA	12 MF	3121-AFR3	128	128	128	—	—	—
		3121-AFT2*	128	128	128	108	64	54
		3121-AFT3*	128	128	221	—	—	—
72kVA	18 MF	3181-AFR3	192	192	192	—	—	—
		3181-AFT2*	192	192	192	162	96	81
		3181-AFT3*	192	192	332	—	—	—

HELIONETICS, INC.

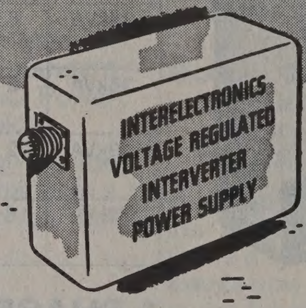
Ask for Steve Tullock

Helionetics, Inc./DECC Division
17312 Eastman St., Irvine, CA 92714
(714) 261-8313 inside Calif.
(800) 421-7915 toll-free outside Calif.

PROVEN RELIABILITY—

DC-DC, DC-AC, SOLID-STATE POWER INVERTERS

over 260,000 logged hours— voltage-regulated, frequency-controlled, for missile, telemeter, ground-support, 135°C all-silicon units available now—



Interelectronics all-silicon thyratron-like gating elements and cubic-grain toroidal magnetic components convert DC to any desired number of AC or DC outputs from 1 to 10,000 watts.

Ultra-reliable in operation (over 260,000 logged hours), no moving parts, unharmed by shorting output or reversing input polarity. High conversion efficiency (to 92%, including voltage regulation by Interelectronics patented reflex high-efficiency magnetic amplifier circuitry).

Wide input voltage range (1 to 250 volts DC). Wide input voltage regulation (output voltage maintained with variations up to 50% in input voltage).

Light weight (to 6 watts/oz.), compact (to 8 watts/cu. in.), low ripple (to 0.01 mv. p-p), excellent voltage regulation (to 0.1%), precise frequency control (to 0.2%) with Interelectronics extreme environment magnetostrictive standards or to 0.0001% with fork or piezoelectric standards.

Complies with MIL specs. for shock (100G 11 misc.), acceleration (100G 15 min.), vibration (100G 5 to 5,000 cps.), temperature (to 150 degrees C), RF noise (I-26600).

AC single and polyphase units supply sine waveform output (to 2% harmonics), will deliver up to ten times rated line current into a short circuit to actuate MIL type magnetic circuit breakers or fuses, will start gyros and motors with starting current surges up to ten times normal operating line current.

Now in use in major missiles, powering telemeter transmitters, radar beacons, electronic equipment. Single and polyphase units now power airborne and marine missile gyros, synchros, servos, magnetic amplifiers.

Interelectronics—first and most experienced in the solid-state power supply field produces its own all-silicon solid-state gating elements, all high flux density magnetic components, high temperature ultra-reliable film capacitors and components, has complete facilities and know how—has designed and delivered more working KVA than any other firm!

For complete engineering data, write Interelectronics today, or call (914) EL 8-8000 in Congers.

INTERELECTRONICS CORPORATION

550 U.S. Route 303, Congers, New York 10920

Powertron

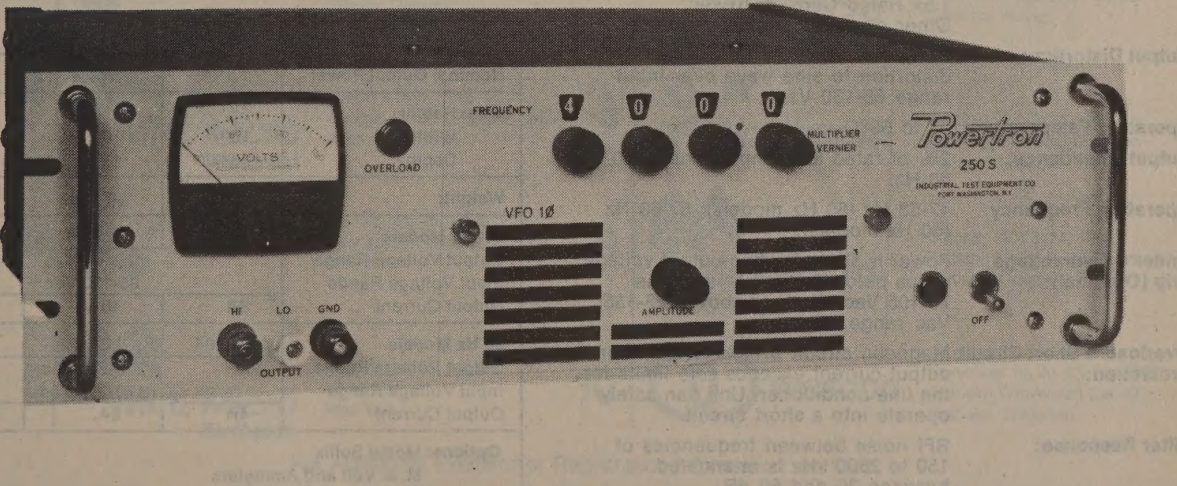
SOLID STATE AC POWER SUPPLIES

The Powertron AC Power Supplies provide stable, low distortion, AC power at frequencies within the audio frequency spectrum. These highly reliable and versatile power sources find wide application in calibration and test stations, motor drives, gyro wheel supplies, laboratory use, military component testing, and operating foreign equipment. These supplies may be used whenever it is necessary to provide AC power at a frequency not otherwise available from the power lines.

The various supplies feature all solid state construction, wide operating frequency range, low distortion, and a wide variety of output voltages and impedances. The units are designed to be used in modular form so that a single unit can provide single-phase output, and two or three units may be used to provide two-phase or three-phase outputs respectively. Two units may also be used together to provide twice the single-phase, two-phase, or three-phase power of a single unit.

The supplies are completely short circuit proof. All forced air cooled units provide air filters, replaceable from the front panel to insure long maintenance free operation of the air cooling system.

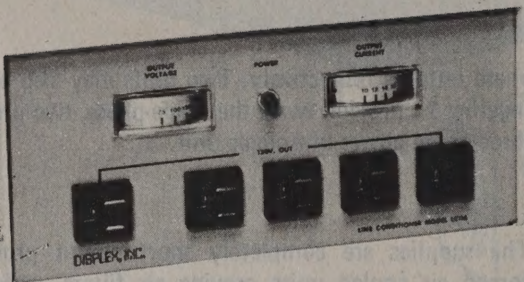
Fixed frequency and variable frequency plug-in oscillators are available for single-phase, two-phase, or three-phase operation. They feature excellent stability and continuous resolution. A wide variety of plug-in oscillators is available.



INDUSTRIAL TEST EQUIPMENT CO., Inc.

21 YENNICOCK AVENUE, PORT WASHINGTON, N.Y. 11050
Phone: (516) 883-1700

DISPLEX LC Line Conditioners



Voltage Regulation

Unit maintains an output voltage of 105-125 volts for an input voltage range of 88 to 130 volts ac. For input voltages above and below the specified ranges, the output voltage will rise above 125 Vac or fall below 105 Vac in proportion to the input changes. The output wave shape will not distort until the input voltages falls below 65 Vac (78 Vac output voltage). Optional adjustable under/overvoltage trip circuit will shut off unit at preset output voltage between 78 and 105 Vac and 125 and 135 Vac.

Power Output:	1 kVA, 2 kVA and 3 kVA models.
Regulation Response Time:	Typically less than 1 cycle for 100% correction.
Efficiency:	Better than 96% at full load and half load.
Load Power Factor:	Unit operates over any power factor.
Overload Rating: (Circuit Breaker Curve)	10x Rated Current ≅ 10 ms 3x Rated Current ≅ 1 sec. 1.5x Rated Current 10 sec. Other overload profiles available.
Output Distortion:	No spikes. Adds no harmonic distortion to sine wave over input range 65-130 Vac.
Operating Temperature:	0° to 50°C
Output Impedance:	2% of rated load impedance at 50 or 60 Hz.
Operating Frequency:	47-53 Hz (50 Hz models), 57-63 Hz (60 Hz models).
Under & Overvoltage Trip (Optional):	Power is shut off when output voltage drops below pre-set level in the 78-105 Vac range or above 125-135 Vac range.
Overload & Short Circuit Protection:	Magnetic circuit breaker trips when output current exceeds safe limits for the line conditioner. Unit can safely operate into a short circuit.
Filter Response:	RFI noise between frequencies of 150 to 2500 kHz is attenuated between 30 and 50 dB. **Note: For optimum noise immunity, load must have a solid ground connection.**
Surge Arrestor (Optional):	A disposable transient voltage suppression network absorbs up to 70 joules of surge energy keeping voltages between high and ground and neutral to ground within safe limits. An indicator will signal when surge arrester requires replacement due to surge fatigue.

The Displex series of LC Line Conditioners supply clean regulated power to computers and other digital control and data processing equipment by conditioning power in three critical ways.

REGULATES VOLTAGE

The LC unit maintains rated output voltage level even during periods of BROWN-OUTS and other low voltage conditions. Furnishes 105-125 Vac clean output for an input range of 88 to 130 Vac.

FILTERS POWER LINE

The LC unit provides clean power to the computer by filtering RFI (Radio Frequency Interference) on the power line.

SURGE ARRESTING

The LC unit levels voltage spikes on the power line caused by lightning and/or heavy equipment operating on the same power line.

LC FEATURES

- Replaces a dedicated line. Combination regulator, filter, surge arrestor and power distribution center.
- Silent operation. Rugged, light weight.
- Short-circuit proof.
- Provides up to 10 times rated current for starting surges.
- Maintains clean sine wave output even under severe brown-out conditions.
- Handles loads of wide power factor.

UNIT SPECIFICATIONS

Nominal Output Power	1 kVA	2 kVA	3 kVA
Size: Height Width Depth	5″ 10″ 13¾″	5″ 10″ 13¾″	5½″ 11½″ 15⅞″
Weight:	23 lbs.	25 lbs.	33 lbs.
60 Hz Models	LC108	LC116	LC124
Output Voltage Range	105-125 Vac		
Input Voltage Range	88-130 Vac		
Output Current	8A	16A	24A
50 Hz Models	LC204	LC208	LC212
Output Voltage Range	200-240 Vac		
Input Voltage Range	170-250 Vac		
Output Current	4A	8A	12A

Options: Model Suffix
M = Volt and Ammeters
P = Surge Arrestor Protection
T = Over/Undervoltage Trip

DISPLEX, INC.

ALEXANDER PLACE, GLEN COVE, NY 11542
(516) 671-4400/Telex: 640476 (NORTHILLS GOVE)

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SHOWTIME '85

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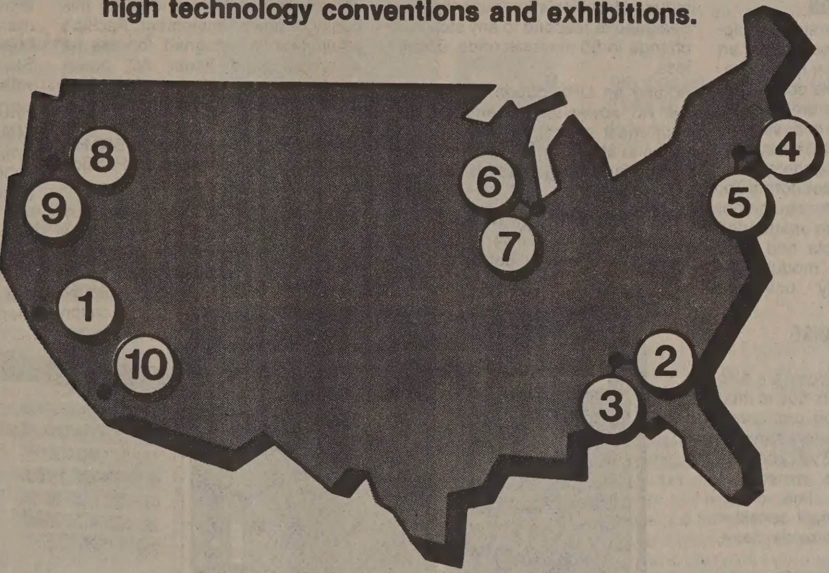

1	**Mini/Micro West**	February 5, 6, 7, 1985	Anaheim Hilton Exposition Center	Anaheim, California
2	**Southcon**	March 5, 6, 7, 1985	Georgia World Congress Center	Atlanta, Georgia
3	**Mini/Micro Southeast**	March 5, 6, 7, 1985	Georgia World Congress Center	Atlanta, Georgia
4	**Electro**	April 23, 24, 25, 1985	New York Coliseum	New York
5	**Mini/Micro Northeast**	April 23, 24, 25, 1985	Albert Hall	New York
6	**Midcon**	September 10, 11, 12, 1985	Rosemont Exposition Center	Chicago, Illinois
7	**Mini/Micro Midwest**	September 10, 11, 12, 1985	Rosemont Exposition Center	Chicago, Illinois
8	**Northcon**	October 22, 23, 24, 1985	Portland Memorial Coliseum	Portland, Oregon
9	**Mini/Micro Northwest**	October 22, 23, 24, 1985	Portland Memorial Coliseum	Portland, Oregon
10	**Wescon**	November 19, 20, 21, 22, 1985	Anaheim Convention Center	Anaheim, California

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Telephone: 213/772-2965 • Telex: 181350

For More Information. Circle No. 21

Quality Solid-State Linear AC Power

PACIFIC
POWER SOURCE CORP.

300KVA to 250VA

AC POWER CONVERSION

Pacific's power conversion equipment is specifically recommended as an AC power converter for generation of 50, 60, and 400 Hz power. The converted power is extremely pure, very highly regulated and virtually immune to load induced cross-talk. Typical applications are generation of US and Non-U.S. power forms for facilities power. This equipment is designed for long term unattended use. It is highly reliable and easy to maintain through module exchange by relatively untrained personnel.

LINE CONDITIONER/NOISE ELIMINATOR/UPS

Pacific's AC Power Sources are also used as line conditioners due to their excellent noise rejection properties. While most line conditioners can only reject a small amount of line disturbances, you can expect to eliminate virtually all line disturbances effecting the most sensitive loads. These systems provide clean, highly regulated power, free of load induced transients because they are designed to respond to any step load change in 50 microseconds, usually less.

Adding an UPS support cabinet to the AC power source ensures that your most critical load will be immune to all power line disturbances, including complete loss of line for extended periods.

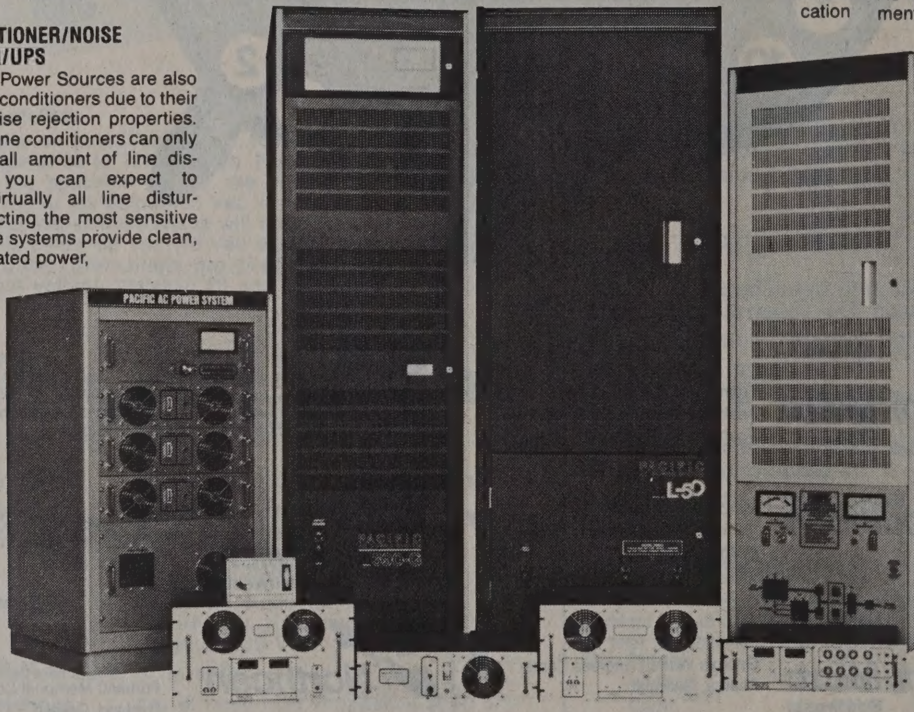
TEST POWER/PRODUCTION BURN-IN

Applications requiring multi-functional AC power at both fixed and variable frequency are ideal for this family of power equipment. Pacific's equipment is designed for use as a broad band linear AC power source; applications requiring highly reliable operation over virtually all power frequencies (and even below 47 Hz and above 500 Hz) are standard on most of Pacific's equipment.

Production testing and burn-in of equipment for shipment abroad is a common application for AC power systems from Pacific. Qualification testing of electronic equipment demands an AC power source with quality and reliability. Quality Solid-State Linear AC Power is standard with *all* Pacific AC power equipment.

PROGRAM POWER & TRANSIENT SIMULATION

When used in conjunction with the MODEL 8037 Transient Generator, Pacific's systems serve as an excellent device for simulation of envelop power transients in accordance with MIL-STD-704, MIL-STD-1399 or MIL-E-16400 and similar standards for AC power equipment. The equipment is usable with any external wave-form generator to produce power with simulated harmonic distortion.



GENERAL PERFORMANCE SPECIFICATIONS

- Power Forms: Virtually all input and output AC power forms are available on most systems.
- Load Power Factor: No load power factor restrictions, leading or lagging.
- Regulation: Line (0.1% max. for 10% change), Load (0.25% at the sense point).
- Load Transient Response: 50 μs max. (Typ. 30 μs).
- Output Distortion: 0.75% THD (Typ. 0.5%).
- Output Isolation: Fully isolated from input and frame ground.
- Output Protection: Integral electronic current limiting with auto-recovery.
- 1Ø/3ØOperation: Some models are user selectable by key locking switch.
- Failure Isolation System: Failed devices are auto-disconnected without output voltage waveform disturbances.
- System Efficiency: 85% Large Systems, 60%-71% Small Systems.
- Parallelable: Systems are parellelable and serve as building blocks for high power level systems; most are user parallelable by your electrical personnel.

FOR POWER SOURCE SELECTION, SEE NEXT PAGE ▶▶▶▶▶▶

PACIFIC
POWER SOURCE CORP.

800-854-2433
In CA, Call 800-472-8465; Corporate Office: 714-898-2691
Ask for an Applications Engineer or your Local Rep. Office
PACIFIC POWER SOURCE CORP.; 15122 Bolsa Chica St.; Huntington Beach, CA 92649

PACIFIC'S "G–SERIES"

• 6-90 KVA • QUALITY AC POWER • MULTI-FUNCTION •

APPLICATIONS FOR PACIFIC'S G–SERIES SYSTEMS

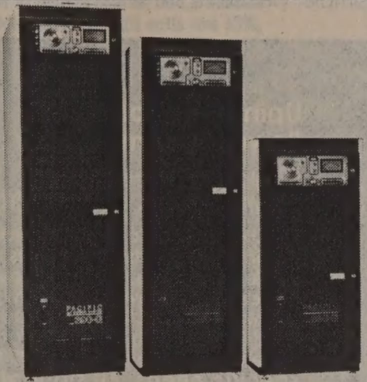
POWER CONVERSION (VOLTAGE, FREQUENCY, AND PHASE)
For aircraft, shipboard, military, facility, and non-U.S. power forms.

LINE CONDITIONING (VOLTAGE AND FREQUENCY)
For data processing, telecommunications, air traffic control, security, and medical systems; computers, and other sensitive equipment.

UNINTERRUPTIBLE POWER (AVAILABLE WITH BATTERY SUPPORT CABINET)
For sensitive equipment protection and applications where continuous power is critical (e.g. long term test set) against brown-outs and black-outs.

PRODUCTION TEST/INSTRUMENTATION SERVO CONTROL
For qualification testing, instrument calibration, production burn-in, motor controllers, and gyro power.

PROGRAMMED POWER AND TRANSIENT SIMULATION
When G-Series is used in conjunction with Model 8037 Transient Generator, input power conditions can be simulated (e.g. in accordance with MIL-STD-704, MIL-STD-1399, or MIL-E-16400) for testing the tolerance parameters of your equipment.


MODEL 390-G MODEL 360-G MODEL 330-G

BENEFITS AND FEATURES

EASE OF MAINTENANCE AND INSTALLATION — TIME, SPACE, AND COST SAVINGS

- Modular design with full front access enables maintenance or exchange of power modules **without system shutdown** or cabinet movement. Installation space requirement is minimal.
- Self-healing circuitry designed with many redundant fail-safes, automatically disconnects failed devices **without effecting system output voltage waveform**.
- Self-diagnostics (fault indicators) make the user aware of the problem and **allows scheduling of maintenance at the user's convenience**.
- Front-filtered air intake with reuseable filter enables **easy access and maintenance of system**, reduces component failures, provides more efficient cooling, and enables system to be located near user due to quiet operation.

MULTI-FUNCTION SYSTEMS REDUCES THE NEED FOR REPLACEMENT — COST SAVINGS

- **Multi-function** design of G-Series Systems **reduces the variety of systems needed for multi-applications** with features such as: 1Ø/3Ø User Switch Selectable, multi output forms available, fixed and/or variable frequency, and operable into any power factor load.
- **Paralleling** capability and **modular** design allow the user to decrease or increase output power as needed by simply adding/removing power modules or paralleling systems for increasing power needs. **This reduces the need for replacing an existing system for a larger one.**

ENERGY AND OPERATING COST SAVINGS

- **Idling power consumption is reduced to a minimum—not** inherent in MG sets which waste costly energy at no load or minimum loads.
- Pacific's Precision AC Power allows users to obtain the **highest performance from their power** as opposed to utility power, MG sets, and even switchers which cannot match Pacific's Regulation (line: ±0.1%, load: ±0.25%), Response Time (50 μs), or Output Distortion (0.75%) and no load power factor restrictions. restrictions.

ELIMINATES REPLACEMENT OF DAMAGED EQUIPMENT OR DATA - COST SAVINGS

- Uninterruptible Power **provides protection from blackouts and brown-outs which sensitive equipment or data cannot tolerate.** Pacific's equipment is especially useful in maintaining precise output voltage and frequency against large scale input power transients.

PROVIDES SAFETY PROTECTION

- Key-lockable front panel and operator control module **allow access only to authorized personnel.**

QUICK DELIVERY

- G-Series Standard Models are **readily available from stock.**

G–SERIES STANDARD MODELS

ARE COMPLETE SYSTEMS READY FOR USE, INCLUDING CABINETS, OSCILLATORS, INPUT CIRCUIT BREAKERS AND OUTPUT CONTACTORS

MODEL	OUTPUT POWER (KVA)	1 PHASE OUTPUT			3 PHASE OUTPUT			CABINETS	
		VOLTS (RMS)	AMPS (RMS)	AMPS (PEAK)	VOLTS (RMS)	AMPS/LEG (RMS)	AMPS/LEG (PEAK)		
330-G ☐ ☐	6	120	48	144	120/208 WYE or 208 DELTA	16	48	1 ea. 330-G	FIXED AND/OR VARIABLE FREQUENCY 1 PHASE/ 3 PHASE/ USER SWITCH CONVERTIBLE MODELS
360-G ☐ ☐	12	120	96	288	120/208 WYE or 208 DELTA	32	96	1 ea. 360-G	
390-G ☐ ☐	18	120	144	432	120/208 WYE or 208 DELTA	48	144	1 ea. 390-G	
3120-G ☐ ☐	24	120	192	576	120/208 WYE or 208 DELTA	64	192	2 ea. 360-G	
3150-G ☐ ☐	30	120	240	720	120/208 WYE or 208 DELTA	80	240	2 ea. 390-G	
3180-G ☐ ☐	36	120	288	864	120/208 WYE or 208 DELTA	96	288	2 ea. 390-G	
3210-G ☐ ☐	42	120	336	1008	120/208 WYE or 208 DELTA	112	336	3 ea. 390-G	
3240-G ☐ ☐	48	120	384	1152	120/208 WYE or 208 DELTA	128	384	3 ea. 390-G	
3270-G ☐ ☐	54	120	432	1296	120/208 WYE or 208 DELTA	144	432	3 ea. 390-G	
3360-G ☐ ☐	72	—	—	—	120/208 WYE or 208 DELTA	192	576	4 ea. 390-G	
3450-G ☐ ☐	90	—	—	—	120/208 WYE or 208 DELTA	240	720	5 ea. 390-G	

☐ - INDICATES CONTROL CHARACTERISTICS AND SECONDARY OUTPUT VOLTAGE INFORMATION . . . PLEASE CALL FACTORY FOR OPTIONS .

ADDITIONAL QUALITY AC POWER SYSTEMS OFFERED BY PACIFIC. . .

POWER LEVEL	SERIES	FEATURES
25 – 250 KVA	L	50 KVA Modular Cabinets, Parallelable, Fixed Frequency, 1Ø or 3Ø
1 – 9 KVA	E	Bench-top/Rack Mountable, Standalone or Parallelable, Interchangeable Plug-In Oscillators, 1Ø or 3Ø
2 – 6 KVA	130-UG	Single Cabinet Self-Contained UPS, Fixed Frequency, 1Ø
250 VA – 4.5 KVA	K	Multi-Function, Bench-Top, Interchangeable Plug-In Oscillators, 1Ø or 3Ø
250 VA – 3 KVA	H	OEM Applications, Bench-Top, Fixed Frequency
N/A	8037	Transient Simulator — Compatible with most of Pacific's Power Sources

800-854-2433
In CA, Call 800-472-8465; Corporate Office: 714-898-2691
Ask for an Applications Engineer or your Local Rep. Office
PACIFIC POWER SOURCE CORP.; 15122 Bolsa Chica St.; Huntington Beach, CA 92649

PACIFIC
POWER SOURCE CORP.

AC POWER LINE CONDITIONING EQUIPMENT

RTE technology brings you AC Power Line Conditioning products that keep your computer or other critical equipment running smoothly throughout a wide variety of power line disturbances. Our products will always keep you in power because we keep our design simple. We use the minimum number of conservatively rated parts. The results of this simple logic are MTBFs from 50,000 hours to over 100,000 hours, depending on the product you select to solve your specific power problem.

Uninterruptible Power Systems

Single and Three Phase, 500VA to 50KVA, 50 and 60Hz

RTE UPS provide complete protection against blackouts, brownouts, spikes, surges and sags, in short, any disturbance in your power line. From our tiny, silent 500VA MICRO-UPS to our 50KVA Model 6000 with Digital Information System, we have the right UPS for your specific needs. All standard 60Hz models are available with stock to 3-week delivery; 50Hz models are stock to 6 weeks.

Super Isolation Transformers

Single and Three Phase, 250VA to 15KVA, 50/60Hz

RTE's Super Isolation Transformers (SIT) provide a low-cost solution to the most common power line problem, noise. Surveys of power quality indicate up to 88% of the disturbances are noise. RTE's SITs eliminate common-mode noise and greatly reduce transverse-mode noise. All standard models are in stock, and come with a 5-Year warranty.

AC Line Conditioners

Single and Three Phase, 150VA to 60KVA, 50 and 60Hz

RTE's AC Line Conditioners eliminate power line noise and regulate AC line voltage to within the tight limits modern computers require. In fact, they solve all power line problems except outages (only an UPS will handle those). RTE has a complete selection of AC Line Conditioners using either of two technologies: rugged, reliable Ferroresonant, or compact, silent Electronic. All popular sizes are available with stock to 2-week delivery.

Need to know more about AC Power Problems and the alternate technologies available to solve them? Send for RTE's AC Power Handbook. Written in layman's language, copies are available at our cost of $4.00 each.
Note: This book is yours FREE if our representative delivers it to you personally.

RTE DELTEC

Formerly Gould Inc., Power Conversion Division

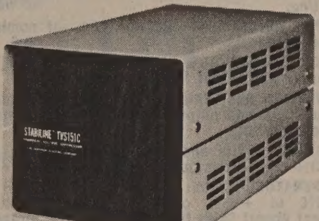
RTE DELTEC CORPORATION
2727 Kurtz Street
San Diego, CA 92110 U.S.A.
Phone (800) 854-2658.
In California (619) 291-4211.
TWX (910) 335-1241.

STABILINE® AUTOMATIC VOLTAGE CONTROLS

STABILINE CR7105C

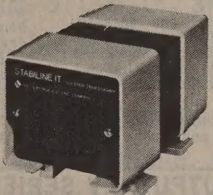
STABILINE® Computer Regulators

Maintain properly conditioned voltage to computers and other voltage critical equipment. Simple cord and plug connection to voltage source; two grounded receptacles for connecting equipment. Provide output of 120 volts rms ±3%, 60 Hz over an input range of 95 to 130 volts rms. Also provide 60dB minimum common-mode noise rejection to help prevent computer errors, loss of information and other noise related problems.



STABILINE® Transient Voltage Suppressors

Suppress momentary voltage spikes on power lines to prevent damage to sensitive equipment. Used to protect medical equipment, computers, word processors, electronic instrumentation, microprocessor based equipment, communications equipment, industrial controls and similar apparatus. Benefits include virtually instantaneous response time, transient reduction of 40dB (100 to 1) per frequency decade above 5kHz, efficiency of 99% at full resistive load and regulation less than 1%. Will attenuate in the same manner regardless of where on the sine wave or in which direction the transient is applied and do not rely on an absolute magnitude before attenuation occurs. Available in 120 and 240 volt models in ratings from 15 to 60 amperes maximum load current.

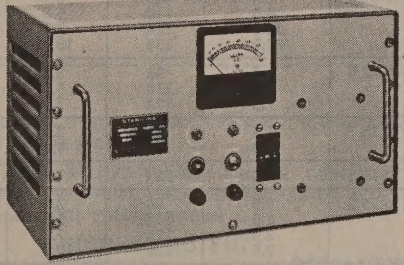


SVR Series STABILINE® Automatic Voltage Regulators

Highly efficient, extremely fast solid-state automatic voltage regulators. Very light in weight when compared with many units of similar kVA ratings. Features include virtually zero waveform distortion, very low internal impedance, negligible phase shift, insensitivity to load power factor and virtually no effect on system power factor. Efficiency is 95 percent at 60 hertz. Models in the SVR Series are available from 0.75 to 4kVA.

STABILINE® Transient Suppressors/Voltage Regulators

In addition to correcting for high or low voltage from power sources, units attenuate transverse-mode (line-to-line) noise and transients. Transient voltage attenuation of 40dB from 5 to 50 kHz. Provide the all-around protection needed by computers, business machines, word processors, microprocessor-based equipment and other voltage sensing devices to reduce or eliminate disruptions, data errors, loss of information and equipment failure. Types SVRS88101C and SVRS88102C are also available with cord/plug sets.



STABILINE® Isolation Transformers

Multi-shielded, ultra-isolation transformers exhibiting low capacitance between primary and secondary windings. Ideal for isolating sensitive equipment and attenuating common mode noise voltage generated by power consuming sources. Common mode noise attenuation is 126dB. Available in four models from 0.5kVA to 5kVA.

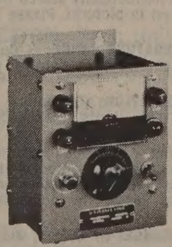
Electro Mechanical STABILINE® Automatic Voltage Regulators

Utilize solid-state control circuits, motor-driven POWERSTAT Variable Transformers and buck-boost transformers to regulate line voltage. Widely used in industrial applications or where constant output voltage is required with zero waveform distortion. EMT Series types are offered with ratings from 2.3 to 118kVA; EMS Series in ratings from 25 to 300kVA. The speed of response of EMT and EMS Series units is slower than for some types of automatic voltage regulators, but is sufficiently fast for the majority of applications.

STABILINE
AUTOMATIC VOLTAGE REGULATOR

Instantaneous Electronic STABILINE® Automatic Voltage Regulators

Highly accurate, fast-correcting units featuring solid-state circuitry. No vacuum tubes, motors, blowers or relays are used. Benefits include very high accuracy, fast response, low distortion, high efficiency (up to 95 percent) and wide operating frequency range. Models are available in ratings from 0.5 to 15kVA.



STABILINE® Full Range Regulator Controllers

Designed for use with any motor-driven POWERSTAT® Variable Transformer to provide full range regulation of a-c voltage, a-c current or d-c voltage. Output voltage will remain within a 2-volt band when used with 120 volt units and a 4-volt band when used with 240 volt models. Output current can be maintained within ±1% of maximum current setting with user supplied current transformer and Superior Electric transformer T6340. Type FR501BDC and user supplied d-c power will provide regulated d-c voltage.

THE SUPERIOR ELECTRIC COMPANY

383G Middle St., Bristol, CT 06010/Telephone: (203) 582-9561/Telex: 962-446

abbott
MILITARY POWER SUPPLIES

60/400 Hz to 5-28 VDC

MODEL
LV

SPECIFICATIONS

INPUT VOLTAGE RANGE: 105 to 125 VRMS.

EFFICIENCY: Typical efficiency 35% for 5V, 65% for 28V.

LINE REGULATION: 0.05% (±1 VC for LLV model).

LOAD REGULATION: 0.10%.

PARD (NOISE & RIPPLE): 1 mVRMS, 5 mV ptp.

INPUT FREQUENCY RANGE: 55 to 65/380 to 420 Hz. Units may be operated down to 47 Hz with 20% derating.

OUTPUT ADJUSTMENT RANGE: ±5% of nominal at output terminals.

INSULATION VOLTAGE: 500 VDC input to case, input to output and output to case.

INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case when measured at 50 VDC.

POLARITY: Inputs and outputs are isolated, either positive or negative output may be grounded.

TEMPERATURE RANGE: Operating: −20°C to +71°C, −40°C to +85°C optional (please consult your nearest Abbott Sales Office for details). Storage temperatures: −55°C to +85°C.

TEMPERATURE EFFECT COEFFICIENT: 0.01% per degree Celsius over entire range.

ENVIRONMENT: Hermetically sealed and encapsulated to meet MIL-STD-810C, including altitude (to 1.3 inches of Hg), acceleration, vibration, shock and temperature altitude cycling. Unit meets MIL-S-901 (5 ft. hammer drop). Copies of certified test reports are available upon request.

ADJUSTMENT RANGE: Unit is equipped with an internal potentiometer. An external adjustment potentiometer is available. Please consult your nearest Abbott Sales Office.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed.

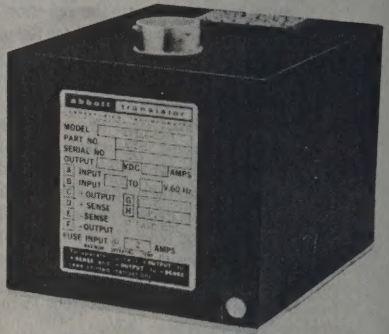
INPUT TRANSIENT PROTECTION: 143.8 VRMS, for 0.3 seconds.

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "sensing" leads. The regulator circuit action compensates for a DC voltage drop up to 0.3 volts in the load leads.

LOAD TRANSIENT: Output voltage returns to regulation limit within 100 microseconds after 50% step change in load current.

ELECTROMAGNETIC INTERFERENCE: Meets MIL-STD-461A, methods CE01 and CE03 for conducted emissions.

RELIABILITY: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of +50°C baseplate temperature, maximum rated output power for LV5DE20-1 was calculated to be 69,987 hrs. for ground benign environment and 10,384 hrs. for naval sheltered environment. MTBF for LLV12DE0.5-1 was calculated to be 186,947 hrs. for a ground benign environment and 30,081 for naval sheltered environment. With Enhanced Reliability Option (ER) MTBF for LV5DE20-1 (ER) was calculated to be 236,033 hrs. for ground benign environment and 35,585 hrs. for naval sheltered environment. For LLV12DE0.5-1 (ER) MTBF was calculated to be 330,349 hrs. for ground benign environment and 50,682 hrs. for a naval sheltered environment.



FEATURES

- Up to 65% efficiency
- Low Output Ripple, 5 mV peak-to-peak
- 0.1% Regulation
- High Density
- Single and Dual Outputs

SINGLE OUTPUT: LV SERIES

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Weight (Lbs.)	Model Number
4.75 to 5.25	2.4	9A	3.1	LV5DE2.4
	6.0	11C	5.8	LV5DE6
	10.0	12A	7.7	LV5DE10
	20.0	13B	10.9	LV5DE20
11.4 to 12.6	1.7	9A	3.1	LV12DE1.7
	4.0	11C	5.8	LV12DE4
	7.5	12A	7.7	LV12DE7.5
14.2 to 15.7	1.5	9A	3.1	LV15DE1.5
	3.0	11C	5.8	LV15DE3
14.5 to 15.5	4.0	12A	7.7	LV15DE4
22.8 to 25.2	0.9	9A	3.1	LV24DE0.9
	2.5	11C	5.8	LV24DE2.5
	3.9	12A	7.7	LV24DE3.9
	7.5	13B	10.9	LV24DE7.5
26.6 to 29.4	0.75	9A	3.1	LV28DE0.75
	2.0	11C	5.6	LV28DE2
	3.15	12A	7.5	LV28DE3.15
	7.5	13B	10.9	LV28DE7.5

DUAL OUTPUT: LLV SERIES

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Weight (Lbs)	Model Number
±11 to ±13	0.5	11N	3.6	LLV12DE0.5
	0.9	12K	4.8	LLV12DE0.9
	1.5	13D	6.6	LLV12DE1.5
±14 to ±16	0.5	11N	3.6	LLV15DE0.5
	0.9	12K	4.8	LLV15DE0.9
	1.5	13D	6.6	LLV15DE1.5

OPTIONAL FEATURES

TTL: (L Option) Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off. The power supply will turn-on with TTL logic "1", and turn-off with TTL logic "0". To specify this feature, please add an "L" to the character after the character "E" in the model number. (EXAMPLE: LV5DE6 to LV5DEL5)

SPECIAL CONNECTORS: A hermetically sealed military-type connector is available for the LV series (as shown in picture). Please consult your nearest Abbott Sales Office for details.

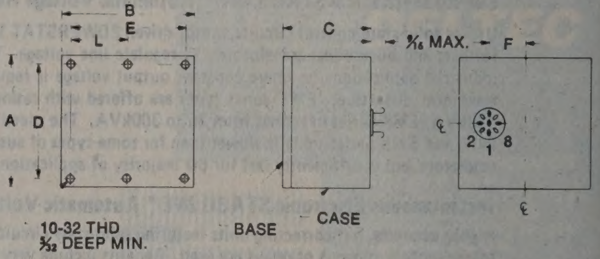
WIDER OPERATING TEMPERATURE RANGE: (T Option) −40°C to +85°C operating temperature range available. Please consult your nearest Abbott Sales Office for details.

OVER TEMPERATURE PROTECTION: (OT Option) Removes input power when conduction surfaces exceed safe limits. Please consult your nearest Abbott Sales Office for details.

OVERVOLTAGE PROTECTION: (-1 Option) An internal crowbar type OVP is available. Unit will crowbar output when output voltage exceeds adjustable set point. Unit input power must be recycled to restore unit. To specify this feature, please add a "-1" after the last number in the model number. (EXAMPLE: LV5DE6 to LV5DE6-1)

WIDER INPUT VOLTAGE RANGE: (H Option) Available at a voltage range 210 to 250 VAC. Please consult your nearest Abbott Sales Office for details.

ENHANCED RELIABILITY: (ER OPTION) This option provides increased reliability by using a higher level of military grade components. This feature allows the power supply to meet customer-specific requirements as to "Hi-Rel" components.



SIZE	A	B	C	D	E	F	L
9A	2.75	4.75	3.75	2.25	4.25	0.875	—
11C	4.25	5.25	4	3.75	4.75	1.875	2.375
12A	4.5	6	4	4	5.5	2.25	2.75
13B	5.5	6.5	5	5	6	2.188	3

SIZE	A	B	C	D	E	F	L
11N	3	6	3.375	2.5	5.5	2	—
12K	4	6.25	3.375	3.5	5.75	0.875	2.875
13D	5.5	6	3.375	5	5.5	1.25	2.5

ABBOTT TRANSISTOR LABORATORIES, INC.

For more information, use our Product Action Card in Volume 4.

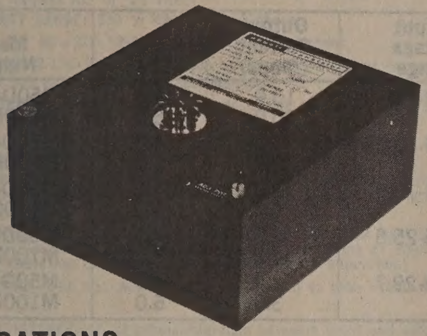
Power Supply Div. Western Offices: 5200 W. Jefferson Blvd., Los Angeles, CA 90016 (213) 936-8185. Telex: 69-1398
Eastern: 520 Main St., Ft. Lee, NJ 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
Florida: (305) 788-0845 • E. Canada: (613) 744-3066

For More Information Circle No. 314

abbott
MILITARY POWER SUPPLIES

Switching Power Supplies

MODEL
M



103.5-126.5 VAC to 4.7-29.7 VDC 47 to 440 Hz. 1 Ø

- Tight line and load regulation.
- Wide temperature range.
- High reliability.
- Encapsulated and hermetically sealed. Meets MIL-STD-810C and MIL-S-901.
- Low EMI. Meets MIL-STD-461A, (Radiated C.E. and C.S. specs) with F option.
- High efficiency. 75% to 81% typical.
- Internal OVP available.
- Remote programming optional.
- TTL compatibility available.

SPECIFICATIONS

INPUT VOLTAGE: 103.5 to 126.5 Vac, (Vrms) single phase, 47 to 440 Hz. Wide input option is available.

INPUT TRANSIENT PROTECTION: Unit will withstand 143.8 Vac for 0.3 seconds in accordance with MIL-STD-1399.

INRUSH CURENT:

MAXIMUM:	(M-50)	16 times the peak input current at low line, full load output, and nominal output voltage, with source impedance of no less than 0.25 ohm.
	(M-100)	8 times the peak input current at low line, full load output, and nominal output voltage, with source impedance of no less than 0.25 ohm.
TYPICAL:	(M-50)	8 times the peak input current under the same conditions.
	(M-100)	4 times the peak input current under the same conditions.

EFFICIENCY: Minimum 65% @ FL, 25°C baseplate temperature and nominal output. Typical efficiency is 75-81% under same conditions.

LINE REGULATION: Within 0.2% or 25mV, whichever is greater for input change of 103.5 to 126.5 Vac, (Vrms) with load constant.

LOAD REGULATION: Within 0.2% or 25mV, whichever is greater for load change of NL to FL with line constant.

RIPPLE & NOISE: 30mVrms, 100mV, whichever is greater for load change of NL to FL with line constant.

LOAD TRANSIENT RECOVERY TIME: Output Voltage returns to regulation limits within 3 msec after a 50% change in load current. Maximum over/under shoot is less than 0.4 Vdc or 3% of the output voltage, whichever is greater.

BROWNOUT HOLDUP-TIME: 15 msec. minimum at low line and maximum output current, 30 msec. typical at nominal line and maximum output current.

OPERATING TEMPERATURE RANGE: 0°C to 71°C. Wider temperature range is available.

STORAGE TEMPERATURE: −55°C to +85°C.

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius maximum.

ISOLATION: 500 Vdc input to output and input to case. 100 Vdc output to case.

INSULATION RESISTANCE: 50 megohms minimum between input and output, input to case, and output to case when measured at 50 Vdc (Input pins tied together, Output pins tied together).

POLARITY: Input and outputs are isolated, either positive or negative side may be grounded.

OUTPUT VOLTAGE ADJUSTMENT: Output continuously adjustable between the limits shown by means of an externally accessible adjustment potentiometer.

ADJUSTMENT RESOLUTION:	NOMINAL OUTPUT VOLTAGE	RESOLUTION
	5, 12, 15 Vdc units	35 milivolts
	24, 28 Vdc units	60 milivolts

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "Sensing" leads. The resulting circuit action compensates for a dc voltage drop up to 0.3 volts in the load leads.

OUTPUT IMPEDANCE: dc to 1 KHz; .03 R_L^* or 0.5 ohm, whichever is greater. 1 KHz to 10 KHz: 0.5 R_L or 0.1 ohm, whichever is greater. 10 KHz to .100 KHz: 0.7 R_L to 0.3 ohm, whichever is greater. *Rate loaded.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against a short circuit of any duration. Unit automatically recovers to normal when short circuit is removed.

ENVIRONMENT: Unit is hermetically sealed to meet MIL-STD-810C. Unit meets MIL-S-901 (5 foot hammer drop). Certified test reports are available.

EMI: Units meet MIL-STD-461A, CEO1, CEO3 with optional filter.

JUNCTION TEMPERATURE: Maximum Junction Temperature of the power transistors is 85°C. Complies with NAVMAT NOTE 3080.

For more information, use our Product Action Card in Volume 4.

ABBOTT TRANSISTOR LABORATORIES, INC.

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Florida: (305) 788-0845 • E. Canada: (613) 744-3066

abbott
MILITARY POWER SUPPLIES

Switching Power Supplies

MODEL
M

OPTIONAL FEATURES

TTL: (L Option) Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off. The power supply will turn-on with TTL logic "I", and turn-off with TTL logic "0". To specify this feature, please add an "L" to the character preceding the first dash of the model number. EXAMPLE: M100DL-5A, M50DL-5A

OVER-VOLTAGE PROTECTION: (-1 Option) An internal non-crowbar type OVP is available. Power supply turns off when output voltage exceeds set point. Unit input power must be recycled to restore output. To specify this feature, please add a "-1" after the "A" in the model number. EXAMPLE: M100DT-5A-1, M50D-5A-1

WIDER OPERATING TEMPERATURE RANGE: (T Option) −20°C to +71°C peak to peak output ripple spec increases to 200mV. To specify this option, please add a "T" to the character preceding the dash of the model number. EXAMPLE: M100DT-5A, M50DT-5A

SPECIAL CONNECTORS: A hermetically sealed military-type connector is available for the M Series. Please consult your nearest Abbott Sales Office for details.

WIDER INPUT VOLTAGE RANGE: (H Option) The standard input voltage range of the "M" line is 103.5 to 126.5 Vac. For the wider input voltage range of 90-126.5 Vac; output current is derated by 20%. To specify this feature, please add an "H" to the character preceding the first dash in the model number. EXAMPLE: M100DH-5A, M50DH-5A

REMOTE PROGRAM OPTION: (R Option) Units can be modified so that their output voltage can be adjusted from a remote location. This is accomplished by adding an additional pin to the header on the unit. To specify this option, please add an "R" after the character preceding the first dash of the model number. EXAMPLE: M100DR-5A, M50DR-5A

EMI FILTER: (F option) An internal EMI filter is available to reduce conducted interference on the input leads. With these filters the model M's will comply with MIL-STD-461A notice 3, CE01 and CE03 on the input leads. The addition of this filter alters the isolation of the input to case to 200 Vdc. To specify this feature, please add an "F" after the "D" in the model number. EXAMPLE: M100DF-5A, M50DF-5A

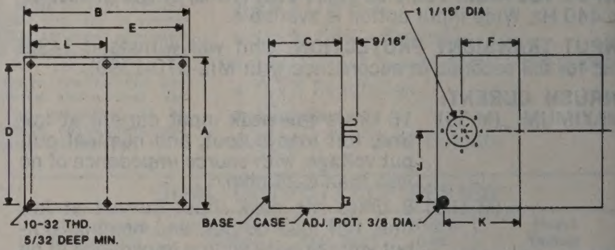
ENHANCED RELIABILITY: (ER Option) This option provides increased reliability by using higher levels of Mil. grade components. This feature allows the power supply to meet customer specific requirements as to "Hi Rel" components, environmental testing and extended Thermal Cycling. Please consult your nearest Abbott Sales Office for details.

SPECIAL ENCAPSULATION: (E Option) All of our hermetically sealed power modules are encapsulated to meet or exceed the shock, acceleration, and vibration requirements of MIL-STD-810C. Special encapsulation to enable these modules to withstand higher shock levels of 60g's, acceleration levels of 50g's, and vibration levels of 30g's, is available. To specify this feature, please add an "E" after the character preceding the first dash in the model number. EXAMPLE: M100DE-5A, M50DE-5A

TEN STANDARD MODELS

Output Voltage Range	Output Current (Amps)	Weight (Lbs.)	Model Number
4.7-5.3	10.0 20.0	4.0 5.0	M50D-5A M100D-5A
11.25-12.75	4.15 8.3	4.0 5.0	M50D-12A M100D-12A
14.1-15.9	3.35 6.7	4.0 5.0	M50D-15A M100D-15A
22.5-25.5	2.1 4.2	4.0 5.0	M50D-24A M100D-24A
26.3-29.7	1.8 3.6	4.0 5.0	M50D-28A M100D-28A

MECHANICAL DIMENSIONS



MODEL	A	B	C	D	E	F	J	K	L
M100	5¾	6¼	2¾	5.25	5.75	2 3/16	2⅝	2⅞	2.88
M50	3⅞	6¼	2¾	3.38	5.75	2 7/16	1 11/16	2⅞	—

TOLERANCES: FRACTION — ±1/32, DECIMAL — ±.015
MATERIAL: BASE — ALUMINUM 6061-T6, CASE-STEEL
FINISH: BLACK FLAT LACQUER FED. STD. 595 COLOR 37038

PIN DESIGNATIONS:
1 AC INPUT
2 AC INPUT
3 −SENSE
4 −OUTPUT (DC)
5 −OUTPUT (DC)
6 +OUTPUT (DC)
7 +OUTPUT (DC)
8 +SENSE
9 CASE GROUND

RELIABILITY

RELIABILITY: MTBF for the Standard version calculated per MIL-HDBK-217D (50°C baseplate temperature, maximum operating input voltage, and maximum rated output power) is shown below.

Model Number	Baseline Temp.	Environment	MTBF
M50D-5A-1 (STD)	50°C	Ground Benign	100,659 hrs.
M50D-5A-1 (STD)	50°C	Naval Sheltered	16,819 hrs.
M100D-5A-1 (STD)	50°C	Ground Benign	71,126 hrs.
M100D-5A-1 (STD)	50°C	Naval Sheltered	11,214 hrs.

ENHANCED RELIABILITY: Abbott offers a higher MTBF unit, as shown below. (see optional features)

Model Number	Baseplate Temp.	Environment	MTBF
M50D-5A-1 (ER)	50°C	Ground Benign	187,251 hrs.
M50D-5A-1 (ER)	50°C	Naval Sheltered	29,261 hrs.
M100D-5A-1 (ER)	50°C	Ground Benign	119,095 hrs.
M100D-5A-1 (ER)	50°C	Naval Sheltered	18,350 hrs.

For more information, use our Product Action Card in Volume 4.

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abbott
MILITARY POWER SUPPLIES

400 Hz to 5-27 VDC

MODEL
W
and WW

SPECIFICATIONS

INPUT VOLTAGE RANGE: 105 to 125 VRMS

INPUT FREQUENCY RANGE: 380 to 420 Hertz, 1 phase

INPUT POWER: Per MIL-STD-704A for category B equipment

LINE REGULATION: 0.1% (0.2% for duals) or 10 mv (whichever is greater) for input change of 105 to 125 VRMS with load constant

LOAD REGULATION: 0.1% (0.2% for duals) or 20 mv (whichever is greater) for change from no load to full load with line constant

RIPPLE: 0.02% or 5 mv RMS (whichever is greater) 25 mv peak-to-peak maximum, each output, measured with scope having 25 MHz bandwidth

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown in the table by means of an externally accessible screwdriver adjustment potentiometer

TRACKING ACCURACY: The negative output will track the positive output to within 1.0% or 100 mv (whichever is greater) for all rated conditions of input voltage, output current, operating temperature, and output voltage adjustment

ISOLATION VOLTAGE: 750 vdc input to output and input to case • 200 vdc output to case

INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case, and output and case when measured at 50 vdc.

POLARITY: Inputs and outputs are isolated, either positive or negative side may be grounded

TEMPERATURE RANGE: Operating: −55°C to +100°C maximum at center of mounting base Storage: −65°C to +125°C

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius maximum

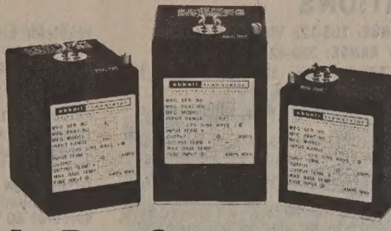
ENVIRONMENT: Encapsulated to meet the environmental requirements of MIL-STD-810C and MIL-E-5400P, Class 2, including: altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output automatically restores to normal when the overload is removed

INPUT TRANSIENT PROTECTION: MIL-STD-704A Figure 3, Limit 1 (180 VAC for 0.1 seconds)

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 100 microseconds (200 microseconds for duals) after 50% step change in load current

ELECTROMAGNETIC INTERFERENCE: Built to meet the requirements of MIL-STD-461 for generation of and susceptibility to radiated and conducted interference



High Performance

- Encapsulated and hermetically sealed to meet MIL-STD-810C and MIL-E-5400P, Class 2.
- Operating temperature range: −55°C to +100°C.
- Low Peak-to-Peak Ripple.
- Tight line and load regulation.
- High reliability. Up to 214,600 hrs. MTBF per MIL-HDBK-217C.
- Compact. Power density up to 2 watts per cu. in.
- Low EMI.

RELIABILITY: MTBF per MIL-HDBK-217C up to 214.600 Hrs.

OVER-VOLTAGE PROTECTION*: An internal, non-crowbar type OVP is available. Power supply turns off when output voltage exceeds set-point.

TTL*: Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off.

* Inclusion of these optional features on these models will most likely require that the case size increases slightly. Please consult nearest Abbott sales office for further details.

Output Voltage Range	Output Curr. (Amps)	Size*	Wt. (Lbs.)	Model Number
4.5-5.5	2.5	2E	1.9	W5D2.5
	5.0	4D	2.7	W5D5.0
	10.0	10B	5.1	W5D10
	15.0	14C	8.9	W5D15
	20.0	14C	8.9	W5D20
5.5-6.5	2.5	2E	1.9	W6D2.5
	5.0	4D	2.7	W6D5.0
	10.0	10B	5.1	W6D10
	15.0	14C	8.9	W6D15
	20.0	14C	8.9	W6D20
6.5-7.5	2.5	2E	1.9	W7D2.5
	5.0	4D	2.7	W7D5.0
	10.0	10B	5.1	W7D10
	15.0	14C	8.9	W7D15
	20.0	14C	8.9	W7D20
7.5-8.5	2.5	2E	1.9	W8D2.5
	5.0	4D	2.7	W8D5.0
	10.0	10B	5.1	W8D10
	15.0	14C	8.9	W8D15
	20.0	14C	8.9	W8D20
8.5-9.5	2.5	2E	1.9	W9D2.5
	5.0	4D	2.7	W9D5.0
	10.0	10B	5.1	W9D10
	15.0	14C	8.9	W9D15
	20.0	14C	8.9	W9D20
9.5-10.5	2.5	2E	1.9	W10D2.5
	5.0	4D	2.7	W10D5.0
	10.0	10B	5.1	W10D10
	15.0	14C	8.9	W10D15
	20.0	14C	8.9	W10D20
10.5-11.5	2.5	2E	1.9	W11D2.5
	5.0	4D	2.7	W11D5.0
	10.0	10B	5.1	W11D10
	15.0	14C	8.9	W11D15
	20.0	14C	8.9	W11D20
11-13	2.5	2E	1.9	W12D2.5
	5.0	4D	2.7	W12D5.0
	10.0	10B	5.1	W12D10
	15.0	14C	8.9	W12D15
	20.0	14C	8.9	W12D20
13-15	1.2	2E	1.9	W14D1.2
	2.5	4D	2.7	W14D2.5
	5.0	10B	5.1	W14D5.0
	10.0	14C	8.9	W14D10
	15.0	14C	8.9	W14D15
14-16	1.2	2E	1.9	W15D1.2
	2.5	4D	2.7	W15D2.5
	5.0	10B	5.1	W15D5.0
	10.0	14C	8.9	W15D10
	15.0	14C	8.9	W15D15
15-17	1.2	2E	1.9	W16D1.2
	2.5	4D	2.7	W16D2.5
	5.0	10B	5.1	W16D5.0
	10.0	14C	8.9	W16D10
	15.0	14C	8.9	W16D15
17-19	1.2	2E	1.9	W18D1.2
	2.5	4D	2.7	W18D2.5
	5.0	10B	5.1	W18D5.0
	10.0	14C	8.9	W18D10
19-21	1.2	2E	1.9	W20D1.2
	2.5	4D	2.7	W20D2.5
	5.0	10B	5.1	W20D5.0
	10.0	14C	8.9	W20D10
21-23	1.2	2E	1.9	W22D1.2
	2.5	4D	2.7	W22D2.5
	5.0	10B	5.1	W22D5.0
	10.0	14C	8.9	W22D10
23-25	1.2	2E	1.9	W24D1.2
	2.5	4D	2.7	W24D2.5
	5.0	10B	5.1	W24D5.0
	10.0	14C	8.9	W24D10
25-27	1.2	2E	1.9	W26D1.2
	2.5	4D	2.7	W26D2.5
	5.0	10B	5.1	W26D5.0
	10.0	14C	8.9	W26D10
27-29	1.2	2E	1.9	W28D1.2
	2.5	4D	2.7	W28D2.5
	5.0	10B	5.1	W28D5.0
	10.0	14C	8.9	W28D10

DUAL OUTPUT

Output Voltage Range	Output Curr. (Amps)	Size*	Wt. (Lbs.)	Model Number
±3.75- ±4.25	0.3	8B	1.9	WW4D0.3
	0.5	9C	2.2	WW4D0.5
	1.0	9C	2.2	WW4D1.0
	2.0	9D	3.1	WW4D2.0
	4.0	11D	5.5	WW4D4.0
±4.5- ±5.5	0.3	8B	1.9	WW5D0.3
	0.5	9C	2.2	WW5D0.5
	1.0	9C	2.2	WW5D1.0
	2.0	9D	3.1	WW5D2.0
	4.0	11D	5.5	WW5D4.0
±11- ±13	0.3	8B	1.9	WW12D0.3
	0.5	9C	2.2	WW12D0.5
	1.0	9C	2.2	WW12D1.0
	2.0	9D	3.1	WW12D2.0
	4.0	11D	5.5	WW12D4.0
±14- ±16	0.3	8B	1.9	WW15D0.3
	0.5	9C	2.2	WW15D0.5
	1.0	9C	2.2	WW15D1.0
	2.0	9D	3.1	WW15D2.0
	4.0	11D	5.5	WW15D4.0
±29- ±31	0.3	9C	2.2	WW30D0.3
	0.5	9C	2.2	WW30D0.5
	1.0	9D	3.1	WW30D1.0
	2.0	11D	5.5	WW30D2.0
	4.0	14C	8.0	WW30D4.0

Other standard Models with any output up to 100 vdc are available. For complete information, please consult our nearest office.
Other standard Models with any output between ±2.75 and ±31.0 vdc are available. For complete information, please consult our nearest office.

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***See page 601 for size charts.**

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MILITARY POWER SUPPLIES

400 Hz to 5-28 VDC

MODEL WL AND WWL

SPECIFICATIONS

INPUT VOLTAGE RANGE: 105-125 VRMS 3ϕ delta.

INPUT FREQUENCY RANGE: 380-420 Hz.

INPUT TRANSIENT PROTECTION: 180 VRMS for 0.1 seconds per MIL-STD-704, Figure 3, Limit 1.

LINE REGULATION: 0.1% or 20 mV, whichever is greater.

ELECTROMAGNETIC INTERFERENCES: Meets MIL-STD-461A, methods CE and CS for conducted emissions.

TURN-ON/TURN-OFF OVERSHOOT: 0.2% or 20 mV, whichever is greater.

LOAD REGULATION: 0.1% or 20 mV, whichever is greater. For load change of no load to full load.

RIPPLE: 0.02% or 5 mVRMS (whichever is greater) 25 mV peak-to-peak.

TRACKING ACCURACY: (WWL models only) The negative output will track the positive output to within 100 mV for all rated conditions of input voltage, output current, operating temperature, and output voltage adjustment.

POLARITY: Outputs are isolated. Either positive or negative may be grounded.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output voltage automatically restores to normal when the overload is removed.

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "sensing" leads. The regulator circuit action compensates for a DC voltage drop up to 0.5 volts in the load leads.

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limit within 100 microseconds after 50% step change in load current for units outputting 10A or less.

ISOLATION VOLTAGE: 750 VDC between input and output, input and case, and 200 VDC between output and case.

INSULATION RESISTANCE: 50 megohms minimum between input and output, input and case when measured at 50 VDC.

TEMPERATURE RANGE: −55°C to +80°C baseplate temperature. 80% rated power at −55°C to +100°C. Storage: −65°C to +125°C.

RELIABILITY: MTBF per MIL-HBK-217D under operating conditions of 50°C baseplate temperature, maximum rated output power for standard model was calculated to be 164,406 hrs. for ground benign environment and 25,633 hrs. for air inhabited transport. With Enhanced Reliability Option (ER) MTBF was calculated to be 883,580 hrs. for ground benign environment and 94,956 hrs. for air inhabited transport.

ENVIRONMENT: Hermetically sealed and encapsulated to meet MIL-STD-810C, including altitude (to 1.3 inches of Hg), acceleration, vibration, shock and temperature altitude cycling.

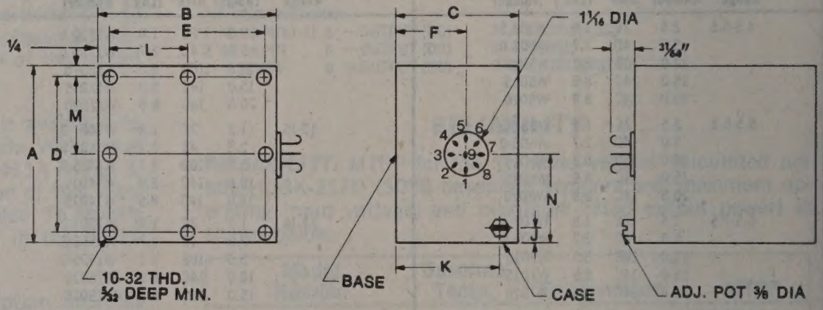
EFFICIENCY: Typical 55%.

SINGLE OUTPUT: WL SERIES

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Model Number
4.8 to 5.8	20	12M	WL5.3D-20
5.8 to 6.8	20	12M	WL6.3D-20
11 to 13	10	11S	WL12D-10
11 to 13	20	12N	WL12D-20
14 to 16	12	12M	WL15D-12
23 to 25	7.5	12M	WL24D-7.5
23 to 25	15	12N	WL24D-15
27 to 29	10	12N	WL28D-10
27 to 29	15	12N	WL28D-15

DUAL OUTPUT: WWL SERIES

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Model Number
±11 to 13	2	10J	WWL12D-2
±14 to 16	2	10J	WWL15D-2



SIZE	A	B	C	D	E	F	J	K	L	M	N
11S	3¼	6	2½	2.75	5.50	1½	¼	2⅛	2.75	—	1⅜
12M	4½	7⅜	2½	4.00	6.88	1½	¼	2	3.44	—	2¼
12N	4¾	8¾	2¾	4.25	8.25	1½	¼	2¼	4.13	—	2⅜
10J	3	5¼	2½	2.50	4.75	1½	¼	2⅛	2.38	—	1½

TOLERANCE: Fractions = ±1/32, Decimals = .015, ±.050
MATERIAL: Base — Aluminum 6061-T6, Case — Steel

OPTIONS

OVERVOLTAGE PROTECTION: (−1 Option) An internal crowbar-type OVP is available. Unit will crowbar output when output voltage exceeds adjustable set point, to 10% or 2V above maximum rated output. To specify option, add "−1" to model number.

ENHANCED RELIABILITY: (ER Option) This option provides increased reliability by using a higher level of military grade components. This feature allows the power supply to meet customer specific requirements as to "Hi-Rel" components. Please consult your nearest Abbott Sales Office for details.

TTL: (L Option) Abbott provides a isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off. The power supply will turn-on with TTL logic "1" and turn-off with TTL logic "0". To specify this feature, please add an "L" to the character preceding the first dash of the model number.

3ϕ ·WYE: (−3 Option) This input voltage is also available as an option. To specify, add "−3" to the end of the model number.

PIN DESIGNATIONS:

	Single Output	Dual Output		Single Output	Dual Output		Single Output	Dual Output
1	AC Input	AC Input	4	+ Output	+ Output	7	− Sense	− Output
2	AC Input	AC Input	5	+ Sense	+ Sense	8	Case Gnd	− Sense
3	AC Input	AC Input	6	− Output	Com Output	9	Not Used	Case Gnd

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MILITARY POWER SUPPLIES

28 VDC to 5-28 VDC

MODEL
BA

SPECIFICATIONS

INPUT VOLTAGE: 24-30 VDC (20-32 VDC with option)

EFFICIENCY: Typical efficiency 55-75% for 5V units, 65-85% for 12, 15, and 18V units.

IN RUSH CURRENT: Less than 8 times the peak input current at low line, full out load and nominal output voltage.

LINE REGULATION: 0.1% (or 20 mV whichever is greater)

LOAD REGULATION: 0.1% (or 20 mV whichever is greater).

PARD (NOISE & RIPPLE): 100 mV peak-to-peak, 20 mVRMS from +25°C to +100°C; 130 mV peak-to-peak, 40 mVRMS from −55°C to +25°C.

ADJUSTMENT RANGE: Output is continuously adjustable between the limits shown by means of externally accessible adjustment potentiometer.

RESOLUTION:	**Nominal Output Voltage**	**Resolution**
	5, 12, 15	35 mV
	24, 28	60 mV

INSULATION VOLTAGE: 100 VDC between input and output, and input and case; 50 VDC between output and case.

INSULATION RESISTANCE: 50 megohms between input and output, input and case when measured at 50 VDC.

POLARITY: Inputs and outputs are isolated, either positive or negative side may be grounded.

TEMPERATURE RANGE: Operating −55°C to +100°C baseplate temperature. Derated maximum output current linearly above +85°C baseplate temperature to 80% of full load rating at +100°C baseplate temperature. Storage: −65°C to +125°C.

TEMPERATURE EFFECT (COEFFICIENT): Less than 0.01% per degree Celsius.

ENVIRONMENT: Hermetically sealed and encapsulated to meet MIL-STD-810C, including altitude (to 1.3 inches of Hg), acceleration, vibration, shock and temperature altitude cycling.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against a short circuit of any duration. Unit automatically recovers to normal when fault is removed.

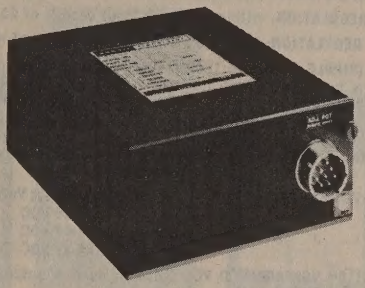
INPUT TRANSIENT PROTECTION: Unit will shut off at input voltage of 37V. Maximum voltage is 80V for one second.

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit monitors the voltage directly at the load using extra "sensing leads." The resulting circuit action compensates for a DC voltage drop up to 0.3V in the load leads.

LOAD TRANSIENT RESPONSE: Output voltage returns to regulation limits within 2 milliseconds after 50% step change in load current. Maximum overshoot is less than 0.8V.

ELECTROMAGNETIC INTERFERENCE: Meets MIL-STD-461A, Methods CE01 and CE03 for conducting emissions (available with "F" option).

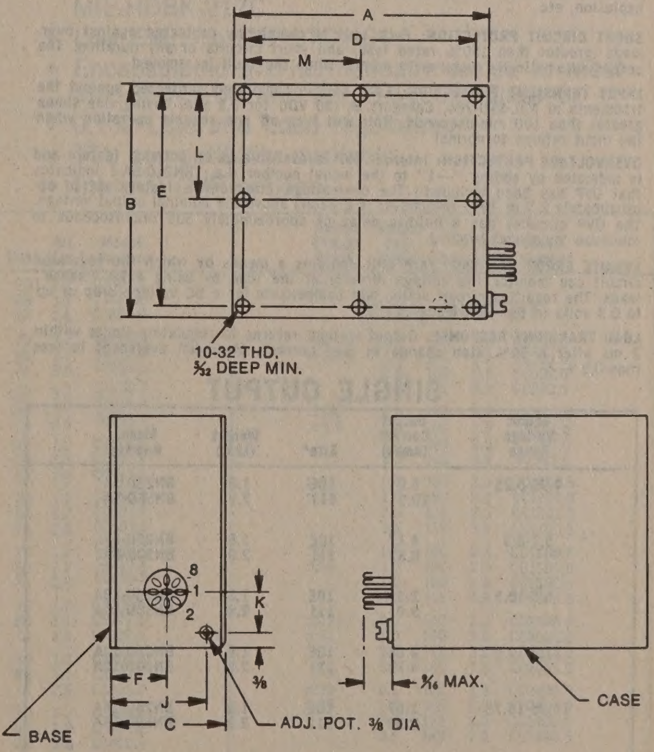
RELIABILITY: The Mean Time Between Failure (MTBF) per MIL-HDBK-217D under operating conditions of +50°C baseplate temperature, maximum rated output power for BA100D-5A-1 was calculated to be 139,899 hrs. for a ground benign environment and 16,866 hrs. for an air inhabited transport environment. With Enhanced Reliability Option (ER) MTBF was calculated to be 378,759 hrs. for ground benign environment and 51,131 hrs. for air inhabited transport environment.



FEATURES

- Up to 85% efficiency
- Meets MIL-STD-810C
- Wide DC input range available (20-32 VDC)
- Tight Regulation within 0.1%

Output Voltage Range (VDC)	Output Current (Amps)	Size (see Dwg.)	Weight (Lbs.)	Model Number
4.7 to 5.3	20.0	12F	4.7	BA100D-5A
11.25 to 12.75	8.33	12F	4.7	BA100D-12A
14.1 to 15.9	6.67	12F	4.7	BA100D-15A
22.5 to 25.5	4.17	12F	4.7	BA100D-24A
26.3 to 29.7	3.57	12F	4.7	BA100D-28A



A	B	C	D	E	F	J	K	L	M
5.875	5.5	2.625	5.37	5	1.375	2.125	1.37	2.5	2.68

OPTIONAL FEATURES

TTL: (L Option) Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off. The power supply will turn-on with TTL logic "1", and turn-off with TTL logic "0". To specify this feature, please add an "L" to the character preceding the first dash of the model number. (EXAMPLE: BA100D-5A to BA100DL-5A)

SPECIAL CONNECTORS: A hermetically sealed military-type connector is available for the BA series (as shown in picture). Please consult your nearest Abbott Sales Office for details.

EMI FILTER: (F Option) An internal EMI filter is available to reduce conducted interference on the input leads. With these filters the Model BA will comply with MIL-STD-461A Notice 3, CE01 and CE03 on the input leads. To specify this feature, please add an "F" after "D" in the model number. (EXAMPLE: BA100D-5A to BA100DF-5A)

REMOTE PROGRAM OPTION: (R Option) Units can be modified so that their output voltage can be adjusted from a remote location. This is accomplished by adding an additional pin to the header on the unit. To specify this option, please add an "R" after this character "D" in the model number. (EXAMPLE: BA100D-5A to BA100DR-5A).

OVERVOLTAGE PROTECTION: (-1 Option) An internal non-crowbar type OVP, power supply turns off when output voltage exceeds set point (available as option by adding "-1" to model number)

WIDER INPUT VOLTAGE RANGE: (H Option) The standard model BA operates from an input voltage range of 24 to 30 VDC. The units can be modified to operate from 20 to 32 VDC. To have this feature included add an "H" after the "D" in the model number and specify the desired input voltage range in parentheses after the entire model number. (EXAMPLE: BA100D-5A to BA100DH-5A (20-26))

ENHANCED RELIABILITY: (ER Option) This option provides increased reliability by using higher levels of military grade components. This feature allows the power supply to meet customer specific requirements as to "Hi-Rel" components, environmental testing and extended Thermal Cycling. Please consult your nearest Abbott Sales Office for details.

SPECIAL ENCAPSULATION: (E Option) All of our hermetically sealed power modules are encapsulated to meet or exceed the shock, acceleration and vibration requirements of MIL-STD-810C. Special encapsulation to enable these modules to withstand higher shock levels of 60g's, acceleration levels of 50g's and vibration levels of 30g's is available. To specify this feature, please add an "E" after the character "D" in the model number. (EXAMPLE: BA100D-5A to BA100DE-5A)

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ABBOTT TRANSISTOR LABORATORIES, INC.

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Eastern: 520 Main St., Ft. Lee, NJ 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
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abbott
MILITARY POWER SUPPLIES

20-32 VDC to 5-50 VDC

MODEL
BN
and BBN

SPECIFICATIONS

INPUT VOLTAGE RANGE: 20 to 32 VDC

EFFICIENCY: Typical efficiency ranges from 50 to 70%.

INRUSH CURRENT: Less than 8 times normal steady-state full load input current

LINE REGULATION: Within 0.5% for input change of 20 to 32 VDC

LOAD REGULATION: Within 0.5%. For load change of no load to full load

PARD (RIPPLE & NOISE): 100 mv peak-to-peak, 25 mv rms from 25°C to +100°C: 130 mv peak-to-peak, 40 mv rms from −55°C to +25°C. Measured at power module terminals with measurement system noise bandwidth of 25 MHz

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown by means of an externally accessible screwdriver adjustment potentiometer. Wider output ranges are available by restricting the input voltage range. Consult the factory for further information

ADJUSTMENT RESOLUTION:	Nominal Output Voltage	Resolution
	5-10 VDC	37 mv
	12-18 VDC	49 mv
	24-31 VDC	75 mv

ISOLATION VOLTAGE: 100 VDC between input & output and input & case; 50 VDC between output & case

INSULATION RESISTANCE: 50 megohms minimum between input & output, input & case and output & case when measured at 50 VDC

POLARITY: Inputs and outputs are isolated; either positive or negative side may be grounded.

TEMPERATURE RANGE: Operating; −55°C to +100°C baseplate temperature. Derate maximum output current linearly above 85°C baseplate temperature to 80% of full load rating at 100°C baseplate temperature. Storage; −65°C to +125°C

TEMPERATURE EFFECT (COEFFICIENT): 0.03% per degree Celsius

ENVIRONMENT: Hermetically sealed and encapsulated to meet the environmental requirements to MIL-STD-810C and MIL-E-5400P, Class 2 including altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

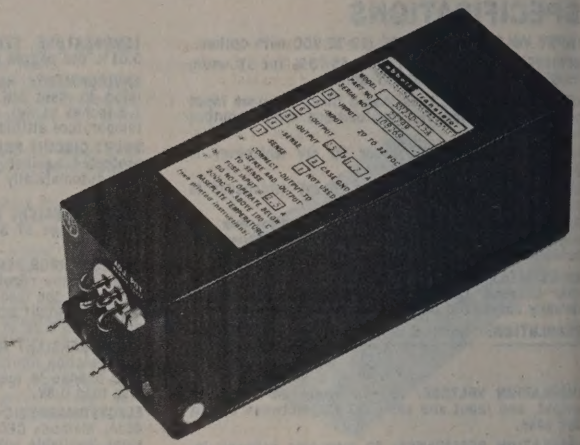
SHORT CIRCUIT PROTECTION: Each unit is completely protected against overloads (greater than 150% rated load) and short circuits of any duration. The output automatically restores to normal when the fault is removed

INPUT TRANSIENT PROTECTION: Each unit is completely protected against the transients of MIL-STD-704, Category B, (80 VDC for 0.1 sec) having rise times greater than 100 microseconds. Unit will turn off and resume operation when the input returns to normal

OVERVOLTAGE PROTECTION: Internal OVP is available as an optional feature and is indicated by adding "—1" to the model number (i.e.: BN25D-5A-1 indicates that OVP has been included.) The overvoltage threshold is factory set to approximately 2 V or 10% (whichever is greater) above the nominal output voltage. The OVP circuitry has a built-in delay of approximately 500 microseconds to minimize 'nuisance' tripping

REMOTE ERROR SENSING: Each unit contains a means by which the regulator circuit can monitor the voltage directly at the load by using extra "sense" leads. The resulting circuit action will compensate for a DC voltage drop of up to 0.3 volts in the load leads

LOAD TRANSIENT RESPONSE: Output voltage returns to regulation limits within 2 ms after a 50% step change in load current. Maximum overshoot is less than 0.8 V



High Efficiency

- Operating temperature range: −55°C to +100°C operation.
- Up to 70% efficiency.
- Small size.
- High reliability. MTBF: 112,000 hrs. per MIL-HDBK-217C.
- Short Circuit Protection.

TURN-ON/TURN-OFF OVERSHOOT: No overshoot during turn-on into loads greater than half load. For loads less than half load, turn-on overshoot is less than 0.8 V for 25 ms. No turn-off overshoot under any conditions

ELECTROMAGNETIC INTERFERENCE: Designed to meet the requirements of MIL-STD-461A for generation of conducted and radiated interference. Test report on a typical model is available.

RELIABILITY: MTBF per MIL-HDBK-217C up to 112,000 hrs.

SINGLE OUTPUT

Output Voltage Range	Output Current (Amps)	Size*	Weight (Lbs.)	Model Number
4.75-5.25	5.0 10.0	10E 11J	1.8 2.9	BN25D-5A BN50D-5A
5.7-6.3	4.17 8.33	10E 11J	1.8 2.9	BN25D-6A BN50D-6A
9.5-10.5	2.5 5.0	10E 11J	1.8 2.9	BN25D-10A BN50D-10A
11.4-12.6	2.08 4.17	10E 11J	1.8 2.9	BN25D-12A BN50D-12A
14.25-15.75	1.67 3.33	10E 11J	1.8 2.9	BN25D-15A BN50D-15A
17.1-18.9	1.39 2.78	10E 11J	1.8 2.9	BN25D-18A BN50D-18A
22.8-25.2	1.04 2.08	10E 11J	1.8 2.9	BN25D-24A BN50D-24A
26.6-29.4	0.89 1.79	10E 11J	1.8 2.9	BN25D-28A BN50D-28A
29.45-32.55	0.81 1.61	10E 11J	1.8 2.9	BN25D-31A BN50D-31A
45.6-50.4	0.52 1.04	10E 11J	1.8 2.9	BN25D-48A BN50D-48A

*See page 601 for size charts.

DUAL OUTPUT

±11.4 to ±12.6	1.04 2.08	10F 11J	2.2 2.9	BBN25D-12A BBN50D-12A
±14.25 to ±15.75	0.83 1.67	10F 11J	2.2 2.9	BBN25D-15A BBN50D-15A

Dual Output Units: 1) The output current listed is for each output.

2) The negative output is "semiregulated" and will meet regulation specifications only when operated into a balanced load from ½ load to full load.

3) The negative output will typically be within 4% of the positive output voltage for load imbalances up to 3:1 in magnitude, provided outputs have a minimum of 30% full load.

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For More Information. Circle No. 314

abbott
MILITARY POWER SUPPLIES

28 VDC to 5-37 VDC

MODEL
C
and CC

SPECIFICATIONS

INPUT VOLTAGE RANGE: 24 to 30VDC. Other input ranges available

LINE REGULATION: 0.1% (0.2% for duals) or 10 mv (whichever is greater) for input change of 24 to 30 VDC with load constant

LOAD REGULATION: 0.1% (0.2% for duals) or 20 mv (whichever is greater) for change from no load to full load with line constant

RIPPLE: 0.02% or 5 mv RMS (whichever is greater) 50 mv peak-to-peak maximum, each output, measured with scope having 25 MHz bandwidth

OUTPUT VOLTAGE ADJUSTMENT: Voltage is continuously adjustable between the limits shown in the table by means of an externally accessible screwdriver adjustment potentiometer

TRACKING ACCURACY: The negative output will track the positive output to within 1.0% or 100 mv (whichever is greater) for all rated conditions of input voltage, output current, operating temperature, and output voltage adjustment

ISOLATION VOLTAGE: 200 volts DC between input and output, input and case, and output and case

INSULATION RESISTANCE: 50 megohms minimum at 50 volts DC between input and output, input and case, and output and case

POLARITY: Inputs and outputs are isolated, either positive or negative side may be grounded.

TEMPERATURE RANGE: Operating: −55°C to +100°C maximum at center of mounting base
Storage: −65°C to +125°C

TEMPERATURE COEFFICIENT: 0.03% per degree Celsius maximum

ENVIRONMENT: Encapsulated to meet the environmental requirements of MIL-STD-810C and MIL-E-5400P, Class 2, including: altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, salt spray, fungus, explosion, etc.

SHORT CIRCUIT PROTECTION: Each unit is completely protected against an overload or short circuit of any duration. The output automatically restores to normal when the overload is removed

INPUT TRANSIENT PROTECTION: MIL-STD-704A, Fig. 9, Limt 1 (80 VDC for 0.1 sec.).

LOAD TRANSIENT RECOVERY TIME: Output voltage returns to regulation limits within 100 microseconds (200 microseconds for duals) after 50% step change in load current

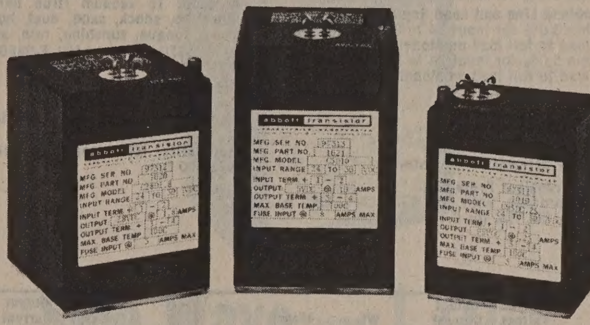
RELIABILITY: MTBF per MIL-HDBK-217C up to 277,200 hrs.

ELECTROMAGNETIC INTERFERENCE: Units meet EMI requirements of MIL-STD 461 conducted and radiated (F option).

OVER-VOLTAGE PROTECTION*: An internal, non-crowbar type OVP is available. Power supply turns off when output voltage exceeds set-point.

TTL*: Abbott provides an isolated pair of terminals used to turn-on and turn-off the regulator portion of the power supply. The unit remains in an idling state while the output is off.

* Inclusion of these optional features on these models will most likely require that the case size increases slightly. Please consult nearest Abbott sales office for further details.



High Performance

- Operating temperature range: −55°C to +100°C.
- Low Peak-to-Peak Ripple.
- Compact. Power density up to 2 watts per cu. in.
- High reliability. Up to 277,200 hrs. MTBF per MIL-HDBK-217C.
- Low EMI. To MIL-STD-461.
- Encapsulated and hermetically sealed to meet MIL-STD-810C and MIL-E-5400P, Class 2.
- 0.1% Line and Load regulation.
- TTL compatibility available.
- Internal OVP optional.

Output Voltage Range	Output Curr. (Amps)	Size†	Wt. (Lbs.)	Model Number
4.5-5.5	2.5	2D	1.2	C5D2.5
	5.0	6B	1.7	C5D5.0
	10.0	7A	2.6	C5D10
5.5-6.5	2.5	2D	1.2	C6D2.5
	5.0	6B	1.7	C6D5.0
	10.0	7A	2.6	C6D10
6.5-7.5	2.5	2D	1.2	C7D2.5
	5.0	6B	1.7	C7D5.0
	10.0	7A	2.6	C7D10
7.5-8.5	1.8	2D	1.2	C8D1.8
	3.5	6B	1.7	C8D3.5
	7.5	7A	2.6	C8D7.5
8.5-9.5	1.8	2D	1.2	C9D1.8
	3.5	6B	1.7	C9D3.5
	7.5	7A	2.6	C9D7.5
9.5-10.5	1.8	2D	1.2	C10D1.8
	3.5	6B	1.7	C10D3.5
	7.5	7A	2.6	C10D7.5
10.5-11.5	1.8	2D	1.2	C11D1.8
	3.5	6B	1.7	C11D3.5
	7.5	7A	2.6	C11D7.5
11-13	1.2	2D	1.2	C12D1.2
	2.5	6B	1.7	C12D2.5
	5.0	7A	2.6	C12D5.0
13-15	1.2	2D	1.2	C14D1.2
	2.5	6B	1.7	C14D2.5
	5.0	7A	2.6	C14D5.0
14-16	1.2	2D	1.2	C15D1.2
	2.5	6B	1.7	C15D2.5
	5.0	7A	2.6	C15D5.0
15-17	1.2	2D	1.2	C16D1.2
	2.5	6B	1.7	C16D2.5
	5.0	7A	2.6	C16D5.0
17-19	1.2	2D	1.2	C18D1.2
	2.5	6B	1.7	C18D2.5
	5.0	7A	2.6	C18D5.0
19-21	0.8	2D	1.2	C20D0.8
	1.8	6B	1.7	C20D1.8
	3.5	7A	2.6	C20D3.5
21-23	0.8	2D	1.2	C22D0.8
	1.8	6B	1.7	C22D1.8
	3.5	7A	2.6	C22D3.5
23-25	0.8	2D	1.2	C24D0.8
	1.8	6B	1.7	C24D1.8
	3.5	7A	2.6	C24D3.5
25-27	0.8	2D	1.2	C26D0.8
	1.8	6B	1.7	C26D1.8
	3.5	7A	2.6	C26D3.5
27-29	0.8	2D	1.2	C28D0.8
	1.8	6B	1.7	C28D1.8
	3.5	7A	2.6	C28D3.5
29-31	0.6	2D	1.2	C30D0.6
	1.2	6B	1.7	C30D1.2
	2.5	7A	2.6	C30D2.5
31-33	0.6	2D	1.2	C32D0.6
	1.2	6B	1.7	C32D1.2
	2.5	7A	2.6	C32D2.5
33-35	0.6	2D	1.2	C34D0.6
	1.2	6B	1.7	C34D1.2
	2.5	7A	2.6	C34D2.5
35-37	0.6	2D	1.2	C36D0.6
	1.2	6B	1.7	C36D1.2
	2.5	7A	2.6	C36D2.5

DUAL OUTPUT

Output Voltage Range	Output Curr. (Amps)	Size†	Wt. (Lbs.)	Model Number
±2.75- ±3.25	0.5	10C	2.3	CC3D0.5
	1.0	10C	2.3	CC3D1.0
	2.0	10D	2.5	CC3D2.0
	3.5	11E	3.9	CC3D3.5
±4.5- ±5.5	0.5	10C	2.3	CC5D0.5
	1.0	10C	2.3	CC5D1.0
	2.0	10D	2.5	CC5D2.0
	3.5	11E	3.9	CC5D3.5
±11- ±13	0.5	10C	2.3	CC12D0.5
	1.0	10C	2.3	CC12D1.0
	2.0	10D	2.5	CC12D2.0
	3.5	11E	3.9	CC12D3.5
±14- ±16	0.5	10C	2.3	CC15D0.5
	1.0	10C	2.3	CC15D1.0
	2.0	10D	2.5	CC15D2.0
	3.5	11E	3.9	CC15D3.5
±19- ±21	0.5	10C	2.3	CC20D0.5
	1.0	10D	2.5	CC20D1.0
	2.0	11E	3.9	CC20D2.0
	3.5	14D	7.9	CC20D3.5
±23- ±25	0.5	10C	2.3	CC24D0.5
	1.0	10D	2.5	CC24D1.0
	2.0	11E	3.9	CC24D2.0
	3.5	14D	7.9	CC24D3.5

***See page 601 for size charts.**

Other standard Models with any output up to 100 vdc are available. For complete information, please consult our nearest office.
Other standard Models with any output between ±2.75 and ±31.0 vdc are available. For complete information, please consult our nearest office.

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abbott
MILITARY POWER SUPPLIES

28 VDC to 500 VDC

MODEL
B

SPECIFICATIONS

Input Voltage Range
24 to 30 volts DC Other ranges available

Line Regulation
Within 0.4% for input 24 to 30 VDC

Combined Line and Load Regulation
Within 3.0% for input 24 to 30 VDC and from ½ load to full load on Model B's
Within 5.0% for input 24 to 30 VDC and from ½ load to full load on Model BL's

Ripple
0.5 RMS — Model B's
1.0% RMS — Model BL's

Voltage Adjustment Range
12% by screwdriver adjustment

Input Transient Protection
In accordance with MIL-STD-704A, Fig. 9, Limit 1, (80 VDC for 0.1 sec.)

Environment
+212°F max. at mounting base using adequate heat sink
−65°F min. at mounting surface
Altitude: To vacuum (true hermetic seal). Vibration, shock, sand, dust, humidity, salt-spray, fungus, sunshine, rain, and explosion to MIL-STD-810C and MIL-E-5400P, Class 2

Output Voltage and Current
See specific models listed
(Outputs and inputs are isolated)

Reliability: MTBF per MIL-HDBK-217C up to 626,400 hrs.

High Reliability

- Operating temperature range −54°C to +100°C.
- Small size.
- High reliability. Up to 626,400 hrs. MTBF per MIL-HDBK-217C.
- Encapsulated and hermetically sealed. Meets MIL-STD-810C and MIL-E-5400P, Class 2.

Output Voltage Range	Output Current (Amps)	Size*	Wt. lbs.	Model Number
4.7-5.3	0.400	1B	0.5	BL02D-5A
	1.0	1A	0.9	BL05D-5A
	2.0	1	1.0	BL1D-5A
	4.0	2	1.1	BL2D-5A
	6.0	4	1.3	BL3D-5A
	10.0	6A	2.5	BL5D-5A
5.3-5.9	0.357	1B	0.5	BL02D-5.6A
	0.9	1A	0.9	BL05D-5.6A
	1.8	1	1.0	BL1D-5.6A
	3.6	2	1.1	BL2D-5.6A
	5.4	4	1.3	BL3D-5.6A
	8.91	6A	2.5	BL5D-5.6A
5.9-6.6	0.318	1B	0.5	BL02D-6.3A
	0.8	1A	0.9	BL05D-6.3A
	1.6	1	1.0	BL1D-6.3A
	3.2	2	1.1	BL2D-6.3A
	4.8	4	1.3	BL3D-6.3A
	7.92	6	1.9	BL5D-6.3A
6.6-7.4	0.286	1B	0.5	BL02D-7A
	0.7	1A	0.9	BL05D-7A
	1.4	1	1.0	BL1D-7A
	2.8	2	1.1	BL2D-7A
	4.2	4	1.3	BL3D-7A
	7.15	6	1.9	BL5D-7A
7.4-8.3	0.253	1B	0.5	BL02D-7.9A
	0.63	1A	0.9	B05D-7.9A
	1.26	1	1.0	BL1D-7.9A
	2.52	2	1.1	BL2D-7.9A
	3.78	4	1.3	BL3D-7.9A
	6.32	6	1.9	BL5D-7.9A
8.3-9.3	0.227	1B	0.5	BL02D-8.8A
	0.57	1A	0.9	B05D-8.8A
	1.14	1	1.0	BL1D-8.8A
	2.28	2	1.1	BL2D-8.8A
	3.42	4	1.3	BL3D-8.8A
	5.68	6	1.9	BL5D-8.8A
9.3-10.4	0.202	1B	0.5	B02D-9.9A
	0.50	1A	0.9	B05D-9.9A
	1.00	1	1.0	BL1D-9.9A
	2.00	2	1.1	BL2D-9.9A
	3.00	4	1.3	BL3D-9.9A
	5.05	6	1.9	BL5D-9.9A
	10.10	11	3.7	BL10D-9.9A
10.4-11.6	0.182	1B	0.5	B02D-11A
	0.45	1A	0.9	B05D-11A
	0.91	1	1.0	BL1D-11A
	1.82	2	1.1	BL2D-11A
	2.73	4	1.3	BL3D-11A
	4.55	6	1.9	BL5D-11A
	9.10	11	3.7	BL10D-11A
11.6-13.0	0.163	1B	0.5	B02D-12.3A
	0.40	1A	0.9	B05D-12.3A
	0.81	1	1.0	BL1D-12.3A
	1.62	2	1.1	BL2D-12.3A
	2.43	4	1.3	BL3D-12.3A
	4.06	6	1.9	BL5D-12.3A
	8.12	11	3.7	BL10D-12.3A
	13.83	14	10.3	BL17D-12.3A
13.0-14.8	0.145	1B	0.5	B02D-13.8A
	0.36	1A	0.9	B05D-13.8A
	0.72	1	1.0	BL1D-13.8A
	1.44	2	1.1	BL2D-13.8A
	2.15	4	1.3	BL3D-13.8A
	3.62	6	1.9	BL5D-13.8A
	7.24	11	3.7	BL10D-13.8A
	12.31	14	10.3	BL17D-13.8A
14.8-16.6	0.127	1B	0.5	B02D-15.7A
	0.32	1A	0.9	B05D-15.7A
	0.64	1	1.0	BL1D-15.7A
	1.28	2	1.1	BL2D-15.7A
	1.92	4	1.3	BL3D-15.7A
	3.18	6	1.9	BL5D-15.7A
	6.36	11	3.7	BL10D-15.7A
	10.81	14	10.3	BL17D-15.7A
16.6-18.6	0.114	1B	0.5	B02D-17.6A
	0.28	1A	0.9	B05D-17.6A
	0.57	1	1.0	BL1D-17.6A
	1.14	2	1.1	BL2D-17.6A
	1.71	4	1.3	BL3D-17.6A
	2.84	6	1.9	BL5D-17.6A
	5.68	11	3.7	BL10D-17.6A
	9.65	14	10.3	BL17D-17.6A
18.6-20.8	0.101	1B	0.5	B02D-19.7A
	0.255	1A	0.9	B05D-19.7A
	0.510	1	1.0	BL1D-19.7A
	1.02	2	1.1	BL2D-19.7A
	1.63	4	1.3	BL3D-19.7A
	2.54	6	1.9	BL5D-19.7A
	5.08	11	3.7	BL10D-19.7A
	8.62	14	10.3	BL17D-19.7A
20.8-23.3	0.091	1B	0.5	B02D-22A
	0.230	1A	0.9	B05D-22A
	0.460	1	1.0	BL1D-22A
	0.920	2	1.1	BL2D-22A
	1.38	4	1.3	BL3D-22A
	2.27	6	1.9	BL5D-22A
	4.54	11	3.7	BL10D-22A
	7.72	14	10.3	BL17D-22A
23.3-26.1	0.081	1B	0.5	B02D-24.7A
	0.205	1A	0.9	B05D-24.7A
	0.410	1	1.0	BL1D-24.7A
	0.820	2	1.1	BL2D-24.7A
	1.23	4	1.3	BL3D-24.7A
	2.02	6	1.9	BL5D-24.7A
	4.04	11	3.7	BL10D-24.7A
	6.88	14	10.3	BL17D-24.7A
26.1-29.2	0.073	1B	0.5	B02D-27.6A
	0.180	1A	0.9	B05D-27.6A
	0.360	1	1.0	BL1D-27.6A
	0.720	2	1.1	BL2D-27.6A
	1.08	4	1.3	BL3D-27.6A
	1.81	6	1.9	BL5D-27.6A
	3.62	11	3.7	BL10D-27.6A
	6.16	14	10.3	BL17D-27.6A
29.2-32.6	0.065	1B	0.5	B02D-31A
	0.160	1A	0.9	B05D-31A
	0.320	1	1.0	B1D-31A
	0.640	2	1.1	B2D-31A
	0.960	4	1.3	BL3D-31A
	1.61	6	1.9	BL5D-31A
	3.22	11	3.7	BL10D-31A
	5.48	14	10.3	BL17D-31A
32.6-36.5	0.058	1B	0.5	B02D-34.6A
	0.145	1A	0.9	B05D-34.6A
	0.290	1	1.0	B1D-34.6A
	0.580	2	1.1	B2D-34.6A
	0.870	4	1.3	BL3D-34.6A
	1.44	6	1.9	BL5D-34.6A
	2.88	11	3.7	BL10D-34.6A
	4.91	14	10.3	BL17D-34.6A
36.5-40.9	0.052	1B	0.5	B02D-38.7A
	0.130	1A	0.9	B05D-38.7A
	0.260	1	1.0	B1D-38.7A
	0.520	2	1.1	B2D-38.7A
	0.780	4	1.3	BL3D-38.7A
	1.29	6	1.9	BL5D-38.7A
	2.58	11	3.7	BL10D-38.7A
	4.39	14	10.3	BL17D-38.7A
40.9-45.8	0.046	1B	0.5	B02D-43.3A
	0.155	1A	0.9	B05D-43.3A
	0.230	1	1.0	B1D-43.3A
	0.460	2	1.1	B2D-43.3A
	0.690	4	1.3	BL3D-43.3A
	1.15	6	1.9	BL5D-43.3A
	2.30	11	3.7	BL10D-43.3A
	3.92	14	10.3	BL17D-43.3A
45.8-51.4	0.041	1B	0.5	B02D-48.6A
	0.103	1A	0.9	B05D-48.6A
	0.206	1	1.0	B1D-48.6A
	0.412	2	1.1	B2D-48.6A
	0.618	4	1.3	B3D-48.6A
	1.03	6	1.9	BL5D-48.6A
	2.06	11	3.7	BL10D-48.6A
	3.49	14	10.3	BL17D-48.6A
51.4-59.0	0.036	1B	0.5	B02D-55.2A
	0.091	1A	0.9	B05D-55.2A
	0.182	1	1.0	B1D-55.2A
	0.364	2	1.1	B2D-55.2A
	0.546	4	1.3	B3D-55.2A
	0.905	6	1.9	BL5D-55.2A
	1.81	11	3.7	BL10D-55.2A
	3.07	14	10.3	BL17D-55.2A
59.0-66.0	0.032	1B	0.5	B02D-63A
	0.080	1A	0.9	B05D-63A
	0.160	1	1.0	B1D-63A
	0.320	2	1.1	B2D-63A
	0.480	4	1.3	B3D-63A
	0.795	6	1.9	BL5D-63A
	1.59	11	3.7	BL10D-63A
	2.69	14	10.3	BL17D-63A
66.0-74.0	0.029	1B	0.5	B02D-70A
	0.071	1A	0.9	B05D-70A
	0.143	1	1.0	B1D-70A
	0.286	2	1.1	B2D-70A
	0.429	4	1.3	B3D-70A
	0.715	6	1.9	BL5D-70A
	1.43	11	3.7	BL10D-70A
	2.42	14	10.3	BL17D-70A
74.0-83.0	0.025	1B	0.5	B02D-79A
	0.063	1A	0.9	B05D-79A
	0.127	1	1.0	B1D-79A
	0.254	2	1.1	B2D-79A
	0.381	4	1.3	B3D-79A
	0.634	6	1.9	BL5D-79A
	1.27	11	3.7	BL10D-79A
	2.15	14	10.3	BL17D-79A
83.0-514	Other standard models are available with output voltages between 83.0 and 514 Vdc at output power ratings of 2, 5, 10, 20, 30, 50, 100 or 170 watts. For complete information, please consult one of the offices listed below.			

*See page 601 for size charts.

ABBOTT TRANSISTOR LABORATORIES, INC. *For more information, use our Product Action Card in Volume 4.*
Power Supply Div. Western Offices: 5200 W. Jefferson Blvd., Los Angeles, CA 90016 (213) 936-8185. Telex: 69-1398
Eastern: 520 Main St., Ft. Lee, NJ 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
Florida: (305) 788-0845 • E. Canada: (613) 744-3066

abbott
MILITARY POWER SUPPLIES

28 VDC to 25-122 VAC

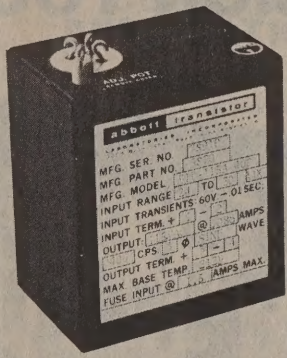
MODEL
S

SPECIFICATIONS

Input Voltage Range: 24 to 30 volts DC. Other input ranges are available.
Load Regulation: ±1.0% from ½ to full load.
Frequency Stability: ±1.0%
Voltage Adjustment Range: 12% by screwdriver adjustment.
Reliability: Up to 340,600 Hrs. MTBF per MIL-HDBK-217C.
Input Transient Protection: In accordance with MIL-STD-704A, Limit 1, Fig. 9 (80 volts for 0.1 seconds).
Environment: +212°F max. at mtg. base using adequate heat sink. −65°F min. at mounting base. Encapsulated to meet the environmental requirements of MIL-STD 810C and MIL-E 5400P, Class 2, including: altitude (to a vacuum), vibration, shock, acceleration, sand, dust, humidity, saltspray, fungus, explosion, etc.

Input Voltage Range	Output Frequency (Hertz)	Output Voltage Range	Output Power (Volt-Amps)	Harmonic Distortion (%)	Size (See Below)	Weight (Lbs.)	Model Number
24-30	400	25.4-28.6	5	2.0	4	1.6	S05D-27A-400
			10	2.5	4C	1.7	S1D-27A-400
			20	2.5	4B	2.3	S2D-27A-400
			30	2.5	6A	2.4	S3D-27A-400
			60	3.0	12	4.8	S6D-27A-400
			120	4.0	14	9.1	S12D 27A-400
24-30	400	108-122	5	2.0	4	1.6	S05D-115A-400
			10	2.5	4C	1.7	S1D-115A-400
			20	2.5	4B	2.3	S2D-115A-400
			30	2.5	6A	2.4	S3D-115A-400
			60	3.0	12	4.8	S6D-115A-400
			120	4.0	14	9.1	S12D-115A-400
24-30	800	25.4-28.6	5	2.0	4	1.6	S05D-27A-800
			10	2.5	4C	1.7	S1D-27A-800
			20	2.5	4B	2.3	S2D-27A-800
			30	2.5	6A	2.4	S3D-27A-800
			60	3.0	12	4.8	S6D-27A-800
			120	4.0	14	9.1	S12D-27A-800
24-30	800	108-122	5	2.0	4	1.6	S05D-115A-800
			10	2.5	4C	1.7	S1D-115A-800
			20	2.5	4B	2.3	S2D-115A-800
			30	2.5	6A	2.4	S3D-115A-800
			60	3.0	12	4.8	S6D-115A-800
			120	4.0	14	9.1	S12D-115A-800

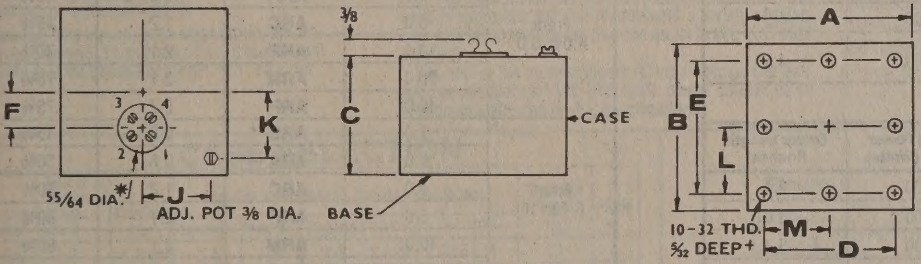
Output frequencies up to 1600 Hz are listed in our catalog as standard models. Contact our nearest office for your free copy.



Sine Wave — 1 Ø
400 to 1600 Hz

- Operating temperature range: −54°C to +100°C.
- High reliability. Up to 340,600 hrs. MTBF per MIL-HDBK-217C.
- Encapsulated and hermetically sealed per MIL-STD-810C and MIL-E-5400P.

CASE DIMENSIONS FOR ABBOTT MODELS W, WW, BN, BBN, C, CC, B AND S



* Models CC and WW use special 8 pin header. Size of special headers is 1 1/16 dia. by 5/16 high.
† 6-32 Thd, 3/16 deep on case size 1B.
** Model BN uses special terminals on A x C face.

Size	A	B	C	D	E	F	J	K	L	M
1	1½	2¾	3	1.00	2.25	9/16	½	1⅛	—	—
1A	1½	2¾	2¾	1.00	2.25	9/16	½	1⅛	—	—
1B	1½	2	2	1.00	1.50	0	½	¾	—	—
2	1⅞	2¾	3¼	1.37	2.25	¾	11/16	1⅛	—	—
2C	2	2¾	2⅛	1.50	2.25	0	¾	1⅛	—	—
2D	2	3	3½	1.50	2.50	¾	¾	1¼	—	—
2E	2⅛	3¼	3¼	1.62	2.75	⅞	13/16	1⅜	—	—
3	2¾	2¾	3	2.25	2.25	¾	1⅛	1⅛	—	—
3A	2¾	2¾	2¾	2.25	2.25	¾	1⅛	1⅛	—	—
4	2¼	2¾	3¼	1.75	2.25	¾	⅞	1⅛	—	—
4B	2½	3	3¾	2.00	2.50	¾	1	1¼	—	—
4C	2¼	2¾	3½	1.75	2.25	¾	⅞	1⅛	—	—
4D	2½	3½	3½	2.00	3.00	0	1	1½	—	—
5	2¾	2¾	3¼	2.25	2.25	¾	1⅛	1⅛	—	—
6	2¾	3	3¼	2.25	2.50	¾	1⅛	1¼	—	—
6A	2¾	3	4	2.25	2.50	¾	1⅛	1¼	—	—
6B	2¾	3⅛	3⅝	2.25	2.62	¾	1⅛	15/16	—	—
7	2¾	2¾	4	2.25	2.25	¾	1⅛	1⅛	—	—
7A	2⅞	3⅜	4½	2.37	2.87	¾	1 3/16	1 7/16	—	—
8B	2⅝	3½	2⅞	2.12	3.00	¾	1 1/16	1½	—	—
9A	2¾	4¾	3¾	2.25	4.25	0	1⅛	2⅛	—	—
9B	2¾	4¾	3½	2.25	4.25	0	1⅛	2⅛	—	—
9C	2½	4⅜	3⅛	2.00	3.87	1	1	1 15/16	—	—
9D	2⅝	4¾	3⅝	2.12	4.25	1	1 1/16	2⅛	—	—
10A	3	5	4	2.50	4.50	0	1¼	2¼	—	—

Size	A	B	C	D	E	F	J	K	L	M
10B	2⅞	4¼	4⅜	2.37	3.75	1⅜	1 3/16	1⅞	—	—
10C	3⅜	3⅜	3¾	2.87	2.87	¾	1 7/16	1 7/16	—	—
10D	3½	3½	4	3.00	3.00	¾	1½	1½	—	—
10E	2⅜	6¼	2½	1.87	5.75	**	**	**	2.87	—
10F	2¾	6¼	2½	2.25	5.75	**	**	**	2.87	—
10G	3½	5½	2½	3.00	3.50	**	**	**	—	—
10H	4	5½	2⅝	3.50	3.50	**	**	**	—	—
11	3	5½	3¼	2.50	5.00	2⅛	1¼	2½	2.50	—
11C	4¼	5¼	4	3.75	4.75	0	1⅞	2⅜	2.37	—
11D	4	4⅞	3⅞	3.50	4.37	1⅜	1¾	2 3/16	—	—
11E	3¾	4½	4¼	3.25	4.00	¾	1⅝	2	—	—
11F	2¾	6¼	2¾	2.25	5.75	1	1⅛	2⅞	2.87	—
11J	3⅜	6¼	2½	2.87	5.75	**	**	**	2.87	—
11K	3⅝	8 13/16	2⅝	2.55	4.31	**	**	**	—	—
12	3	5½	4	2.50	5.00	2⅛	1¼	2½	2.50	—
12A	4½	6	4	4.00	5.50	0	2	2¾	2.75	—
12C	3⅞	6¼	2¾	3.37	5.75	1½	1 11/16	2⅞	2.87	—
12F	5½	5⅞	2⅝	5.00	5.37	**	**	**	2.68	2.50
12G	5⅛	8¾	2⅝	4.62	6.56	**	**	**	3.28	—
13A	5½	6½	4½	5.00	6.00	0	2½	3	3.00	2.50
14	6	6	4	5.50	5.50	2⅜	2¾	2¾	2.75	2.75
14C	5½	5½	3⅝	5.00	5.00	1⅞	2½	2½	2.50	2.50
14D	6	6¼	3⅞	5.50	5.75	1¼	2¾	2⅞	2.87	2.75
14E	5¾	6¼	2¾	5.25	5.75	1¼	2⅝	2⅞	2.87	2.62
16A	6¾	7½	4¼	6.25	7.00	2¾	3⅛	3½	3.50	3.12

DIMENSIONAL TOLERANCES: FRACTIONS ±1/32; DECIMALS .XX ±0.015.

ABBOTT TRANSISTOR LABORATORIES, INC. *For more information, use our Product Action Card in Volume 4.*

Power Supply Div. Western Offices: 5200 W. Jefferson Blvd., Los Angeles, CA 90016 (213) 936-8185. Telex: 69-1398
Eastern: 520 Main St., Ft. Lee, NJ 07024 (201) 461-4411. Telex: 13-5332 • Southwest: 710 Kindred Lane, Richardson, TX 75080 (214) 437-0697
Florida: (305) 788-0845 • E. Canada: (613) 744-3066

ARNOLD MAGNETICS

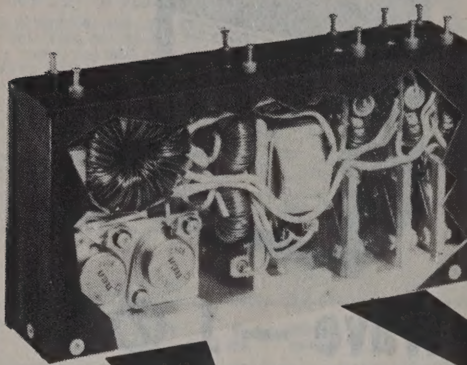
AC-DC/DC-DC MODULAR MINIATURIZED

SWITCHING POWER SUPPLIES

DESIGN YOUR OWN POWER SUPPLY

FROM OFF-THE-SHELF MODULES!

Miniature Packages to 400 Watts Output.



(Shown before encapsulation)

You select from over 120 Standard Sub-Modules to design your own "Tailor -Made" Switching Power Supply. Why wait many months for a "custom" supply and still risk the failure of an unproven circuit or thermal design?

- MIL-Spec or Industrial
- 50% to 75% smaller than other switchers
- From 1 to 10 DC Outputs DC Input AC or DC Input
- Power Density to 5.33 Watts /cubic inch
- Delivery in 8-12 weeks ARO
- Encapsulated for Reliability: MIL-STD-810C, MIL-E-5400, MIL-E-16400

1. SELECT INPUT DRIVER

(Use "E options" for ranges not shown)

AC INPUT

Input Voltage Range	Model	Output Power Rating (Watts)	Driver Length (Inches)
115 ±12 VAC 47-500 Hz	TL	100	4.2
	TH	200	4.8
	TV	300	8.1
	TW	400	4.5
115 ±12VAC 340-500 Hz	BL*	100	4.5

DC INPUT

Input Voltage Range	Model	Output Power Rating (Watts)	Driver Length (Inches)
28 VDC (24-30 VDC)	NL	100	2.4
	NH	200	3.0
	NV	300	5.4
48 ±4 VDC	JL	100	2.4
	JH	200	2.4
	JV	300	Consult Factory
125 ±10 VDC (100-150 VDC using "E" option)	KL	100	2.4
	KH	200	2.4
	NV	300	Consult Factory

* Cannot be used with ARF, ARM or ARP Regulators.

2. SELECT OUTPUT REGULATORS

(All outputs adjustable ±5% from nominal voltage. Outputs are isolated and can be connected in positive or negative polarity.)

Specify Nominal VDC Output	Output Current (maximum)	Model	Regulator Length (Inches)	Worst Case Efficiency
From 2.0 to 3.9	1.0	ARS**	0.6	30%
	2.0	ARA	0.6	30%
	3.0	ARC	1.2	30%
	5.0	ARF	2.1	60%
	10.0	ARM	2.1	60%
	20.0*	ARP	2.7	60%
From 4.0 to 6.0	1.5	ARS**	0.6	35%
	3.5	ARA	0.6	45%
	6.0	ARC	1.2	45%
	10.0	ARF	2.1	70%
	20.0	ARM	2.1	70%
	40.0*	ARP	2.7	75%
From 6.1 to 16	1.0	ARS**	0.6	45%
	2.0	ARA	0.6	50%
	4.0	ARC	1.2	50%
	5.0	ARF	2.1	80%
	10.0	ARM	2.1	80%
	16.0*	ARP	2.7	80%
From 16.1 to 30	0.5	ARS**	0.6	60%
	1.5	ARA	0.6	65%
	2.5	ARC	1.2	65%
	3.0	ARF	2.1	80%
	5.0	ARM	2.1	80%
	8.0*	ARP	2.7	80%
From 30.1 to 55	0.5	ARB	0.6	65%
	1.5	ARK	1.2	65%
From 56 to 110	0.25	ARB	0.6	70%
	0.75	ARK	1.2	70%
From 111 to 160	0.15	ARB	0.6	70%
	0.3	ARK	1.2	70%
From 161 to 200	0.1	ARB	0.6	75%
	0.2	ARK	1.2	75%
From 201 to 250	0.05	ARB	0.6	75%
	1.10	ARK	1.2	75%
From 251 to 300	0.05	ARB	0.6	75%
	0.1	ARK	1.2	75%

* Higher currents also available.

3. SELECT OPTIONS

(Contact Factory for prices)

Option Letter	Description	Option Letter	Description
V	Output Overvoltage Protection	TS	Over-Temperature Shutdown
T	Extended Temperature Operation	SYN*	External Synchronization
E	Extended Input Voltage Range	LC*	TTL On/Off Control
TP	Input Transient Protection	D*	Power-Down Signal
R	Remote Sense	S*	Output Sequencing
A	Remote Voltage Adjustment	LP*	Programmable Outputs

* Minimum Order of 10 units or Small-Lot Charge for these Options.
* * For ARS regulator, do not exceed agreed upon output current rating.

ARNOLD MAGNETICS CORPORATION
11520 W. Jefferson Blvd., Culver City, California 90230 • Phone: (213) 390-3537, (213) 390-8837 TWX: 910-343-6468

AC-DC/DC-DC MODULAR MINIATURIZED SWITCHING POWER SUPPLIES

ARNOLD MAGNETICS

OPERATING SPECIFICATIONS

- **REGULATOR SPECIFICATIONS**

ARA, ARC, ARB, ARK
LINE REGULATION (for ± 10% input change): 0.1% of E out + 10 mV
LOAD REGULATION (½ to full load change): 0.1% of E out + 10 mV.
TEMPERATURE COEFFICIENT: 0.01%/°C.

ARA, ARC, ARB, ARK
LINE REGULATION (for ± 10% input change): 0.2% of E out + 10 mV
LOAD REGULATION (½ to full load change): 0.2% of E out + 10 mV.
TEMPERATURE COEFFICIENT: 0.02%/°C.

ARA, ARC, ARB, ARK
0.1% of E out +10mV RMS.

ARS
0.25% of E out + 10 mV RMS.
23 mV RMS max. for outputs from 2-4 VDC.

ARF, ARM, ARP
0.5% of E out + 10 mV RMS.
35 mV RMS max. for outputs from 2-4 VDC.

- **Operating Temperature:** (Baseplate): −10°C to +71°C (optional −55°C to +85°C).
- **Storage Temperature:** −65°C to +100°C.
- **Short Circuit Protection:** All outputs are short circuit protected and feature foldback current limiting.
- **Output Adjustment Range:** All outputs are adjustable over a plus or minus 5% range minimum.
- **Input Voltage Surge Protection** (AC Input Units): 140 VAC. Unit will turn off if surge exceeds 140 VAC. (See TP option)
- **Semiconductor Junction Temperature:** Maximum of 120°C at operating baseplate temperature of +71°C or optional +85°C.
- **Isolation:** The inputs, case and outputs are isolated (floating) from each other. isolation test voltage is the greater of 50VDC or 1.3 X E out.

ENVIRONMENTAL SPECIFICATIONS

(Test Reports Available)

- **Temperature Range:** Operating Temperature: −10°C to +71° Baseplate Temperature. Optional −55°C to +85°C range. Non-Operating Storage Temperature: −65°C to +100°C.
- **High Temperature:** Per MIL-STD-810, Method 501, Procedure II.
- **Low Temperature:** Per MIL-STD-810, Method 502, Procedure I.
- **Temperature-Altitude:** Per MIL-STD-810, Method 504, Procedure I; the following details apply: −10°C to +71°C (and −55°C to +85°C) at Altitude: Sea level to 70,000 ft.
- **Humidity:** Per MIL-STD-810, Method 507, Procedure I.
- **Acceleration:** Per MIL-STD-810, Method 513, Procedure I and II, at a test level of 14 G.
- **Vibration:** Per MIL-STD-810, Method 514, Procedure I, at a test level of 15 G.
- **Shock:** Per MIL-STD-810, Method 516, Procedures I, II, III, V, and VI at a test level of 40 G.

MIL-STD 461A

Noise/Ripple Considerations

Qualifications to the provisions of MIL-STD 461A is a system level concern. Arnold Magnetics Power Supplies have been included in many systems that have received MIL-STD 461A approval without additional filtering. Other systems may require moderate filtering external to the power supply to pass all provisions of the MIL-STD 461A tests.

For example, a single two-pole filter has been used with over 140 different Arnold models to achieve MIL-STD 461A system approvals. We can recommend a variety of filters and installation techniques that can assist in MIL-STD 461A approval.

Because of the more stringent AC input voltage line leakage specifications of MIL-STD 461B, please consult us on applications affected by that specification.

CURRENT APPLICATIONS

GOVERNMENT/MILITARY

Space Shuttle—Flight Compartment Instrumentation
UYK-40 Military Computer—Including Arnold UPS Power Supply
Airborne Command Center Instrumentation—Over 140 Different Models in Use
Radar Warning Training System
Portable Dynamic Simulator (PDS) Threat Simulation System
Tow Missile Test Set
Stinger Missile Test Set
F-16 Ground Support Equipment
Aircraft Anti-Stall System
M47 Weapons System
Military Preparedness Data Bank
Dockside EW Training System
Mark 48 Torpedo Projectile Power Supply

HI-REL INDUSTRIAL

Voice Controlled Wheel Chair
Alaska Pipeline Monitor
Deep Water Camera for Cable Recovery
Medical Plasma Display
Microwave Station Alarm System
Oil Rig Control Computer
Multi-Channel Aricraft Flight Recorder
Nuclear Reactor Moderator System
Telephone Switching and Test
Ultra-Wide Band Oscilloscope
Putman Wind Generator
Turbine Control Electronics
Auto Analysis Data Recorder
Synthesized Sweeping Signal Generator (SSSG)
Communications Frequency Synthesizer
Power Switching Distribution Control

CASE SELECTION

Case Size	Total of Module Lengths (inches)	Baseplate Area	Case Dimensions (Inches)			Mounting Holes (Inches)			Final Unit Weight (oz.)	Figure No.
			Length(L)	Width(W)	Height(H)	M	N	Quan.		
AA	3.2	4.8 in²	3.5	1.6	3.6	1.125	2.750	4	21	1
BA	4.7	7.1 in²	5.0	1.6	3.6	1.125	4.250	4	30	1
CA	6.7	10.1 in²	7.0	1.6	3.6	1.125	2.750	6	41	1
FA	8.2	12.4 in²	8.5	1.6	3.6	1.125	3.500	6	50	1
DA	10.2	15.4 in²	10.5	1.6	3.6	1.125	4.500	6	62	1
"DOUBLE WIDE" Packages below allow modules to be mounted side by side.										
AB	2×3.2	9.7 in²	3.5	3.1	3.6	2.625	2.750	4	42	2
BB	2×4.7	14.2 in²	5.0	3.1	3.6	2.625	4.250	4	60	2
CB	2×6.7	20.2 in²	7.0	3.1	3.6	2.625	2.750	6	82	2
FB	2×8.2	24.8 in²	8.5	3.1	3.6	2.625	3.500	6	100	2
DB	2×10.2	30.8 in²	10.5	3.1	3.6	2.625	4.500	6	124	2
"TRIPLE WIDE" Packages below allow modules to be mounted three across.										
AC	3×3.2	14.4 in²	3.5	4.6	3.6	4.126	2.750	4	63	2
BC	3×4.7	21.3 in²	5.0	4.6	3.6	4.126	4.250	4	90	2
CC	3×6.7	30.3 in²	7.0	4.6	3.6	4.126	2.750	6	123	2
FC	3×8.2	37.2 in²	8.5	4.6	3.6	4.126	3.500	6	150	2
DC	3×10.2	46.2 in²	10.5	4.6	3.6	4.126	4.500	6	186	2

All cases are black anodized aluminum with turret-style solder terminals, and Teflon insulation.

Figure 1

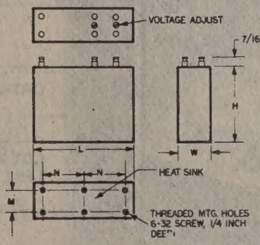
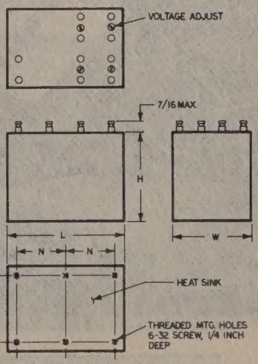


Figure 2



ARNOLD MAGNETICS CORPORATION

11520 W. Jefferson Blvd., Culver City, California 90230 • Phone: (213) 390-3537, (213) 390-8837 TWX: 910-343-6468

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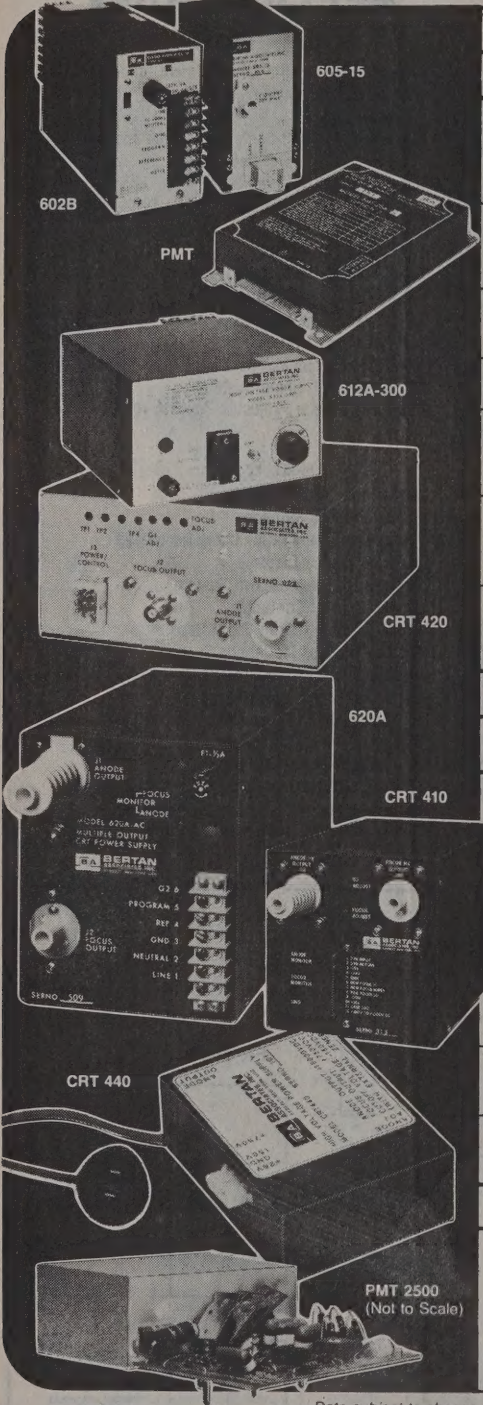
BERTAN ASSOCIATES, INC.

HIGH VOLTAGE
PRECISION POWER SUPPLIES

DELIVERY FROM STOCK

• Outputs to 150kV • Low Noise • High Stability • Computer Programmable



Model	Output Volts dc	Output mA	Regulation Line/Load%	Ripple mV p-p	Inches H × W × D	Input Power**
Single Output Modules						
ᴙ 602B-15P,N	0 to 1500*	10	0.001/0.002	15	5 × 3.1 × 8.6	A
ᴙ 602B-30P,N	0 to 3000*	5	0.001/0.002	30	5 × 3.1 × 8.6	A
ᴙ 602B-50P,N	0 to 5000*	2	0.001/0.002	50	5 × 3.1 × 8.6	A
ᴙ 602B-150P,N	0 to 15,000*	0.6	0.001/0.002	150	5 × 3.1 × 8.6	A
602B-200P,N	0 to 20,000*	0.4	0.005/0.005	800	5 × 4 × 8.6	A
603-15P,N	0 to 1500*	20	0.001/0.002	15	5 × 5.5 × 8.5	A
603-30P,N	0 to 3000*	10	0.001/0.002	30	5 × 5.5 × 8.5	A
603-50P,N	0 to 5000*	5	0.001/0.002	50	5 × 5.5 × 8.5	A
603-150P,N	0 to 15,000*	1.5	0.001/0.002	450	5 × 5.5 × 8.5	A
612A-200P,N	0 to 20,000*	1	0.001/0.002	200	4.9 × 8.8 × 8.4	A
612A-300P,N	0 to 30,000*	0.5	0.001/0.002	300	4.9 × 8.8 × 8.4	A
612A-500P,N	0 to 50,000*	0.3	0.001/0.002	800	4.9 × 8.8 × 8.4	A
PMT-1500P,N	0 to 1500*	1	0.005/0.005	25	1 × 2.6 × 3.5	+15V
PMT-2500P,N	0 to 2500*	0.5	0.005/0.005	25	1 × 2.6 × 3.5	+15V
ᴙ PMT-05AP,N	0 to 500*	8	0.001/0.002	5	1.1 × 3.9 × 5.3	C,D
ᴙ PMT-10AP,N	0 to 1000*	4	0.001/0.002	4	1.1 × 3.9 × 5.3	C,D
ᴙ PMT-20AP,N	0 to 2000*	2	0.001/0.002	2	1.1 × 3.9 × 5.3	C,D
ᴙ PMT-50AP,N	0 to 5000*	0.5	0.001/0.002	10	1.1 × 3.9 × 5.3	C,D
605A-15P,N	0 to 1500*	6	0.002/0.002	15	5 × 2.7 × 4.7	C
605A-30P,N	0 to 3000*	3	0.002/0.002	30	5 × 2.7 × 4.7	C
605A-75P,N	0 to 7500*	1	0.002/0.002	150	5 × 2.7 × 4.7	C
605A-150P,N	0 to 15,000*	0.4	0.002/0.002	750	5 × 2.7 × 4.7	C
606-15P,N	0 to 1500*	20	0.002/0.002	15	5 × 5.5 × 4.5	C
606-30P,N	0 to 3000*	10	0.002/0.002	30	5 × 5.5 × 4.5	C
606-75P,N	0 to 7500*	3	0.002/0.002	150	5 × 5.5 × 4.5	C
606-150P,N	0 to 15,000*	1.5	0.002/0.002	750	5 × 5.5 × 4.5	C
High Voltage Switching Modules						
HVS-505-10P,N	50 to 1000V*	700	0.05/0.05	500	6 × 12.5 × 14	A
HVS-505-50P,N	200 to 5000V*	150	0.05/0.05	2.5V	6 × 12.5 × 14	A
Multi-Output CRT Supplies						
CRT-410	Anode: +10 to 26kV Focus: +2.5 to 7.5kV Dyn: +300V/30μsec. G2: +300 to 1000V G1: 0 to −100V	0.05 0.5 0.1 0.1	0.005/0.01 0.01/0.05 0.01/0.02 0.01/0.02	1V 3V 100 50	6 × 6 × 10	E
CRT-420	Anode: +10kV Focus: +2 to +3.5kV Dyn: +250V/125μsec. G2: +300V G1: −10 to −70V Filament: 6.3V	0.5 0.5 0.5 0.1 750	0.003/0.005 0.005/0.005 0.005/0.005 0.005/0.005 0.1/1.0	700 800 30 30 30	3.4 × 6.8 × 9.4	A
CRT-440	Anode: +5 to 15kV Focus: +250 to 750V G1: −150V	0.25 1 1	0.05/0.05	7.5V 400	1.8 × 3.8 × 4.9	C
CRT-30 TEST SET	Anode: 0 to +30kV Focus: 0 to +10kV G2: 0 to +1kV	Complete functional test set for cathode ray tubes. Options available include G1, filament and dynamic focus outputs and IEEE 488 programming of high voltage outputs				
X-Ray Source Supplies						
XR-30	Target Voltage: 0 to +30kV Target Current: 0 to 4.5mA	A complete X-Ray power supply and control system including filament power supply. Provides local or remote computer control of X-Ray source target voltage and current. IEEE 488 programming available.				
XR-50	Target Voltage: 0 to +50kV Target Current: 0 to 2.5mA					
XR-75	Target Voltage: 0 to +75kV Target Current: 0 to 2mA					

Data subject to change.

See EEM, Gold Book or EBG for Rep List

*__Specify Output Polarity Suffix:__ P-Positive, N-Negative, R-Reversible, X-One Positive and One Negative Output. (e.g. 205A-10P specifies 0 to + 10,000V).

****Input Power:** **A**-115/230V±10%, 50-400Hz, **B**-±12V±24Vdc input from NIM bin **C**-+28Vdc. (Other dc input available on special order.) **D**-±12 to ±18 or +24 to +30Vdc. **E**-±15Vdc and +24Vdc

ᴙ **Recognized under the Component Program of Underwriters Laboratories Inc.**

Precision High Voltage Power Supplies for ELECTRON BEAM / CRT / ELECTROSTATIC AND DYNAMIC FOCUS / X RAYS PHOTOMULTIPLIER/HIGH SPEED LITHOGRAPHY/MEDICAL/CORONA DISCHARGE/ULTRASONIC/NUCLEAR INSTRUMENTATION/SEM

BA BERTAN ASSOCIATES, Inc. 121 New South Rd., Hicksville, NY 11801 • (516) 433-3110 • TWX 510-221-2144

For More Information. Circle No. 316

HIGH VOLTAGE INSTRUMENTATION & TEST EQUIPMENT

DELIVERY FROM STOCK

BA
BERTAN ASSOCIATES, INC.

• Regulated • Short Circuit and Arc Protected • Standard or Custom Design

Model	Output Volts dc	Output mA	Regulation Line/Load%	Ripple mV p-p	Inches H × W × D	Input Power**
Laboratory Instruments						
214	0 to ± 1000	15	0.001/0.005	15	5.3 × 7.6 × 7.5	A
215	0 to ± 3000	5	0.001/0.005	15	5.3 × 7.6 × 7.5	A
205A-01R	0 to ± 1000	30	0.001/0.005	10	3.5 × 19 × 10	A
205A-03R	0 to ± 3000	10	0.001/0.005	30	3.5 × 19 × 10	A
205A-05R	0 to ± 5000	5	0.001/0.005	50	3.5 × 19 × 10	A
205A-10P,N,R	0 to 10,000*	2.5	0.001/0.005	100	3.5 × 19 × 10	A
205A-20P,N,R	0 to 20,000*	1	0.001/0.005	300	3.5 × 19 × 10	A
205A-30P,N,R	0 to 30,000*	0.5	0.001/0.005	400	5.3 × 19 × 15	A
205A-50P,N,R	0 to 50,000*	0.3	0.001/0.005	2V	5.3 × 19 × 15	A
210-01R	0 to ± 1000	225	0.001/0.005	50	5.3 × 19 × 15	A
210-03R	0 to ± 3000	75	0.001/0.005	100	5.3 × 19 × 15	A
210-05R	0 to ± 5000	40	0.001/0.005	200	5.3 × 19 × 15	A
210-10P,N,R	0 to 10,000*	15	0.001/0.005	500	5.3 × 19 × 15	A
210-20P,N,R	0 to 20,000*	7	0.001/0.005	1V	5.3 × 19 × 15	A
210-30P,N,R	0 to 30,000*	4.5	0.001/0.005	1.5V	5.3 × 19 × 15	A
210-50P,N,R	0 to 50,000*	2.5	0.001/0.005	5V	5.3 × 19 × 15	A
Series 205A/210 are available with analog, binary, BCD or IEEE-488 remote programming.						
Nuclear Instrumentation Modules						
NIM342	0 to ± 2000	1	0.001/0.002	2	Single NIM	B
NIM345	0 to ± 5000	0.3	0.001/0.002	5	Single NIM	B
NIM353	0 to ± 3000	2	0.001/0.002	5	Single NIM	A
NIM355	0 to ± 5000	1	0.001/0.002	10	Single NIM	A
NIM301	0 to ± 1000	3	0.001/0.002	1	Dual NIM	B
NIM303	0 to ± 3000	1	0.001/0.002	3	Dual NIM	B
NIM305	0 to ± 5000	0.5	0.001/0.002	5	Dual NIM	B
NIM310P,N	0 to 10,000*	250μA	0.001/0.002	20	Dual NIM	B
NIM313A	0 to ± 3000	10	0.001/0.002	10	Dual NIM	A
NIM315	0 to ± 5000	5	0.001/0.002	25	Dual NIM	A
NIM320P,N	0 to 10,000*	2	0.001/0.002	100	Dual NIM	A
NIM362	0 to 2000	Dual outputs in a single width NIM package. Independent polarity reversal, voltage control and output voltage metering.				B
NIM365	0 to 5000					B
MWPC-1755P,N,X*	0 to 5000	0.5	0.001/0.002	50	All Models: • Dual Independent Outputs • Dual NIM	B
MWPC-1739P,N,X*	0 to 7500	0.5	0.001/0.002	50		B
MWPC-1792P,N,X*	0 to 10,000	0.3	0.001/0.001	50		B
Electron Beam Power Supplies						
EB-30	Beam: 0 to −30kV Bias: 0 to −1kV Fil: 0 to 5V	These units provide 3 independently adjustable and highly stable power supplies for beam acceleration, bias and filament in an electron beam system. Optional IEEE 488 programming is available.				A
EB-50	Beam: 0 to −50kV Bias: 0 to −2kV Fil: 0 to 5V					A

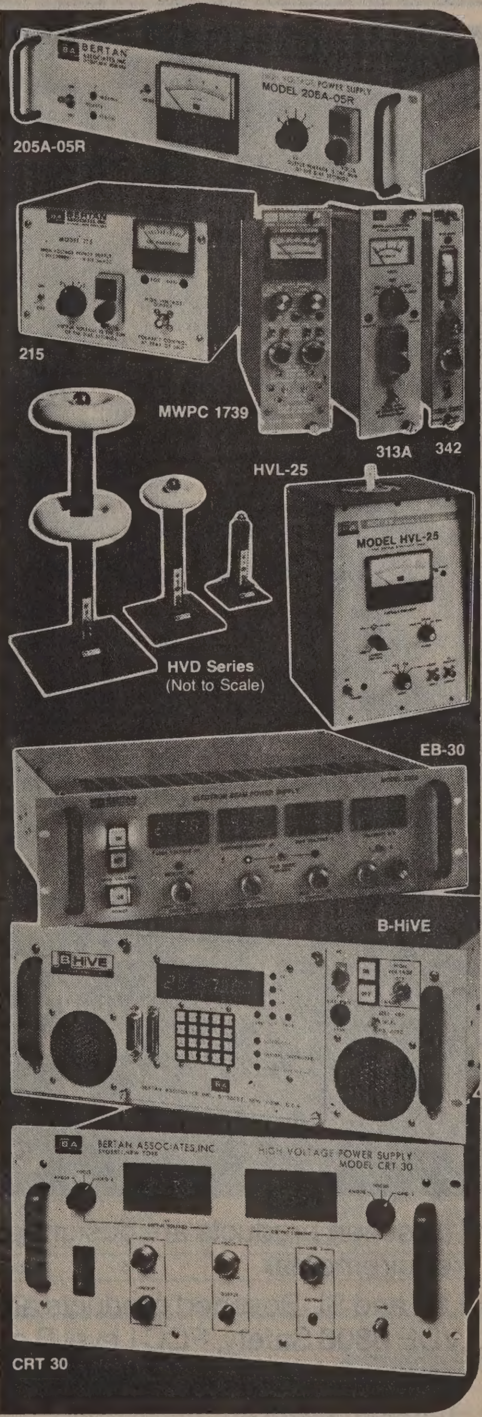
Microprocessor Based Multi-Output System

B-HIVE	Microprocessor controlled 32 output high voltage sytem with IEEE-488 and RS232C interfaces. For photomultiplier assemblies, multiwire proportional chambers and automatic test equipment. Can be used with any combination of 32 self contained plug in high voltage supplies, controllers for BERTAN Laboratory Supplies up to 75kV and/or controllers for other general purpose programmable and monitoring instrumentation.

Test Equipment

Electronic Load	Applied Voltage	Load Current	Size	Input
HVL-25	+5kV to +25kV	0 to 3mA	12 × 9 × 8	A

Resistive Dividers	Maximum Applied Voltage	Divider Impedance	Accuracy	Temp. Coef.	Inches H × W × D
HVD-10	10kV	100meg.	± 0.2%	25ppm	11 × 6.3 × 6.3
HVD-30	30kV	300meg.	± 0.2%	25ppm	16.8 × 7 × 7
HVD-60	60kV	600meg.	± 0.2%	25ppm	29.6 × 12 × 12



Application Oriented Custom Designs

Bertan provides the widest range of standard *off-the-shelf* High Voltage Power Supplies available. If our Application Engineers cannot match a standard catalog unit to your requirement we will be pleased to quote to your exact specifications.

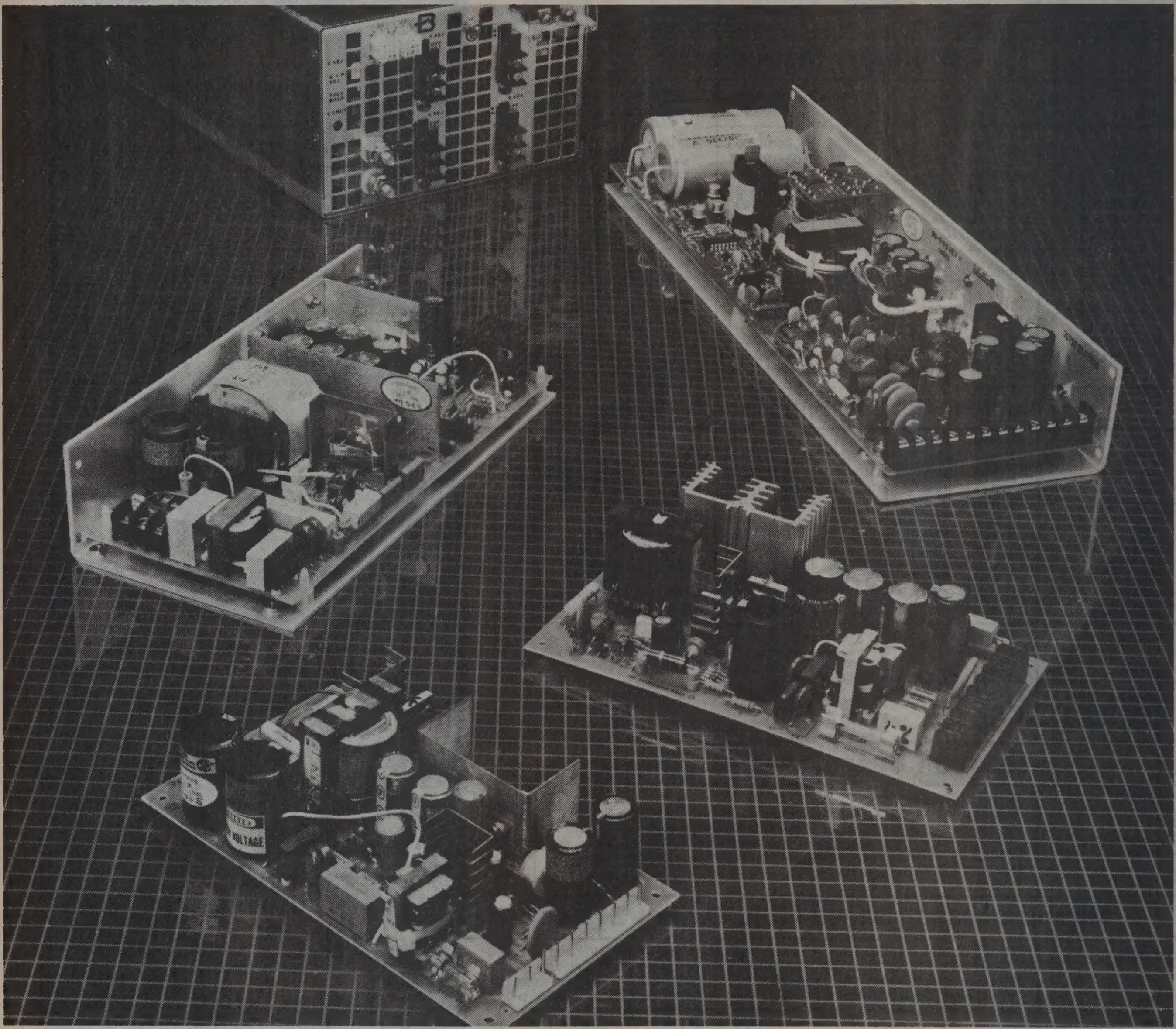
We produce hundreds of *different* custom designed units each year. Many designs incorporate custom interface, control and monitoring circuits (including IEEE-488) that can more economically and reliably be included in the High Voltage power supply.

Contact your local representative or call the factory directly. We can probably meet your special need with a quick, minor modification to one of our reliable, field proven designs. If not, we can design a new unit and deliver the first article in 120 days *or less*. Either way our Application Engineers will ensure that you obtain the best overall solution to your High Voltage power supply requirements.

BA BERTAN ASSOCIATES, Inc. 121 New South Rd., Hicksville, NY 11801 • (516) 433-3110 • TWX 510-221-2144

SWITCHING POWER SELECTION GUIDE

Boschert Incorporated
384 Santa Trinita Avenue
Sunnyvale, CA 94086
(408) 732-2440
TWX 910-339-9241



- All Boschert products are designed to meet UL and CSA safety requirements.
- All XL and SL Boschert products are designed to meet IEC 380 VDE 0806 Safety, FCC Level B and VDE 0871 Level B EMI, and are available in versions designed to meet British Telecom Safety.
- All Boschert AC to DC products have user selectable 110/220 VAC inputs.
- Multiple Output and Single Output Switchers have a one-year warranty. High Power Products have a two-year warranty.

10TH Anniversary 1974–1984
Boschert

For More Information. Circle No. 317

SWITCHING POWER SELECTION GUIDE

Boschert

MULTIPLE OUTPUT SWITCHERS

Model Number	Output Voltages and Maximum Current + 5V	− 5V	+ 12V	+ 12V	− 12V	+ 15V	− 15V	+ 24V	Maximum Continuous Output Power
OL25-3001	3.5A	0.5A	1A		0.5A				25W
XL40-3601	2.5A		2A		0.5A				40W
XL50-3601	6A	0.7A	3A		0.7A				60W
XL50-3602	6A		0.7A		0.7A			2A	60W
XL50-3603	6A		3A	1.5A	0.7A				60W
XL50-3604	6A	0.7A				2A	0.7A		60W
XL50-3655	7.3A		2.5A	2A	0.5A				65W
XL60-3601	6A	0.7A	3.5A		0.7A				70W
XL60-3602	6A		0.7A		0.7A			2A	70W
XL60-3603	6A		3A	1.5A	0.7A				70W
XL65-3620	6A	0.5A	3A		1.5A			1.2A	65W
XL80-3601	8A	0.7A	3.5A		0.7A				80W/*100W
XL80-3603	8A		3A	1.5A	0.7A				80W/*100W
XL100-3601	10A	0.7A	4A		0.7A				100W
XL100-3602	10A		4A		0.7A			3A	100W
XL100-3603	10A		4A	1.5A	0.7A				100W
XL125-3601	15A	0.7A	5A		0.7A				130W
XL125-3602	15A		4A		0.7A			4A	130W
XL125-3603	15A		4A	1.5A	0.7A				130W
OL130-3001	15A	0.7A	3A		2A				130W
OL130-3022	15A		3A		2A			2A	130W
*OL153-1025	20A					4A	4A	4A	180
*OL153-1033	20A		4A		4A			4A	180
OL200-3006	20A/*25A	3A/*4A	3A/*4A		3A/*4A				200W
OL200-3024	20A/*25A		3A/*4A		3A/*4A			4A	200W
XL200-3501	20A/*25A	3A	4A		4A				200W
XL200-3504	20A/*25A		4A		4A			3A	200W
*OL301-3026	20A		4A		4A	4A	4A	4A	300W
*OL400-3015	45A	4A	10A		10A			4A	400W
*OL400-3026	45A	4A				10A	10A	4A	400W

Shaded outputs are tightly regulated. *Forced air required. For information regarding peak outputs, please contact factory. Limited one year warranty.

HIGH POWER PRODUCTS—MULTIPLE OUTPUT

Model Number	Output Voltages and Maximum Current 5V	5V	12V	12V	15V	15V	24V	24V	Maximum Continuous Output Power
XL750-4601	10-100A	0-10A	0-10A	0-6A			0-4A		750W
XL750-4604	10-100A	0-10A			0-8A	0-8A			750W
XL750-4605	10-100A				0-8A	0-8A	0-4A		750W
XL750-4606	10-100A	0-10A	0-6A	0-6A			0-4A		750W
XL750-4607	10-100A		0-6A	0-6A			0-4A	0-4A	750W
XL750-4608	10-100A		0-10A	0-10A					750W
XL750-4609	10-100A				0-8A	0-8A			750W
XL750-4610	10-100A		0-10A				0-5A		750W

All XL750 outputs are floating and may be used with either polarity All outputs are well regulated. Limited two year warranty.

SINGLE OUTPUT SWITCHERS

Output Voltage	30W Model	Current	60W Model	Current	120W Model	Current	220W Model	Current
4.5V-5.5V	SL30-3605	6A	SL60-3605	12A	SL120-3605	20A	SL220-3605	44A
11.5V-18V	SL30-3612	2.5A	SL60-3612	5A	SL120-3612	10A	SL220-3612	20A
18V-30V	SL30-3624	1.25A	SL60-3624	2.5A	SL120-3624	5A	SL220-3624	10A

All the above SL models are designed to meet FCC RFI, VDE 0871 RFI, UL 478, CSA C22.2 and VDE0806 safety requirement.

HIGH POWER PRODUCTS—SINGLE OUTPUT

Model Number	Output Adjustment Range	Rated Current at 50°C	Maximum Continuous Output Power
HL1000-4605	4.5V-5.5V	200A	1000W

Limited two year warranty.

DC-DC SWITCHERS

Model Number	Description
3T12AP-6130	10V-60V input, output adjustable from 4.5V-30V @ 12A
3T20AP-6115	10V-60V input, output adjustable from 4.5V-15V @ 20A
3T5AN-4030	10V-40V input, output adjustable from −4.5V −30V @ 5A
3T5AN-6030	20V-60V input, output adjustable from −4.5V −30V @ 5A

Limited two year warranty.

For More Information, Circle No. 317

nesco

NATIONAL ELECTRO-SALES CORP.

7110 GERALD AVENUE, VAN NUYS, CALIFORNIA 91406 • (818) 781-050
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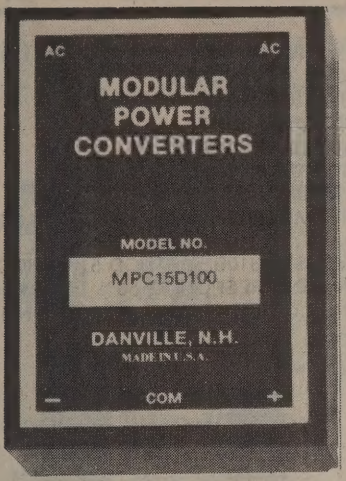
For More Information. Circle No. 326

MODULAR POWER CONVERTERS

AC TO DC



FEATURES

- EXCELLENT REGULATION
- HIGH QUALITY QC/QA TO YOUR PROGRAM
- ENCAPSULATED MODULES
- ENVIRONMENT RESISTANT
- COST EFFECTIVE
- DELIVERY FROM STOCK
- OPTIONS AVAILABLE

	SUFFIX	PRICE ADDER
220 Vac Input	E	$5.00
240 Vac Input	K	5.00
100 Vac Input	J	5.00
2.0″ Input Pin Configuration	A	None
Chassis mounting with terminal barrier strip	CM	10.00

SELECTION GUIDE

	SINGLE OUTPUT UNITS				DUAL OUTPUT UNITS						TRIPLE
MODEL	MPC5S250	MPC5S500	MPC5S1000	MPC5S2000	MPC15D100	MPC12D100	MPC15D200	MPC12D200	MPC15D300	MPC12D300	MPC5S500 /15D100
E (Vdc)	5	5	5	5	15	12	15	12	15	12	
I(mA)	250	500	1000	2000	100	100	200	200	300	300	
Case	A	A	B	C	A	A	B	B	C	C	C
	UNIT PRICES ($) F O B DANVILLE NH 03819 USA										
1-4	34.00	39.00	47.00	61.00	40.00	42.00	48.00	52.00	57.00	59.00	77.00
5-9	31.00	37.00	45.00	57.00	37.00	40.00	46.00	48.00	54.00	55.00	72.00
10-99	27.00	32.00	38.00	49.00	33.00	34.00	39.00	42.00	46.00	48.00	63.00
100-499	24.00	28.00	34.00	43.00	29.00	31.00	35.00	37.00	41.00	42.00	55.00
500-999	21.00	24.00	29.00	37.00	26.00	26.00	31.00	32.00	36.00	37.00	48.00
1000 & UP	19.00	22.00	27.00	34.00	24.00	24.00	29.00	29.00	34.00	34.00	44.00

ELECTRICAL SPECIFICATIONS

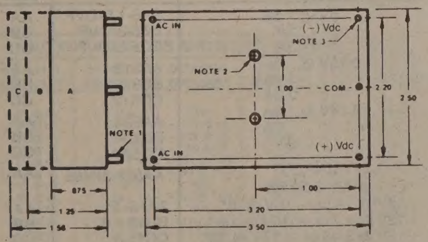
TYPICAL AT 25° C UNLESS OTHERWISE SPECIFIED

• INPUT	
VOLTAGE	105 to 125 Vac
FREQUENCY	50 to 440 Hz
• OUTPUT	
FIXED VOLTAGE (Vdc)	1% Max.
LINE REGULATION	0.05%
LOAD REGULATION (5 Vdc Models)	0.2%
LOAD REGULATION (Dual Models)	0.05%
RIPPLE & NOISE (PARD)	1mV RMS Max
OVERVOLTAGE PROTECTION on 5 Vdc Models Only	Set for 6.5 Vdc
SHORT CIRCUIT PROTECTED	Continuous

• ENVIRONMENT	
OPERATING	-25° C to +71° C
STORAGE	-25° C to +85° C
TEMPERATURE COEFFICIENT	0.02%/° C
WARM-UP DRIFT	0.25% after 15 minutes

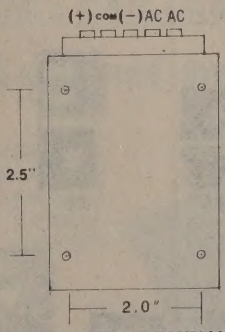
PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

MECHANICAL SPECIFICATIONS



SINGLE AND DUAL

NOTES:
1 Gold Plated 0.040 Dia 0.20 Lg Min
2 Mounting Inserts 4-40 0.10 Lg Min
3 Single Output Models No Connection
4 All Dimensions in Inches



TOP VIEW

CHASSIS MOUNTING WITH TERMINAL BARRIER STRIP

MPC designs power converters, including DC to DC converters to exact customer requirements when they differ from standard specifications. MPC also makes toroidal power transformers ≤ 30VA. Please send MPC your specifications for a fast response.

MPC / DIVISION OF CONSULTING SYSTEMS • RFD BOX 441
FREMONT, NH 03044
603-642-5913

SINGLE OUTPUT
DUAL OUTPUT
TRIPLE OUTPUT

CONDOR INC.
D.C. POWER SUPPLIES

201 FLYNN RD.
CAMARILLO, CA
93010
(805) 484-2851
OUTSIDE CA
(800) 235-5929

FEATURES

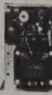
- INDUSTRY STANDARD SIZES
- ALL MODELS U.L. RECOGNIZED
- 2 YEAR WARRANTY
- RUGGED ALUMINUM CHASSIS
- IC REGULATED DESIGN
- OVP BUILT-IN ON 5V OUTPUTS
- 2 HOUR BURN-IN, ALL UNITS
- DELIVERY FROM STOCK
- OUTPUT RIPPLE 1.5mv PK-PK TYP.
- ±.05% STABILITY FOR 24 HOURS AFTER WARM-UP
- FULL POWER TO 50°C
- 115/230 VAC ±10% INPUT, 47-440 HZ
- ±.01%/°C TEMP. COEFFICIENT
- ±.02% REGULATION TYPICAL
- FOLDBACK CURRENT LIMIT
- REMOTE SENSING ABOVE 4 AMPS
- REMOTE PROGRAMMING — MOST MODELS
- 50,000 HOUR MTBF
- VIBRATION PER MIL-STD-810B, METHOD 514, CURVE
- AB (to 50 HZ)
- SHOCK PER MIL-STD-810B, METHOD 516, PROCEDURE V
- 30μ SEC TRANSIENT RESPONSE, 50% LOAD CHANGE
- 45% EFFICIENCY ON 5V MODELS, 55-60% ON 12-28V
- MODELS

SEE BOTTOM OF THIRD CONDOR AD PAGE FOR DIMENSIONS

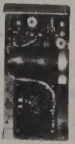
SINGLE OUTPUT MODELS

A

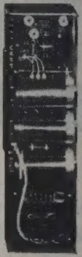
B


C

N


D

E


F/G

SINGLE OUTPUT MODELS — VOLTAGE/CURRENT RATING CHART

Voltage	Cur-rent	Model	Case	Price 1-9 pcs
2V	1.2	A2-1.2	A	$ ***
	3	B2-3	B	***
	6	C2-8	C	***
	9	N2-9	N	***
	12	D2-12	D	***
	18	E2-18	E	***
5V	1.2	A5-1.2/OVP	A	24.00
	3	B5-3/OVP	B	30.00
	6	C5-6/OVP	C	52.00
	9	N5-9/OVP	N	72.00
	12	D5-12/OVP	D	82.00
	15	RD5-15/OVP	D	105.00
	18	E5-18/OVP	E	117.00
	23	RE5-23/OVP	E	135.00
	25	F5-25/OVP	F	154.00
	35	G5-35/OVP	G	190.00
	40	RG5-40/OVP	G	200.00
	50	*G5-50/OVP	G	205.00
12V	.5	A12-.5	A	24.00
	1.7	B12-1.7	B	30.00
	3.4	C12-3.4	C	47.00
12V	5.1	N12-5.1	N	67.00
	6.8	D12-6.8	D	77.00
	10.2	E12-10.2	E	107.00
	16	F15-15	F	154.00
15V	.5	A15-.5	A	24.00
	1.5	B15-1.5	B	30.00
	3	C15-3	C	47.00
	4.5	N15-4.5	N	67.00
	6	D15-6	D	77.00
	9	E15-9	E	107.00
	15	F15-15	F	154.00
24V	.3	A24-.225	A	24.00
	1.2	B24-1.2	B	30.00
	2.4	C24-2.4	C	47.00
	3.6	N24-3.6	N	67.00
	4.8	D24-4.8	D	77.00
	7.2	E24-7.2	E	107.00
	12	F24-12	F	154.00
28V	.25	A28-.20	A	24.00
	1	B28-1	B	30.00
	2	C28-2	C	47.00
28V	3	N28-3	N	67.00
	4	D28-4	D	77.00
	6	E28-6	E	107.00
	10	F24-12	F	154.00
48V	.5	B48-.5	B	34.00
	1	C48-1	C	54.00
	3	D48-3	D	84.00
	4	E48-4	E	114.00
55V	2.5	D55-2.5	D	***
150V	.15	B150-.15	B	38.00
	.5	C150-.5	C	***
	1.0	D150-1.0	D	***
	2.5	G150-2.5	G	***
175-210V	.12	B200-.12	B	***
240-260V	.1	B250-.1	B	38.00
	.25	C250-.25	C	***
	.5	D250-.5	D	***
	1.5	G250-1.5	G	***

* G5-50 requires 30 CFM moving air at full rated output

DUAL & TRIPLE OUTPUT MODELS

AA

BB

CC

DUAL OUTPUT — 14 MODELS

Output No. 1	Output No. 2	Model	Case	Price 1-9 pcs
5V @ 1.5A	5V @ 1.5A	AA5-1.5/OVP	AA	$ 50.00
3A	3A	BB5-3/OVP	BB	65.00
6A	6A	CC5-6/OVP	CC	92.00
5V @ 2A	9-15V @ .5A	AA512	AA	47.00
3A	1.25A	BB512	BB	57.00
6A	2.5A	CC512	CC	92.00
5V @ 2A	18-24V @ .3A	AA524	AA	47.00
3A	.8A	BB524	BB	57.00
6A	2A	CC524	CC	92.00
5V @ 2A	24V UNREG** @ 5A, 2.5A PK	AA524-AIM65	AA	47.00
+12V @ 1A or 15V @ .8A	+12V @ 1A or — 15V @ .8*	AA15-.8	AA	41.00
+12V @ 1.7 or 15V @ 1.5A	+12V @ 1.7 or — 15V @ 1.5*	BB15-1.5	BB	52.00
+12V @ 3.4A or 15V @ 3A	+12V @ 3.4A or — 15V @ 3A*	CC15-3	CC	85.00
+18V @ .4A or 24V @ .6A	+18V @ .4A or — 24V @ .6	AA24-.6	AA	41.00

TRIPLE OUTPUT — 8 MODELS

Output No. 1 5V	Output No. 2 +12 to 15V	Output No. 3 −12V to 15V	Model	Case	Price 1-9 pcs
@ 2A	@ .4/.4A	@ .4/.4A	TAA-16W	AA	$ 52.00
3A	1/.8A	1/.8A	BAA-40W	BAA	73.00
3A	3.4/3.0A	3.4/3.0A	CBB-105W	CBB	97.00
6A	1/.8A	1/.8A	TD-60W	D	87.00
6A	1.7/1.5A	1.7/1.5A	CBB-75W	CBB	97.00
9A	1.7/1.5A	1.7/1.5A	NBB-90W	NBB	127.00
12A	1.7/1.5A	1.7/1.5A	DBB-105W	DBB	132.00
12A	3.4/3A	3.4/3A	DCC-140W	DBB	152.00

TAA

BAA

CBB

NBB

DBB

No. 3 output useable at −5V, rate at ½ 15V current rating.

* −12/15 useable at −5V, rate at ½ 15V current.
±12/15 and ±24 have common returns; all others are isolated outputs.

** APPROVED FOR ROCKWELL AIM 65 MICROCOMPUTER WITH PRINTER.

*** Non Stock. Contact factory for setup prices.

For More Information. Circle No. 319

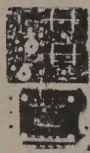
DISC DRIVE / PRINTER
MICROPROCESSOR
SWITCHERS
OVP MODELS
CUSTOM DESIGN

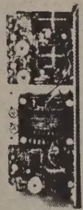
CONDOR INC.
D.C. POWER SUPPLIES

201 FLYNN RD.
CAMARILLO, CA
93010
(805) 484-2851
OUTSIDE CA
(800) 235-5929

DISC DRIVE / PRINTER & MICROPROCESSOR MODELS

AA


BB


BAA

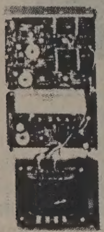
DISC DRIVE and PRINTER SERIES — 8 MODELS

Output No. 1	Output No. 2	Output No. 3	Model	Case	Price 1-9 pcs
24V, 1.5A (1.7PK)	5V, 2A	5V, 5A	FBAA-45W	BAA	$ 73.00
24V, 3A (3.5PK)	5V, 3A	5V, 1A	FCBB-90W	CBB	97.00
24V, 3A (3.5PK)	5V, 3A	12V, 1.7A	FCBB-512	CBB	97.00
24V, 5A (6APK)	5V, 3A	5V, 1A	FNBB-140W	NBB	127.00
12V, 1.1A (1.7APK)	5V, 7A	NA	FAA512	AA	41.00
12V, 4A W/OVP	5V, 2A	NA	FBB512	BB	77.00
5V, 2A	24V, 5A unreg	NA	AA524-AIM65	AA	47.00
24V, 2.4A (6APK)*	NA	NA	FC24-2.4	C	***
35V, 1.5A (6APK)*	NA	NA	FC35-1.5	C	***
24V, 4.2 (5.5APK)	12V, 1A	+5V, 6A	CP564	564	***

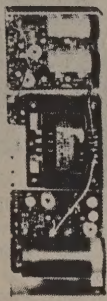
* 6A Peak for 20 seconds, 5% duty cycle at peak rating 12V, 5A (12APK) 5V, 6A NA FD-125 D 127.00
** OPERATE TEMP.: 30°C AMBIENT

3 & 5 OUTPUT FIXED DISC SERIES — 7 MODELS

Output No. 1	Output No. 2	Output No. 3	Output No. 4	Output No. 5	Model	Case	Price 1-9 pcs
+5V @ 15A	+24V @ 2/4.5APK	+12V @ .8A	−5V @ .8A	−12V @ 1A	FDBB-149	DBB	$174.00
+5V @ 9A	+24V @ 2/4.5APK	+12V @ .8A	−5V @ .8A	−12V @ 1A	FNBB-119	NBB	145.00
+5V @ 6A	+24V @ 1.5/4.5APK	+12V @ .8A	−5V @ .8A	−12V @ .8A	FCBB-89	CBB	***
+5V @ 15A	+24V @ 2/4.5APK	N/A	N/A	−5V or −12V @ 1.2A	FCBB-148	DBB	154.00
+5V @ 9A	+24V @ 3.5/5.5APK	N/A	N/A	−5V or −12V @ 1.2A	FNBB-120	NBB	127.00
+5V @ 9A	+24V @ 2/4.5APK	N/A	N/A	−5V or −12V @ 1.2A	FNBB-118	NBB	127.00
+5V @ 6A	+24V @ 1.5/4.5APK	N/A	N/A	−5V or −12V @ .8A	FCBB-88	CBB	***


NBB

CBB


DBB

MICROPROCESSOR SERIES — QUAD OUTPUT — 6 MODELS

Output No. 1 +5V @	Output No. 2 −5V @	Output No. 3 +12V @	Output No. 4 −12V @	Model	Case	Price 1-9 pcs
2A W/OVP	.4A*	.4A	.4A*	MPS-16W	AA	$ 65.00
3A W/OVP	.5A*	1.0A	1.0*	MPS-40W	BAA	85.00
4A	.5A	.5A	.2	MPS-30W	BAA**	***
6A W/OVP	.5A	1.7A W/OVP	1.2 W/OVP	MPS-75W	CBB	***
9A W/OVP	.5A	1.7A W/OVP	1.2 W/OVP	MPS-90W	NBB	***
15A W/OVP	.5A	3.4A W/OVP	2.5 W/OVP	MPS-140W	DBB	152.00
15A W/OVP	.5A	3.4A W/OVP	2.5 W/OVP	CP532	532	152.00

* Total current these outputs must be less than −12V rating
** Without end flanges, no OVP's on this unit

OVP on 5V outputs @ 6.2 ±.4VDC
OVP on 12V outputs @ 15 ±1VDC

SWITCHERS

- All outputs are isolated and independent
- Output regulation of 1% ±20% line tolerance
- Inrush limiting on turn-on
- Thermal protection
- Output ripple and noise ≤ 50 MV PK-PK
- Temperature 0 to 40°C
- 70% minimum efficiency at full load
- OVP optional on main output
- Current limit with automatic foldback

KE

KF

KH

KG

KJ

KP

Model	Input	Output No. 1	Output No. 2	Output No. 3	Output No. 4	Price 1-9 pcs
KE5-15	115VAC	5V @ 15A				$138.00
KE12-6.5	115VAC	12V @ 6.5A				***
KE15-5	115VAC	15V @ 5A				***
KFT301	115VAC	5V @ 15A	12V @ 1A	12V @ 1A		170.00
KFT302	115VAC	5V @ 15A	15V @ 1A	15V @ 1A		***
KFT303	115VAC	5V @ 15A	5V @ 1A	12V @ 1A		***
KFT304	115VAC	5V @ 15A	5V @ 1A	15V @ 1A		***
KGM401	115VAC	5V @ 15A	5V @ 1A	12V @ 1A	12V @ 1A	***
KGM402	115VAC	5V @ 15A	5V @ 1A	15V @ 1A	15V @ 1A	***
KH5-20	115/230VAC	5V @ 20A				160.00
KH12-12.5	115/230VAC	12V @ 12.5A				160.00
KH15-10	115/230VAC	15V @ 10A				***
KJT301	115/230VAC	5V @ 20A	12V @ 3A	12V @ 3A		276.00
KJT302	115/230VAC	5V @ 20A	15V @ 2.4A	15V @ 2.4A		***
KJT303	115/230VAC	5V @ 20A	5V @ 3A	12V @ 3A		***
KJT304	115/230VAC	5V @ 20A	5V @ 3A	15V @ 2.4A		***
KJT305	115/230VAC	5V @ 20A	5V @ 3A	24V @ 1.7A		***
KPT305	115/230VAC	5V @ 20A	5V @ 1A	24V @ 1.7A		
KPM401	115/230VAC	5V @ 20A	5V @ 1A	12V @ 3A	12V @ 3A	287.00
KPM402	115/230VAC	5V @ 20A	5V @ 1A	15V @ 2.4A	15V @ 2.4	***

OUTPUT VOLTAGES AND MAXIMUM RATED LOADS

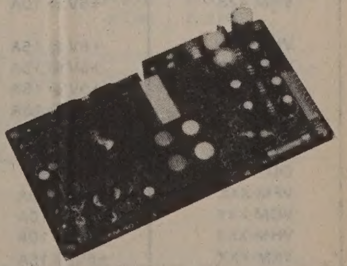
MODEL NUMBER	OUTPUT #1 VNOM IMAX	OUTPUT #2 VNOM IMAX	OUTPUT #3 VNOM IMAX	OUTPUT #4 VNOM IMAX	MAX CONTIN. OUTPUT POWER	PRICE EACH 1-9
STANDARDS:						
LFM 201	+5V @ 3A	+12V @ 4.5A	N/A	N/A	65WATTS	$ 86.00
LFM 302	+5V @ 6A	+12V @ 1A	—12V @ 1A	N/A	55WATTS	83.00
LFM 410	+5V @ 4A	+12V @ 2A	—12V @ 1A	—5V @ 1A	50WATTS	83.00
LFM 411	+5V @ 4A	+15V @ 2A	—15V @ 1A	—5V @ 1A	50WATTS	**
LFM 412	+5V @ 4A	+12V @ 1.5A	—12V @ 1.5A	N/A	50WATTS	83.00
LFM 413	+5V @ 4A	+15V @ 1.5A	—15V @ 1.5A	N/A	50WATTS	**
LFM 414	+5V @ 4A	+24V @ 2A	N/A	—5V @ 1A	50WATTS	83.00
LFM 415	+5V @ 4A	+12V @ 1.5A	—12V @ 1.5A	+24V @ 2A	50WATTS	83.00
LFM 416	+5V @ 8A	+12V @ 4/9/AP	N/A	N/A	85WATTS	92.00
LGM 410	+5V @ 6A	+12V @ 2.5A	—12V @ 2A	—5V @ 1A	65WATTS	86.00
LGM 411	+5V @ 6A	+12V @ 2.5A	—15V @ 2A	—5V @ 1A	65WATTS	**
LGM 412	+5V @ 6A	+12V @ 2.5A	—12V @ 2.5A	N/A	65WATTS	86.00
LGM 413	+5V @ 6A	+15V @ 2.5A	—15V @ 2.5A	N/A	65WATTS	**
LGM 414	+5V @ 6A	+12V @ 2.0A	N/A	—5V @ 2A	65WATTS	86.00
LGM 415	+5V @ 6A	+12V @ 2.0A	—12V @ 2A	+24V @ 2A	65WATTS	86.00
LHM 410	+5V @ 8A	+12V @ 3.5A	—12V @ 2A	—5V @ 2A	85WATTS	92.00
LHM 411	+5V @ 8A	+12V @ 3.5A	—12V @ 2A	—5V @ 2A	85WATTS	**
LHM 412	+5V @ 8A	+12V @ 3A	—12V @ 2A	N/A	86WATTS	92.00
LHM 413	+5V @ 8A	+15V @ 3A	—15V @ 2A	N/A	85WATTS	**
LHM 414	+5V @ 8A	+24V @ 3A	N/A	—5V @ 2A	85WATTS	92.00
LHM 415	+5V @ 8A	+12V @ 3A	—12V @ 3A	+24V @ 2A	85WATTS	92.00
LHM 416	+5V @ 8A	+12V @ 3/6A	N/A	N/A	85WATTS	
LKM 410	+5V @ 15A	+12V @ 4A	—12V @ 2A	—5V @ 2A	125WATTS	109.00
LKM 411	+5V @ 15A	+15V @ 4A	—15V @ 2A	—5V @ 2A	125WATTS	**
LKM 412	+5V @ 15A	+12V @ 4A	—12V @ 2A	N/A	125WATTS	109.00
LKM 413	+5V @ 15A	+15V @ 4A	—15V @ 2A	N/A	125WATTS	**
LKM 414	+5V @ 15A	+24V @ 4A	N/A	—5V @ 2A	125WATTS	109.00
LKM 415	+5V @ 15A	+24V @ 4/6PK	—12V @ 2A	—5V @ 2A	125WATTS	109.00
OPTIONAL OUTPUTS						
LFM-XXX	+5V @ 10A	* @ 4A	* @ 4A	* @ 2A	85WATTS	**
LGM-XXX	+5V @ 10A	* @ 4A	* @ 4A	* @ 2A	85WATTS	**
LHM-XXX	+5V @ 10A	* @ 4A	* @ 4A	* @ 2A	85WATTS	**
LKM-XXX	+5V @ 15A	* @ 4A	* @ 4A	* @ 2A	125WATTS	**

*USER SPECIFIED VOLTAGE

STANDARD L SERIES SWITCHERS

FEATURES

- PCB Construction (optional chasses)
- Short circuit protection
- Input fusing included
- Overvoltage protection
- Brown-out rated
- Input EMI filtering
- 16 ms holdup time
- 25 KHz switching
- Input surge protection.



L SERIES DIMENSIONS

	LENGTH	WIDTH	HEIGHT
LF	7.75″	4.25″	1.75″
LG	8.25″	4.25″	1.75″
LH	8.4″	4.6″	2.1″
LK	10.4″	4.6″	2.1″

For More Information. Circle No. 319

V SERIES SWITCHES

CONDOR INC.
D.C. POWER SUPPLIES

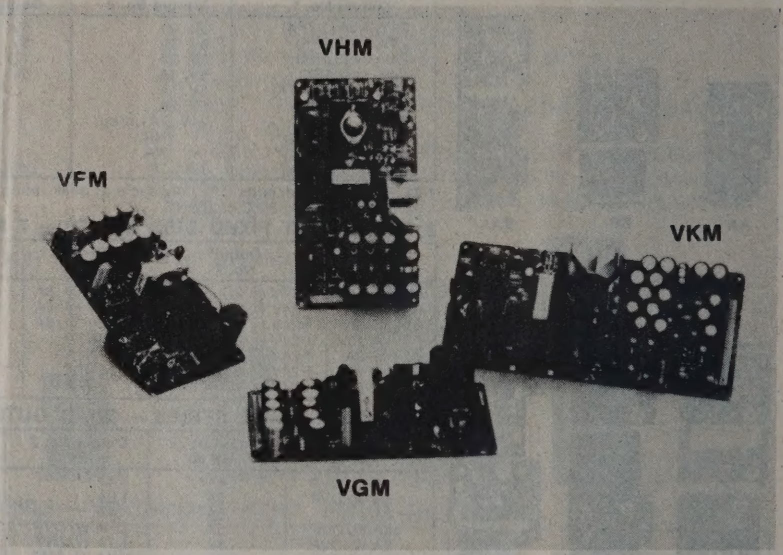
201 FLYNN RD.
CAMARILLO, CA
93010
(805) 484-2851
OUTSIDE CA
(800) 235-5929

V SERIES SWITCHERS

The "V" series switchers offer the same performance and specifications as the "L" series on the opposite page with the following added features:

- Designed to meet IEC/VDE safety requirements.
- Two of the outputs are isolated and may be paralleled (when same voltage) for increased current or used in series for higher voltage.

Consult factory for complete specifications and applications.



OUTPUT VOLTAGES AND MAXIMUM RATED LOADS

MODEL NUMBER	OUTPUT #1 ¶¶ VNOM IMAX	OUTPUT #2 ¶¶ VNOM IMAX	OUTPUT #3** VNOM IMAX	OUTPUT #4 ** VNOM IMAX	MAX CONTIN. OUTPUT POWER	PRICE EACH 1-9
STANDARDS:						
VFM 420	+5V @ 4A	+12V @ 2A	12V @ 2A	12V @ 2A	50WATTS	$ 99.00
VFM 421	+5V @ 4A	+12V @ 2A	12V @ 2A	¶ 5V @ 1A	50WATTS	99.00
VFM 422	+5V @ 4A	+15V @ 2A	15V @ 2A	15V @ 2A	50WATTS	99.00
VFM 423	+5V @ 4A	+15V @ 2A	15V @ 2A	¶ 5V @ 1A	50WATTS	99.00
VFM 424	+5V @ 8A	N/A	12V @ 2A/4.5PK	+12V @ 2A/4.5PK	85WATTS	110.00
VGM 420	+5V @ 6A	+12V @ 2.5A	12V @ 2.5A	12V @ 2.5A	65WATTS	104.00
VGM 421	+5V @ 6A	+12V @ 2.5A	12V @ 2.5A	¶ 5V @ 1A	65WATTS	104.00
VGM 422	+5V @ 6A	+15V @ 2.5A	15V @ 2.5A	15V @ 2.5A	65WATTS	104.00
VGM 423	+5V @ 6A	+15V @ 2.5A	15V @ 2.5A	¶ 5V @ 1A	65WATTS	104.00
VHM 420	+5V @ 10A	+12V @ 4A	12V @ 3A	12V @ 3A	85WATTS	110.00
VHM 421	+5V @ 10A	+12V @ 4A	12V @ 3A	¶ 5V @ 1A	85WATTS	110.00
VHM 422	+5V @ 10A	+15V @ 4A	15V @ 3A	15V @ 3A	85WATTS	110.00
VHM 423	+5V @ 10A	+15V @ 4A	15V @ 3A	¶ 5V @ 1A	85WATTS	110.00
VKM 420	+5V @ 15A	+12V @ 4A	12V @ 3A	12V @ 3A	125WATTS	130.00
VKM 421	+5V @ 15A	+12V @ 4A	12V @ 3A	¶ 5V @ 1A	125WATTS	130.00
VKM 422	+5V @ 15A	+15V @ 4A	15V @ 3A	15V @ 3A	125WATTS	130.00
VKM 423	+5V @ 15A	+15V @ 4A	15V @ 3A	¶ 5V @ 1A	125WATTS	130.00
OPTIONAL OUTPUTS:						***
VFM-XXX	+5V @ 10A	* @ 4A	* @ 4A	* @ 2A	85WATTS	***
VGM-XXX	+5V @ 10A	* @ 4A	* @ 4A	* @ 2A	85WATTS	***
VHM-XXX	+5V @ 10A	* @ 4A	* @ 4A	* @ 2A	85WATTS	***
VKM-XXX	+5V @ 15A	* @ 4A	* @ 4A	* @ 2A	125WATTS	***

*USER SPECIFIED VOLTAGE

**Outputs 3 & 4 are isolated. May be connected in series or parallel with other outputs for additional voltage or currents as required. (Parallel connection requires same voltages.)

¶3 Pin Regulator

¶¶Outputs 1 & 2 have common return.

*****NON STOCK:** Requires setup fee of $250 per release if less than 50 pieces. per order. No setup fee on orders over 50 pieces with 50 pieces minimum per release.

NOTES: Quantity discounts: 10-24 (5% off 1-9), 25-49 (10% off 1-9), 50-99 (15% off 1-9), 100-249 (20% off 1-9)

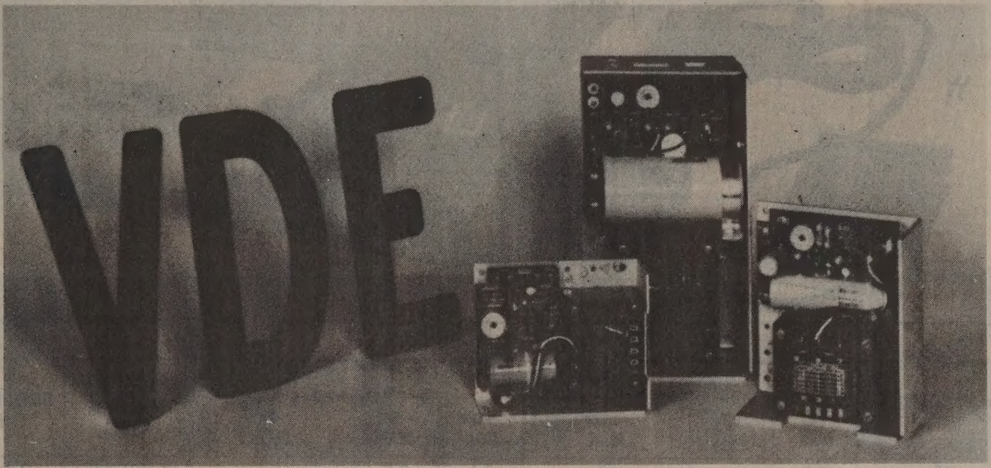
For More Information. Circle No. 319

INTERNATIONAL SERIES

CONDOR INC.
D.C. POWER SUPPLIES

201 FLYNN RD.
CAMARILLO, CA
93010
(805) 484-2851
OUTSIDE CA
(800) 235-5929

CONDOR'S NEW INTERNATIONAL SERIES



Stop stocking one kind of open frame power supplies to meet domestic needs and another to meet the tough safety, reliability and operational standards of VDE. The forty four models in Condor's new **International Series** will take care of just about all your needs. And to save you more, Condor's new International Series is *priced lower than competition*. General specifications are at the top of the inside front cover. Here's more features:

A Model For Every Application

Twenty five singles, seven duals, six triples, six disc drive models, all with industry standard cases.

Meeting International Requirements

All are designed to meet requirements of IEC, VDE, BPO CSA, CEE and ECMA. All are UL recognized.

Widest Choice Of Input Voltages And Frequencies

100 120, 220, 230 and 240 Volt AC, 50-440 Hz, which enables them to be used for a wide variety of applications including aircraft and military ground support equipment.

Increased Reliability

50,000 hrs. MTBF, meet vibration per MIL-STD 810B (Method 514, Curve AB to 50 Hz) and shock to MIL-STD810B (Method 516-Procedure V). In addition, all IC's are burned in to MIL 883 (Level B).

VOLTAGE/CURRENT RATING CHART

Model	+5V	+12V	+15V	+24V	+28V	Price
Single Output						32.00
B5-3/OVP-A	3.0A					32.00
B12-1.7-A		1.7A				32.00
B15-1.5-A			1.5A			32.00
B24-1.2-A				1.2A		32.00
B28-1-A					1.0A	54.00
C5-6/OVP-A	6.0A					49.00
C12-3.4-A		3.4A				49.00
C15-3-A			3.0A			49.00
C24-2.4-A				2.4A		49.00
C28-2-A					2.0A	74.00
N5-9/OVP-A	9.0A					69.00
N12-5.1-A		5.1A				69.00
N15-4.5-A			4.5A			69.00
N24-3.6-A				3.6A		69.00
N28-3-A					3.0A	84.00
D5-12/OVP-A	12.0A					79.00
D12-6.8-A		6.8A				79.00
D15-6-A			6.0A			79.00
D24-4.8-A				4.8A		79.00
D28-4-A					4.0A	119.00
E5-18/OVP-A	18.0A					109.00
E12-10.2-A		10.2A				109.00
E15-9-A			9.0A			109.00
E24-7.2A				7.2A		109.00
E28-6-A					6.0A	109.00

Model	+5V	+12V	+15V	+24V	−5V	−12V	−15V	Price
Dual Outputs								
AA15-0.8-A		1.0A	or 0.8A		0.4A**	or 1.0	or 0.8A	42.00
BB15-1.5-A		1.7A	or 1.5A		0.7A**	or 1.7	or 1.5A	54.00
CC15-3-A		3.4A	or 3.0A			**3.4**	or 3.0A	87.00
DD15-5/OVP-A		5.0A	or 5.0A			**5.0**	or 5.0A	138.00
AA512-A	**2.0A**	**0.5A***	**0.5A***					49.00
BB512-A	3.0A	**1.25A***	**1.25***					59.00
CC512-A	**6.0A**	**2.5A***	**2.5A***					94.00
AA524/AIM65	2.0A			.5(2.5PK) UN-REGULATED				
Triple Outputs								
TAA-16W-A	2.0A	0.4A*	0.4A*		**0.4****	or 0.4*	or 0.4A*	54.00
BAA-40W-A	3.0A	1.0A	or 0.8A		**0.4****	or 1.0	or 0.8A	75.00
CAA-60W-A	6.0A	1.0A	or 1.0A		**0.4****	or 1.0	or 1.0A	89.00
CBB-75W-A	6.0A	1.7A	or 1.5A		0.7**	or 1.7	or 1.5A	99.00
NBB-90-A	9.0A	1.7A	or 1.5A		0.7**	or 1.7	or 1.5A	120.00
DBB-105W-A	12.0A	1.7A	or 1.5A		0.7**	or 1.7	or 1.5A	134.00
DCC-140W-A	12.0A	3.4A	or 3.0A			or 3.4A	or 3.0A	154.00
DCC-150-A	12.0A	3.4A	or 3.0A			or 3.4A	or 3.0A	
Disc Drives								
FCBB-88-A	6.0A			3.5 (5.5 PK)	**1.2****	or **1.2A**		***
FNBB-120-A	**9.0A**			3.5 (5.5 PK)	**1.2****	or **1.2A**		79.00
FBB512-A	**2.0A**	**4.0A**						129.00
FBAA-45W-A	**1.0A**			1.5 (1.7 PK)	**0.5A**			75.00
FCBB-90W-A	2.5A			3.0 (3.4 PK)	**0.5A**			99.00
FNBB-140W-A	3.0A			5.0 (6.0 PK)	0.6A			129.00

* 9 to 15V Floating Output ** Requires jumper on PCB for −5V **Bold Face** output indicates no remote sense

*** = Non Stk. Contact factory for setup charges.

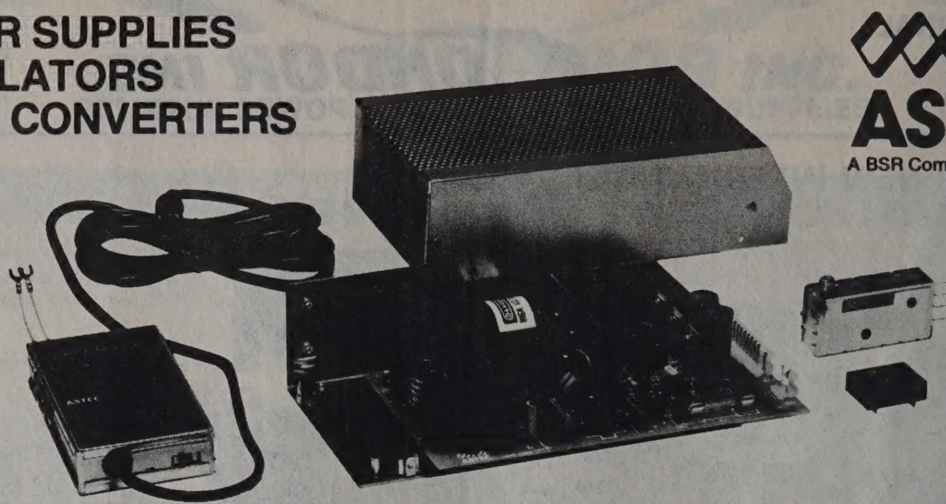
CASE DIMENSIONS
ALL CONDOR MODELS EXCEPT L SERIES SWITCHERS

CASE SIZE	DIMENSIONS, Inches	CASE SIZE	DIMENSIONS, Inches	CASE SIZE	DIMENSIONS, Inches
A	3.75 x 3.0 x 1.6	F, G	16.75 x 4.87 x 5.0	CBB	11.0 x 4.87 x 3.2
B	4.8 x 4.0 x 2.1	AA, TAA	6.4 x 4.0 x 2.1	DBB	14.25 x 4.87 x 3.2
C	5.62 x 4.87 x 2.95	BB	7.0 x 4.87 x 2.95	NBB	11.0 x 4.87 x 3.2
D	9.0 x 4.87 x 3.2	CC	9.38 x 4.87 x 3.2	OVP-12	1.6 x 1.6 x 0.7
E	14.0 x 4.87 x 3.2	BAA	10.25 x 4.0 x 2.95	OVP-24	2.8 x 2.0 x 0.9

For More Information. Circle No. 319

POWER SUPPLIES
MODULATORS
DC-DC CONVERTERS

ASTEC®
A BSR Company



POWER SUPPLIES

MODEL NUMBER	MAX OUTPUT WATTS	OUTPUT LOAD CURRENT—AMPS +5V MAX	−5V MAX	+12V* MAX	+12V* MAX	−12V MAX	+24V MAX	PHOTO KEY (PACKAGE TYPE)	DIMENSIONS (inches) H x W x L
AC9365[1]	65	6.0		1.5	2.1	0.1		(L BRACKET)	2.4 x 4.4 x 8
AC8151	40	2.5		2.0		0.1		(OPEN PCB)	2.0 x 3.9 x 6.3
AC8254	43	2.0	0.2				1.3	(OPEN PCB)	2.0 x 4.25 x 7.75
AC9252	50	6.0	0.5	2.5		0.5		(OPEN PCB)	1.75 x 4.25 x 7.75
AC9262[1]	50	6.0	0.5	2.5		0.5		(L BRACKET)	2.4 x 4.4 x 8
AC9250	50	6.0	0.5	2.0		1.0		(OPEN PCB)	2.0 x 4.25 x 7.75
AC9351	62	8.0	0.75	1.0		0.5		(OPEN PCB)	2.2 x 6.2 x 7.4
AC9355	65	6.0		1.5	2.1	0.1		(OPEN PCB)	1.75 x 4.25 x 7.75
AC9431	100	12.0	0.5	4.0		0.5		(BOX)	2.4 x 6.5 x 8
AC9354	75	4.7		2.0	2.0	0.5		(OPEN PCB)	2.0 x 6.2 x 7.4
AC8353	70	3.0				0.17	2.2	(OPEN PCB)	2.0 x 6.2 x 7.4
AC9461[1]	100	12.0	0.5	4.0		0.5		(L BRACKET)	2.4 x 6.5 x 8
AC9531[2]	128	10.0		3.5	2.5	0.5		(BOX)	2.6 x 5 x 10.5
AC9561[2]	128	10.0		3.5	2.5	0.5		(L BRACKET)	2.6 x 5 x 10.5
AC9664	145	13.5		1.5	.75	0.2	2.0	(L BRACKET)	2.5 x 6.7 x 10

†

Input voltages to all units are strap selectable at 115/230 VAC
*Dual +12V output available on some models
†Listed or pending approval
1.)Also available with metal cover
2.)Requires min. 15 CFM airflow

WE SPECIALIZE IN CUSTOM POWER SUPPLIES

RF MODULATORS

Model Number	Video Application	Audio (sub-carrier frequency)	Market	Channel Number (carrier frequency)	Mounting	Comments
UM1082L	VHF-Color	No	US (NTSC)	A2 (55.5 MHz) A3 (61.5 MHz)	PCB Mount	Low Profile
UM1233	UHF-Color	No	Europe/UK (PAL)	E36 (591.25 MHz)	PCB Mount	Low Profile
UM1622	VHF-Color	No	US (NTSC)	A3 (61.25 MHz) A4 (67.25 MHz)	PCB Mount	Low Profile
UM1285-8	VHF-Color	Yes (4.5 MHz)	US (NTSC)	A3 (61.25 MHz) A4 (67.25 MHz)	PCB Mount	VSB Filter
UM1285E3-4	VHF-Color	Yes (5.5 MHz)	Europe (PAL)	A3 (61.25 MHz) A4 (67.25 MHz)	PCB Mount	VSB Filter
UM1286	UHF-Color	Yes (6 MHz)	UK (PAL)	E36 (591.25 MHz)	PCB Mount	
UM1286-2	UHF-Color	Yes (5.5 MHz)	Europe (PAL)	E36 (591.25 MHz)	PCB Mount	
UM1381-1	VHF-Color	Yes (4.5 MHz)	US (NTSC)	A3 (61.25 MHz) A4 (67.25 MHz)	STANDALONE	FCC Approval

DC-DC CONVERTERS

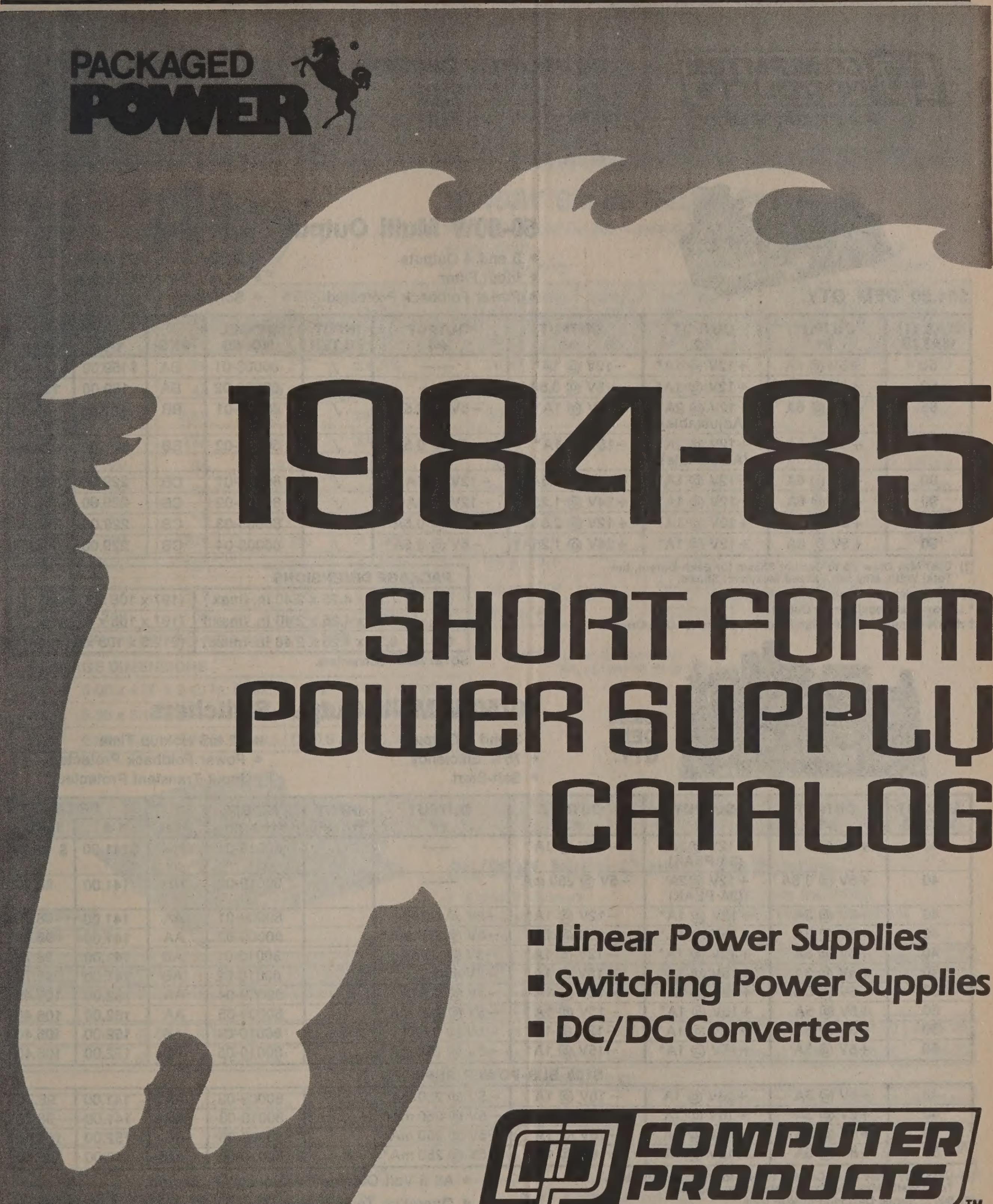
Model Number	Input	Output (V)	Voltage (%)	Output Min	Current Max	Max Cont Power Out	Efficiency	Output Ripple	Typical Application
AD1D12A10	5V ±20%	±12	±4	12mA (ea)	42mA (ea)	1000mW	70%	500mV	RS232 interface
AD1P12A10	5V ±20%	+12	±3	25mA	84mA	1000mV	70%	500mV	Auxiliary +12V Output
AD1P26A05	5V ±20%	+26	±3	7mA	20mA	500mW	75%	600mV	Programming EPROMS
AD1N12A10	5V ±20%	−12	±3	25mA	84mA	1000mW	70%	500mV	Memory Bias
AD4N250R30N	+12 ±5%	−250	±5	45mA	130mA	30W	75%	10V	Plasma Displays—50W peak

ASTEC
A BSR Company

ASTEC U.S.A. Limited
221 N. Central Ave., Campbell, CA 95008 U.S.A. Tel (408) 748-1200, Telex: 474-5018 ASTEC UI, Fax (408)727-8281

These power supplies covered by one or more patents including U.S. patent 4,323,961

For More Information. Circle No. 320



PACKAGED POWER

1984-85 SHORT-FORM POWER SUPPLY CATALOG

- Linear Power Supplies
- Switching Power Supplies
- DC/DC Converters

COMPUTER PRODUCTS™

POWER CONVERSION

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STEVENS-ARNOLD DIVISION—SOUTH BOSTON, MASSACHUSETTS
COMPOWER DIVISION—SAN JOSE, CALIFORNIA
POWER PRODUCTS LIMITED—REPUBLIC OF IRELAND

COMPUTER PRODUCTS™
POWER CONVERSION

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SAN JOSE, CA 95131
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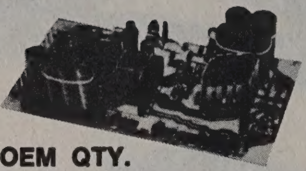
PACKAGED POWER



$54.50 OEM QTY.

50-90W Multi Output Switchers

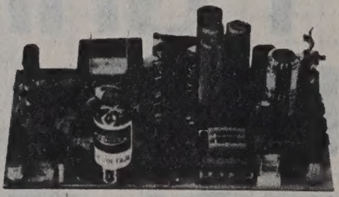
- 3 and 4 Outputs
- Input Filter
- Power Foldback Protected
- Designed to VDE 0806
- 50 mV P-P Max. Ripple
- Soft-Start

MAX. (1) WATTS	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	INPUT FILTER	MODEL NO. (2)	PKG.	PRICE	
								1-9	100's
50	+5V @ 6A	+12V @ 1A*	−12V @ 1A*	——	✓	80003-01	BA	$159.00	$111.30
50	+5V @ 6A	+12V @ 1A*	−5V @ 0.5A*	——	✓	80003-02	BA	159.00	111.30
65	+5V @ 5A	+12V @ 2A* (Adjustable)	−12V @ 1A*	−5V @ 0.5A*	✓	80004-01	BB	187.00	138.90
65	+5V @ 5A	+12V @ 2A* (Adjustable)	−15V @ 1A*	−5V @ 0.5A*	✓	80004-02	BB	187.00	138.90
90	+5V @ 6A	+12V @ 1A*	+12V @ 2.5A†	−12V @ 1A*	✓	80005-01	CB	229.00	168.30
90	+5V @ 6A	+12V @ 1A*	+24V @ 1.25A†	−12V @ 1A*	✓	80005-02	CB	229.00	168.30
90	+5V @ 6A	+12V @ 1A*	+12V @ 2.5A†	−5V @ 0.5A*	✓	80005-03	CB	229.00	168.30
90	+5V @ 6A	+12V @ 1A*	+24V @ 1.25A†	−5V @ 0.5A*	✓	80005-04	CB	229.00	168.30

(1) User May Draw up to Current Shown for Each Output, but Total Watts May Not Exceed Maximum Shown.
(2) All Models are Designed to VDC 0806.
* Linear Post Regulator on Output.
† ±10% Regulation with High Peak Capability for Disk Drive.

PACKAGE DIMENSIONS		
BA	7.75 x 4.25 x 2.40 In. (max.)	(197 x 108 x 61 mm)
BB	7.75 x 4.25 x 2.40 In. (max.)	(197 x 108 x 61 mm)
CB	8.36 x 4.25 x 2.40 In. (max.)	(212.3 x 108 x 61 mm)

NOTE: Molex Connectors.



$39.90 OEM QTY.

40/50W Multi Output Switchers

- 3 and 4 Outputs
- 75% Efficiency
- Soft-Start
- 32 mS Holdup Time
- Power Foldback Protected
- Input Transient Protected

MAX. (1) WATTS	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	INPUT FILTER	MODEL NO. (2)	PKG.	PRICE	
								1-9	100's
40	+5V @ 3.5A	+12V @2A (3A PEAK)	−12V @ 1A*	——	✓	80013-01	HH	$141.00	$ 98.70
40	+5V @ 3.5A	+12V @2A (3A PEAK)	−5V @ 250 mA*	——	✓	80013-02	HH	141.00	98.70
40	+5V @ 3A	+12V @ 1A*	−12V @ 1A*	−5V @ 0.5A*		80009-01	AA	141.00	98.70
40	+5V @ 3A	+15V @ 1A*	−15V @ 1A*	−5V @ 250 mA*		80009-02	AA	141.00	98.70
40	+5V @ 3A	+12V @ 1A*	−12V @ 1A*	−5V @ 0.5A*		80010-01	AB	141.00	98.70
40	+5V @ 3A	+15V @ 1A*	−15V @ 1A*	−5V @ 250 mA*		80010-02	AB	141.00	98.70
50	+5V @ 5A	+12V @ 1A*	−12V @ 1A*	−5V @ 0.5A*		80009-04	AA	152.00	106.40
50	+5V @ 5A	+15V @ 1A*	−15V @ 1A*	−5V @ 250 mA*		80009-05	AA	152.00	106.40
50	+5V @ 5A	+12V @ 1A*	−12V @ 1A*	−5V @ 0.5A*		80010-04	AB	152.00	106.40
50	+5V @ 5A	+15V @ 1A*	−15V @ 1A*	−5V @ 250 mA*		80010-05	AB	152.00	106.40
S100 BUS POWER SUPPLIES									
40	+8V @ 3A	+16V @ 1A	−16V @ 1A	−5V @ 250 mA*		80009-03	AA	141.00	98.70
40	+8V @ 3A	+16V @ 1A	−16V @ 1A	−5V @ 250 mA*		80010-03	AB	141.00	98.70
50	+8V @ 5A	+16V @ 1A	−16V @ 1A	−5V @ 250 mA*		80009-06	AA	152.00	106.40
50	+8V @ 5A	+16V @ 1A	−16V @ 1A	−5V @ 250 mA*		80010-06	AB	152.00	106.40

(1) User May Draw up to Current Shown for Each Output, but Total Watts May Not Exceed Maximum Shown.
(2) 80013 Series Designed to VDE 0806.
* Linear Post Regulator on Output.

PACKAGE DIMENSIONS		
AA	5.93 x 3.83 x 2.40 In. (max.)	(150.6 x 97.3 x 61 mm)
AB	5.93 x 3.83 x 2.40 In. (max.)	(150.6 x 97.3 x 61 mm)
HH	6.30 x 3.94 x 2.40 In. (max.)	(160 x 100.1 x 61 mm)

NOTE: AA: Barrier Strip Connector.
AB: Molex Connector.
HH: Molex Connector.

TWO-YEAR WARRANTY

- All 5 Volt Outputs Overvoltage Protected.
- Operating Temperature Range: 0°C to 70°C. Full Rating up to 60°C. From 60°C to 70°C, derate Linearly to 50% of Full Rating.
- All models feature power foldback output protection, input transient protection, 30 KHz switching rate, soft-start, no turn-on overshoot and 32 msec. hold-up time.
- Input Voltage Range: User-Selectable from 90 VAC to 135 VAC or 180 VAC to 270 VAC. Single-Wire Jumper.
- All models are UL Recognized ® and CSA Certified.

All Prices and Specifications Subject to Change Without Notice.

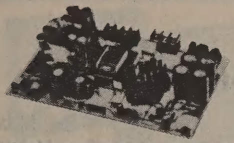
For More Information. Circle No. 527

COMPUTER PRODUCTS™
POWER CONVERSION

COMPOWER DIVISION
2220 LUNDY AVENUE
SAN JOSE, CA 95131
TELEPHONE (408) 942-1434 • TELEX: 172760

PACKAGED POWER

$55.40 OEM QTY.



30-150W Single Output Switchers

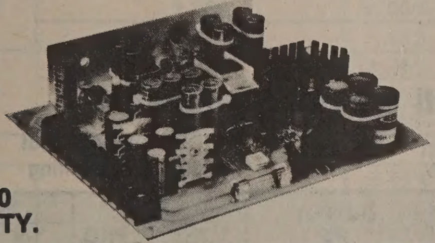
- OVP Crowbar On All Outputs
- Soft-Start
- 75% Efficiency
- 32 mS Holdup Time
- 50 mV P-P Max. Ripple
- Power Foldback Protected

MAX. WATTS	OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION LINE	REGULATION LOAD	OVP	RIPPLE AND NOISE (MAX.)	INPUT FILTER	MODEL NO. (1)	PKG.	PRICE 1-9	PRICE 100's
30	5V	6A	±0.2%	±0.5%	√	50 mV P-P	√	80007-01	JJ	$155.00	$108.50
60	12V	5A	±0.2%	±0.5%	√	50 mV P-P	√	80007-02	JJ	168.10	114.30
60	15V	4A	±0.2%	±0.5%	√	50 mV P-P	√	80007-03	JJ	168.10	114.30
60	24V	2.5A	±0.2%	±0.5%	√	50 mV P-P	√	80007-04	JJ	168.10	114.30
60	5V	12A	±0.2%	±0.5%	√	50 mV P-P		80011-01	KK	215.00	150.50
100	12V	8A	±0.2%	±0.5%	√	50 mV P-P		80011-02	KK	215.00	150.50
100	15V	6A	±0.2%	±0.5%	√	50 mV P-P		80011-03	KK	215.00	150.50
100	24V	4A	±0.2%	±0.5%	√	50 mV P-P		80011-04	KK	215.00	150.50
150	5V	30A	±0.2%	±1.0%	√	50 mV P-P	√	80012-01	LL	299.00	209.30
150	12V	12A	±0.2%	±1.0%	√	50 mV P-P	√	80012-02	LL	299.00	209.30
150	15V	10A	±0.2%	±1.0%	√	50 mV P-P	√	80012-03	LL	299.00	209.30
150	24V	6A	±0.2%	±1.0%	√	50 mV P-P	√	80012-04	LL	299.00	209.30

NOTE: (1) 80007 and 80012 Series Designed to VDE 0806.

PACKAGE DIMENSIONS		
JJ	5.00 x 4.00 x 2.40 In. (max.)	(127 x 101.6 x 61mm)
KK	8.38 x 5.10 x 2.40 In. (max.)	(212.9 x 129.5 x 61 mm)
LL	8.68 x 6.35 x 2.40 In. (max.)	(220.5 x 161.1 x 61 mm)

NOTE: JJ: Molex Connector.
KK, LL: Barrier Strip Connector.



$39.00 OEM QTY.

85/90W Multi Output Switchers

- 4 and 5 Outputs
- Soft-Start
- Power Foldback Protected
- 30 KHz Switching
- No Turn-On Overshoot

MAX. (1) WATTS	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	OUTPUT #5	INPUT FILTER	MODEL NO.	PKG.	PRICE 1-9	PRICE 100's
UNIVERSAL SERIES										
85	+5V @ 6A	+12V @ 3A*	+24V @ 2A*	−12V @ 1A*	−5V @ 0.5A*		80006-01	FF	$236.00	$165.20
85	+5V @ 6A	+15V @ 3A*	+24V @ 2A*	−15V @ 1A*	−5V @ 0.5A*		80006-02	FF	236.00	165.20
SMALL BUSINESS SYSTEM SERIES (2)										
90	+5V @ 7A	+12V @ 2.5A	+12V @ 1A*	−12V @ 1A*	——	√	80001-01	GG	$234.00	$163.80
90	+5V @ 7A	+24V @ 1.25A	+12V @ 1A*	−12V @ 1A*	——	√	80001-02	GG	234.00	163.80
90	+5V @ 7A	+12VDC @ 3A	+12V @ 1.25A*	−12V @ .75A*	——	——	70021	GG	75.00	70.00

(1) User May Draw up to Current Shown for Each Output, but Total Watts May Not Exceed Maximum Shown.
(2) Designed to VDE 0806.
* Linear Post Regulator on Output.

PACKAGE DIMENSIONS		
FF	7.75 x 6.50 x 2.40 In. (max.)	(196.9 x 165.1 x 61 mm)
GG	8.50 x 4.88 x 2.40 In. (max.)	(215.9 x 124 x 61 mm)

NOTE: FF: Barrier Strip Connector
GG: Molex Connector

- All 5 Volt Outputs Overvoltage Protected.
- Operating Temperature Range: 0°C to 70°C. Full Rating up to 60°C. From 60°C to 70°C, derate Linearly to 50% of Full Rating.
- All models feature power foldback output protection, input transient protection, 30 KHz switching rate, soft-start, no turn-on overshoot and 32 msec. hold-up time.
- Input Voltage Range: User-Selectable from 90 VAC to 135 VAC or 180 VAC to 270 VAC. Single-Wire Jumper.
- All models are UL Recognized and CSA Certified.

TWO-YEAR WARRANTY

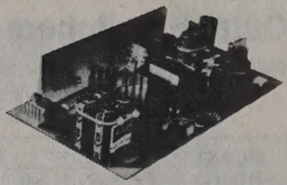
All Prices and Specifications Subject to Change Without Notice.

COMPUTER PRODUCTS™
POWER CONVERSION

COMPOWER DIVISION
2220 LUNDY AVENUE
SAN JOSE, CA 95131
TELEPHONE (408) 942-1434 • TELEX: 172760

PACKAGED POWER

$58.60 OEM QTY.



65-90W Multi Output Switchers

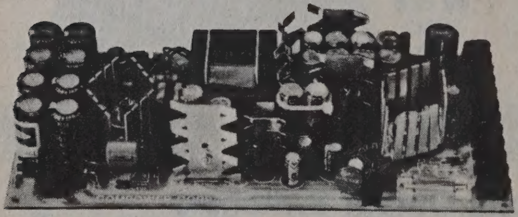
- 3 and 5 Outputs
- Input Filter
- Soft-Start
- 50 mV P-P Max. Ripple
- 32 mSec Hold-Up

MAX. (1) WATTS	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	OUTPUT #5	INPUT FILTER	MODEL NO.	PKG.	PRICE	
									1-9	100's
65	+5V @ 6A	+12V @ 1A*	−12V @ 1A*	−5V @ 0.5A*	+12V @ 2.5A†	✓	80002-01	DD	$187.00	$130.90
65	+5V @ 6A	+12V @ 1A*	−12V @ 1A*	−5V @ 0.5A*	+24V @ 1.25A†	✓	80002-02	DD	187.00	130.90
75	+5V @ 6A	+12V @ 3.5A* (5A Peak) Adjust. ±5%	−12V @ 1A*	——	——		80002-03	DD	229.00	160.30
90	+5V @ 6A	+12V @ 1A*	−12V @ 1A*	−5V @ 0.5A*	+12V @ 2.5A†	✓	80002-04	DD	229.00	160.30
90	+5V @ 6A	+12V @ 1A*	−12V @ 1A*	−5V @ 0.5A*	+24V @ 1.25A†	✓	80002-05	DD	229.00	160.30

(1) User May Draw up to Current Shown for Each Output, but Total Watts May Not Exceed Maximum Shown.
* Linear Post Regulator on Output.
† ±10% Regulation with High Peak Capability for Disk Drive.

PACKAGE DIMENSIONS		
DD	9.45 x 5.00 x 2.40 In. (max.)	(240 x 127 x 61 m))

NOTE: Edge Connector (outputs).
Molex Connector (input).



$105.00 OEM QTY.

150W Multi Output Switchers

- 5 Outputs
- 75% Efficiency
- OVP on 5V Output
- 30 KHz Switching

MAX. (1) WATTS	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	OUTPUT #5	MODEL NO.	PKG.	PRICE	
								1-9	100's
150	+5V @ 15A	+12V @ 3A†	+12V @ 2A*	−12V @ 1A*	−5V @ 150 mA*	80008-01	EE	$315.00	$220.50
150	+5V @ 15A	+24V @ 3A†	+12V @ 2A*	−12V @ 1A*	−5V @ 150 mA*	80008-03	EE	315.00	220.50
150	+5V @ 15A	+12V @ 3A†	+24V @ 2A*	−12V @ 1A*	−5V @ 150 mA*	80008-05	EE	315.00	220.50
150	+5V @ 15A	+12V @ 3A†	+24V @ 3A†	−12V @ 1A*	−5V @ 150 mA*	80008-06	EE	315.00	220.50

(1) User May Draw up to Current Shown for Each Output, but Total Watts May Not Exceed Maximum Shown.
* Linear Post Regulator on Output.
† ±10% Regulation with High Peak Capability for Disk Drive.

PACKAGE DIMENSIONS		
EE	10.18 x 4.75 x 2.40 In. (max.)	(258.6 x 120.7 x 61 mm)

NOTE: Barrier Strip Connectors

- All 5 Volt Outputs Overvoltage Protected.
- Operating Temperature Range: 0°C to 70°C. Full Rating up to 60°C. From 60°C to 70°C, derate Linearly to 50% of Full Rating.
- All models feature power foldback output protection, input transient protection, 30 KHz switching rate, soft-start, no turn-on overshoot and 32 msec. hold-up time.
- Input Voltage Range: User-Selectable from 90 VAC to 135 VAC or 180 VAC to 270 VAC. Single-Wire Jumper.
- All models are UL Recognized, ⓡ and CSA Ⓢ Certified.

TWO-YEAR WARRANTY

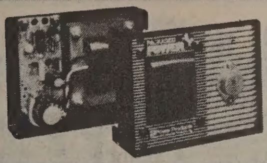
All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 527

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TELEPHONE (305) 975-7660 • TWX 510-956-3098

PACKAGED POWER



Open-Frame Linear Power Supplies

- User-Selectable Input Voltage: 100/115/220/230/240 VAC
- Up to 65% Efficiency
- Split-Bobbin Transformers
- 1500 VAC Isolation
- Designed to Meet UL & CSA

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION LINE*	REGULATION LOAD	RIPPLE AND NOISE	CASE SIZE	MODEL NUMBER	PRICE 1-9	PRICE 100's
SINGLE OUTPUT MODELS								
5V	3A	±.05%	±.05%	1.0 mV RMS	B	PL110	$ 40.00	$ 34.00
	6A	±.05%	±.05%	1.0 mV RMS	C	PL111	60.00	51.00
	9A	±.05%	±.05%	1.0 mV RMS	N	PL112	78.00	66.30
	12A	±.05%	±.05%	1.0 mV RMS	D	PL113	90.00	76.50
	18A	±.05%	±.05%	1.0 mV RMS	E	PL114	125.00	106.25
12V	1.8A	±.05%	±.05%	1.0 mV RMS	B	PL120	40.00	34.00
	3.4A	±.05%	±.05%	1.0 mV RMS	C	PL121	60.00	51.00
	6.8A	±.05%	±.05%	1.0 mV RMS	D	PL122	90.00	76.50
	10.2A	±.05%	±.05%	1.0 mV RMS	E	PL123	125.00	106.25
15V	1.5A	±.05%	±.05%	1.0 mV RMS	B	PL130	40.00	34.00
	3A	±.05%	±.05%	1.0 mV RMS	C	PL131	60.00	51.00
	6A	±.05%	±.05%	1.0 mV RMS	D	PL132	94.00	79.90
	9A	±.05%	±.05%	1.0 mV RMS	E	PL133	135.00	114.75
24V	1.2A	±.05%	±.05%	1.0 mV RMS	B	PL140	40.00	34.00
	2.4A	±.05%	±.05%	1.0 mV RMS	C	PL141	60.00	51.00
	4.8A	±.05%	±.05%	1.0 mV RMS	D	PL142	95.00	80.75
	7.2A	±.05%	±.05%	1.0 mV RMS	E	PL143	135.00	114.75
DUAL OUTPUT MODELS								
±12V	±1A	±.05%	±.05%	1.0 mV RMS	AA	PL150	49.00	41.65
	±1.8A	±.05%	±.05%	1.0 mV RMS	BB	PL151	68.00	57.80
	±3.4A	±.05%	±.05%	1.0 mV RMS	CC	PL152	96.00	81.60
±15V	±0.8A	±.05%	±.05%	1.0 mV RMS	AA	PL160	49.00	41.65
	±1.5A	±.05%	±.05%	1.0 mV RMS	BB	PL161	68.00	57.80
	±3.0A	±.05%	±.05%	1.0 mV RMS	CC	PL162	96.00	81.60
TRIPLE OUTPUT MODELS								
5V/±12V	3/±1A	±.05%	±.05%	1.0 mV RMS	BB	PL170	86.00	73.10
	6/±1.8A	±.05%	±.05%	1.0 mV RMS	CBB	PL171	105.00	89.25
	12/±1.8A	±.05%	±.05%	1.0 mV RMS	CBB	PL172	130.00	110.50
5V/±15V	3/±0.8A	±.05%	±.05%	1.0 mV RMS	BB	PL180	86.00	73.10
	6/±1.5A	±.05%	±.05%	1.0 mV RMS	CBB	PL181	105.00	89.25
	12/±1.5A	±.05%	±.05%	1.0 mV RMS	CBB	PL182	130.00	110.50
FLOPPY DISK DUAL OUTPUT MODELS								
5V/9-12V	7/1.2A	±.05%	±.05%	1.0 mV RMS	N	PL190	92.00	78.20
5V/24V	2.2/1.2A (2.4A PK)	±.05%	±.05%	1.0 mV RMS	BB	PL191	90.00	76.50
	2.2/2.4A (4.2A PK)	±.05%	±.05%	1.0 mV RMS	BB	PL192	110.00	93.50
12V/−12V	4A (6.5A PK)/.15A (0.5A PK)	±.05%	±.05%	1.0 mV RMS	BB	PL193	95.00	80.75

* Per ±10% Input Change

INPUT VOLTAGE RANGES

NOMINAL INPUT	INPUT VOLTAGE RANGE
100 VAC	90-110 VAC
115 VAC	105-125 VAC
220 VAC	200-240 VAC
230 VAC	210-264 VAC
240 VAC	210-264 VAC

ALL MODELS HAVE OPERATING TEMPERATURE RANGE OF 0°C TO 70°C AND STORAGE TEMPERATURE RANGE OF −25°C TO +85°C

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

PACKAGE DIMENSIONS

CASE	DIMENSIONS INCHES (LxWxH)	DIMENSIONS MM (LxWxH)	MOUNTING SURFACES
B	4.88 x 4.00 x 1.62	123.9 x 101.6 x 41.1	3
C	5.62 x 4.88 x 2.50	142.7 x 123.9 x 63.5	3
D	9.00 x 4.88 x 2.75	228.6 x 123.9 x 69.8	4
E	14.00 x 4.88 x 2.75	355.6 x 123.9 x 69.8	4
N	7.00 x 4.88 x 2.75	177.8 x 123.9 x 69.8	4
AA	6.50 x 4.00 x 1.63	165.1 x 101.6 x 41.1	3
BB	7.00 x 4.88 x 2.50	177.8 x 123.9 x 63.5	3
CC	9.38 x 4.88 x 2.75	238.3 x 123.9 x 69.8	4
CBB	11.00 x 4.88 x 2.75	279.4 x 123.9 x 69.8	4

For More Information. Circle No. 528

COMPUTER PRODUCTS
POWER CONVERSION

POWER PRODUCTS DIVISION

2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TELEPHONE (305) 975-7660 • TWX 510-956-3098

PACKAGED POWER

Linear Power Modules

- Power to 15 Watts
- Excellent Regulation
- Low Ripple and Noise
- Single, Dual, Triple Outputs
- Compact Encapsulated Package

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		RIPPLE AND NOISE	CASE SIZE	MODEL NUMBER	PRICE	
		LINE	LOAD				1-9	100's
			PC-MOUNTABLE PM500 SERIES					
5V	250 mA	±.02%	±.04%	1.0 mV RMS	B1	PM533	$ 64.00	$ 44.80
	250 mA	±.05%	±.05%	0.5 mV RMS	H	PM529	53.00	37.10
	500 mA	±.02%	±.04%	1.0 mV RMS	B1	PM534	71.00	49.70
	1000 mA	±.02%	±.04%	1.0 mV RMS	B2	PM542	94.00	65.80
	2000 mA	±.02%	±.05%	1.0 mV RMS	B3	PM545	118.00	82.60
10V	120 mA	±.02%	±.02%	0.5 mV RMS	A	PM587	53.00	37.10
12V	100 mA	±.02%	±.02%	0.5 mV RMS	A	PM563	53.00	37.10
	240 mA	±.02%	±.02%	0.5 mV RMS	B2	PM515	71.00	49.70
	400 mA	±.02%	±.02%	1.0 mV RMS	B3	PM516	94.00	65.80
	600 mA	±.02%	±.02%	1.0 mV RMS	B3	PM517	112.00	78.40
15V	100 mA	±.02%	±.02%	0.5 mV RMS	A	PM576	53.00	37.10
	200 mA	±.02%	±.02%	0.5 mV RMS	B2	PM554	71.00	49.70
	350 mA	±.02%	±.02%	1.0 mV RMS	B3	PM555	94.00	65.80
	500 mA	±.02%	±.02%	1.0 mV RMS	B3	PM556	112.00	78.40
18V	65 mA	±.02%	±.02%	1.0 mV RMS	A	PM560	53.00	37.10
20V	60 mA	±.02%	±.02%	1.0 mV RMS	A	PM574	53.00	37.10
24V	50 mA	±.02%	±.02%	1.0 mV RMS	A	PM585	53.00	37.10
	100 mA	±.02%	±.02%	1.0 mV RMS	B2	PM566	71.00	49.70
	200 mA	±.02%	±.02%	1.0 mV RMS	B3	PM567	94.00	65.80
	400 mA	±.02%	±.02%	1.0 mV RMS	B3	PM568	118.00	82.60
28V	40 mA	±.02%	±.02%	1.0 mV RMS	A	PM562	53.00	37.10
±12V	±25 mA	±.20%	±.20%	2.0 mV RMS	B1	PM509	56.00	39.20
	±50 mA	±.02%	±.02%	0.5 mV RMS	B1	PM510	64.00	44.80
	±120 mA	±.02%	±.02%	0.5 mV RMS	B1	PM536	71.00	49.70
	±240 mA	±.02%	±.02%	0.5 mV RMS	B2	PM537	94.00	65.80
	±400 mA	±.02%	±.02%	0.5 mV RMS	B3	PM597	118.00	82.60
±15V	±25 mA	±.20%	±.20%	2.0 mV RMS	B1	PM538	56.00	39.20
	±65 Am	±.02%	±.02%	0.5 mV RMS	B1	PM553	64.00	44.80
	±100 mA	±.02%	±.02%	0.5 mV RMS	B1	PM505	71.00	49.70
	±150 mA	±.02%	±.02%	0.5 mV RMS	B2	PM570	83.00	58.10
	±200 mA	±.02%	±.02%	0.5 mV RMS	B2	PM565	94.00	65.80
	±350 mA	±.02%	±.02%	1.0 mV RMS	B3	PM501	118.00	82.60
±18V	±25 mA	±.20%	±.20%	1.0 mV RMS	B1	PM511	56.00	39.20
	±50 mA	±.02%	±.02%	0.5 mV RMS	B2	PM512	64.00	44.80
	±100 mA	±.02%	±.02%	0.5 mV RMS	B2	PM513	71.00	49.70
±24V	±50 mA	±.02%	±.02%	0.5 mV RMS	B1	PM531	71.00	49.70
	±100 mA	±.02%	±.02%	0.5 mV RMS	B2	PM514	94.00	65.80
5V/±12V	300/±180 mA	±.02%	±.05%/±.02%	0.5 mV RMS	B2	PM595	112.00	78.40
	500/±120 mA	±.02%	±.05%/±.02%	0.5 mV RMS	B2	PM591	112.00	78.40
	1000/±150 mA	±.02%	±.10%/±.02%	1.0/0.5 mV RMS	B3	PM592	154.00	107.80
5V/±15V	300/±150 mA	±.02%	±.05%/±.02%	0.5 mV RMS	B2	PM594	112.00	78.40
	500/±100 mA	±.02%	±.05%/±.02%	0.5 mV RMS	B2	PM590	112.00	78.40
	1000/±150 mA	±.02%	±.10%/±.02%	1.0/0.5 mV RMS	B3	PM593	154.00	107.80

All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 528

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
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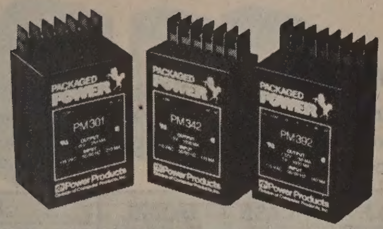
PACKAGED POWER



Linear Power Modules (cont.)

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION LINE	REGULATION LOAD	RIPPLE AND NOISE	CASE SIZE	MODEL NUMBER	PRICE 1-9	PRICE 100's
CHASSIS-MOUNTABLE PM300 SERIES								
5V	500 mA	±.05%	±.01%	2.0 mV RMS	C1	PM334	$ 81.00	$ 56.70
	1000 mA	±.05%	±.15%	2.0 mV RMS	C1	PM342	104.00	72.80
	2000 mA	±.05%	±.15%	2.0 mV RMS	C2	PM345	128.00	89.60
12V	240 mA	±.05%	±.05%	1.0 mV RMS	C1	PM315	81.00	56.70
	400 mA	±.05%	±.05%	1.0 mV RMS	C2	PM316	104.00	72.80
	600 mA	±.05%	±.05%	1.0 mV RMS	C2	PM317	123.00	86.10
15V	200 mA	±.05%	±.05%	1.0 mV RMS	C1	PM354	81.00	56.70
	350 mA	±.05%	±.05%	1.0 mV RMS	C2	PM355	104.00	72.80
	500 mA	±.05%	±.05%	1.0 mV RMS	C2	PM356	123.00	86.10
24V	100 mA	±.05%	±.05%	1.0 mV RMS	C1	PM366	81.00	56.70
	200 mA	±.05%	±.05%	1.0 mV RMS	C1	PM367	104.00	72.80
	400 mA	±.05%	±.05%	1.0 mV RMS	C2	PM368	128.00	89.60
±12V	±120 mA	±.05%	±.05%	1.0 mV RMS	C1	PM336	81.00	56.70
	±240 mA	±.05%	±.05%	1.0 mV RMS	C1	PM337	104.00	72.80
	±400 mA	±.05%	±.05%	1.0 mV RMS	C2	PM397	128.00	89.60
±15V	±100 mA	±.05%	±.05%	1.0 mV RMS	C1	PM302	81.00	56.70
	±200 mA	±.05%	±.05%	1.0 mV RMS	C1	PM365	104.00	72.80
	±350 mA	±.05%	±.05%	1.0 mV RMS	C2	PM301	128.00	89.60
	±500 mA	±.05%	±.05%	1.0 mV RMS	C2	PM396	154.00	107.80
5V/±12V	300/±180 mA	±.05%	±.10% / ±.05%	1.0 mV RMS	C1	PM395	123.00	86.10
	500/±120 mA	±.05%	±.10% / ±.05%	1.0 mV RMS	C1	PM391	123.00	86.10
	1000/±150 mA	±.02%	±.10% / ±.02%	1.0/0.5 mV RMS	C2	PM392	164.00	114.80
5V/±15V	300/±150 mA	±.05%	±.10% / ±.05%	1.0 mV RMS	C1	PM394	123.00	86.10
	500/±100 mA	±.05%	±.10% / ±.05%	1.0 mV RMS	C1	PM390	123.00	86.10
	1000/±150 mA	±.02%	±.10% / ±.02%	1.0/0.5 mV RMS	C2	PM393	164.00	114.80

CASE DIMENSIONS		
A	2.25 x 1.75 x 1.00 Inches	(57.2 x 44.5 x 25.4 mm)
B1	3.50 x 2.50 x 0.88 Inches	(88.9 x 63.5 x 22.4 mm)
B2	3.50 x 2.50 x 1.25 Inches	(88.9 x 63.5 x 31.8 mm)
B3	3.50 x 2.50 x 1.62 Inches	(88.9 x 63.5 x 41.1 mm)
C1	4.00 x 2.70 x 1.45 Inches	(101.6 x 68.6 x 36.8 mm)
C2	4.00 x 2.70 x 2.00 Inches	(101.6 x 68.6 x 50.8 mm)
H	3.00 x 2.00 x 1.00 Inches	(76.2 x 50.8 x 25.4 mm)

LINEAR POWER MODULE OPTIONS	INPUT VOLTAGE	SUFFIX
	115 ±10 VAC	(NONE)
	100 ±10 VAC	J
	220 ±20 VAC	D
	240 ±20 VAC	K

ALL MODELS HAVE OPERATING TEMPERATURE RANGE OF −25°C TO +71°C AND STORAGE TEMPERATURE RANGE OF −25°C to +85°C

Recognized by Underwriters Laboratories, Inc.

Certified by Canadian Standards Association

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TELEPHONE (305) 975-7660 • TWX 510-956-3098

PACKAGED POWER

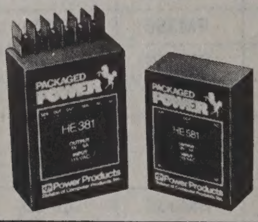
PACKAGED POWER
PACKAGED POWER
Power Products

Hybrid Power Modules

- Power to 15 Watts
- Switcher Efficiency
- OVP on 5V Output
- Linear Regulation
- Wide Input Voltage Range

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION*		RIPPLE AND NOISE	CASE SIZE	MODEL NUMBER	PRICE	
		LINE	LOAD				1-9	100's
PC-MOUNTABLE HM500 SERIES								
5V	3.00A	±0.05%	±0.1%	50 mV P-P	B2	HM530	$147.00	$102.90
12V	1.25A	±0.05%	±0.1%	50 mV P-P	B2	HM503	147.00	102.90
15V	1.00A	±0.05%	±0.1%	50 mV P-P	B2	HM504	147.00	102.90
±12V	±600 mA	±0.1%	±0.1%	50 mV P-P	B2	HM551	147.00	102.90
±15V	±500 mA	±0.1%	±0.1%	50 mV P-P	B2	HM552	147.00	102.90
CHASSIS-MOUNTABLE HM300 SERIES								
5V	3.00A	±0.05%	±0.2%	100 mV P-P	C1	HM330	$157.00	$109.90
12V	1.25A	±0.05%	±0.1%	100 mV P-P	C1	HM303	157.00	109.90
15V	1.00A	±0.05%	±0.1%	100 mV P-P	C1	HM304	157.00	109.90
±12V	±600 mA	±0.05%	±0.1%	100 mV P-P	C1	HM351	157.00	109.90
±15V	±500 mA	±0.05%	±0.1%	100 mV P-P	C1	HM352	157.00	109.90

* Linear post regulator on all outputs.



Switching Power Modules

- 25 and 30 Watts
- High Efficiency
- Good Regulation
- Current Limited
- Most Watts Per Cubic Inch

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		RIPPLE AND NOISE	CASE SIZE	MODEL NUMBER	PRICE	
		LINE	LOAD				1-9	100's
PC-MOUNTABLE HE500 SERIES								
12V	2.2A	±0.1%	±0.1%	100 mV P-P	B2	HE583	$188.00	$131.60
15V	1.8A	±0.1%	±0.1%	100 mV P-P	B2	HE584	188.00	131.60
PC-MOUNTABLE: NEW SERIES								
5V	5.0A	±0.1%	±0.1%	100 mV P-P	B2	HE560*	$145.00	$101.50
	5.0A	±0.1%	±0.1%	100 mV P-P	B2	HE561	175.00	122.50
5V	6.0A	±0.1%	±0.1%	100 mV P-P	B2	HE570*	165.00	115.50
	6.0A	±0.1%	±0.1%	100 mV P-P	B2	HE571	195.00	136.50
5/±12V	4A/±400mA	±0.1%	±0.1%	100 mV P-P	B3	HE576*	175.00	122.50
	4A/±400mA	±0.1%	±0.1%	100 mV P-P	B3	HE577	205.00	143.50
5/±15V	4A/±330mA	±0.1%	±0.1%	100 mV P-P	B3	HE578*	175.00	122.50
	4A/±330mA	±0.1%	±0.1%	100 mV P-P	B3	HE579	205.00	143.50
CHASSIS-MOUNTABLE HE300 SERIES†								
12V	2.2A	±0.1%	±0.1%	100 mV P-P	C1	HE383*	$199.00	$139.30
15V	1.8A	±0.1%	±0.1%	100 mV P-P	C1	HE384*	199.00	139.30
CHASSIS-MOUNTABLE: NEW SERIES†								
5V	5.0A	±0.1%	±0.1%	100 mV P-P	C1	HE360*	$155.00	$108.50
	5.0A	±0.1%	±0.1%	100 mV P-P	C1	HE361	185.00	129.50
5V	6.0A	±0.1%	±0.1%	100 mV P-P	C1	HE370*	175.00	122.50
	6.0A	±0.1%	±0.1%	100 mV P-P	C1	HE371	205.00	143.50
5/±12V	4A/±400mA	±0.1%	±0.1%	100 mV P-P	C2	HE376*	185.00	129.50
	4A/±400mA	±0.1%	±0.1%	100 mV P-P	C2	HE377	215.00	150.50
5/±15V	4A/±330mA	±0.1%	±0.1%	100 mV P-P	C2	HE378*	185.00	129.50
	4A/±330mA	±0.1%	±0.1%	100 mV P-P	C2	HE379	215.00	150.50

* These models are without filter and shield.
All other models have 6-sided continuous copper shield and Pi + Balun input filter.

† All chassis mountable models have remote sensing.

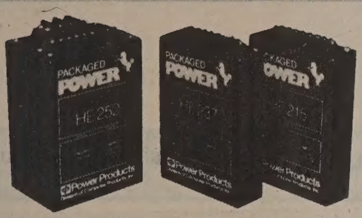
All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 528

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TELEPHONE (305) 975-7660 • TWX 510-956-3098

PACKAGED POWER



Switching Power Supplies

- Power to 100 Watts
- High Efficiency
- Low Ripple and Noise
- Remote Sensing on 5V Outputs
- OVP on 5V Outputs

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		RIPPLE AND NOISE	CASE SIZE	MODEL NUMBER	PRICE	
		LINE	LOAD				1-9	100's
CHASSIS-MOUNTABLE HE200 SERIES								
5V	10A	±0.1%	±0.1%	25 mV P-P	D	HE237	$261.00	$208.80
5V	20A	±0.1%	±0.1%	50 mV P-P	E	HE252	359.00	287.20
12V to 15V	3A	±.02%	±0.1%	20 mV P-P	D	HE212	261.00	208.80
24V to 30V	1.5A	±.02%	±0.1%	20 mV P-P	D	HE224	261.00	208.80
±12V to ±15V	±1.5A	±.02%	±.05%	10 mV P-P	D	HE215	261.00	208.80

OPTIONS

HYBRID POWER MODULES HM500/300 SERIES		SWITCHING POWER MODULES HE500/300 SERIES		SWITCHING POWER MODULES NEW HE500/300 SERIES		SWITCHING POWER SUPPLIES HE200 SERIES	
INPUT VOLTAGE	SUFFIX	INPUT VOLTAGE	SUFFIX	INPUT VOLTAGE	SUFFIX	INPUT VOLTAGE	SUFFIX
90-130 VAC	(NONE)	100-130 VAC	(NONE)	90-130 VAC	(NONE)	90-130 VAC	(NONE)
180-260 VAC	E	200-260 VAC	E	180-260 VAC	E	180-260 VAC	E

ALL MODELS HAVE OPERATING TEMPERATURE RANGE OF −25°C TO +71°C AND STORAGE TEMPERATURE RANGE OF −25°C to +85°C

CASE DIMENSIONS		
B2	3.50 x 2.50 x 1.25 Inches	(88.9 x 63.5 x 31.8 mm)
C1	4.00 x 2.70 x 1.45 Inches	(101.6 x 68.6 x 36.8 mm)
D	6.50 x 4.50 x 1.50 Inches	(165.1 x 114.3 x 38.1 mm)
E	6.50 x 4.50 x 3.19 Inches	(165.1 x 114.3 x 81 mm)

TWO-YEAR WARRANTY

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COMPUTER PRODUCTS
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
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PACKAGED POWER

Switching Power Supplies

50-200 WATT SERIES

- Jumper Selectable 115/230 VAC Input
- Designed to Meet FCC, VDE Class A EMI
- Designed to Meet, UL, CSA and VDE
- 70% Efficiency Minimum
- Remote Sense on Single Output Models
- Short Circuit Protection
- Soft Start
- Single, Dual, Triple and Quad Output Models

MAX. WATTS	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	INPUT EMI FILTER	MODEL NUMBER	PKG.	PRICE	
								1-9	100's
SINGLE OUTPUT MODELS									
50	5V @ 10A				✓	HE201	J1		
50	12V @ 4A				✓	HE202	J1		
50	15V @ 3.3A				✓	HE203	J1		
50	24V @ 2A				✓	HE204	J1		
100	5V @ 20A				✓	HE214	J1		
100	12V @ 8.5A				✓	HE216	J1		
100	15V @ 7A				✓	HE217	J1		
100	24V @ 4.5A				✓	HE218	J1		
DUAL OUTPUT MODELS									
50	5V @ 8A	−5V @ 2A			✓	HE205	J1		
50	12V @ 3A	−12V @ 2A			✓	HE206	J1		
50	15V @ 3A	−15V @ 2A			✓	HE207	J1		
100	5V @ 16A	−5V @ 4A			✓	HE219	J2		
100	12V @ 7A	−12V @ 3A			✓	HE220	J2		
100	15V @ 6A	−15V @ 3A			✓	HE221	J2		
TRIPLE OUTPUT MODELS									
50	5V @ 6A	+12V @ 1A	−12V @ 1A		✓	HE208	J1		
50	5V @ 6A	+15V @ 1A	−15V @ 1A		✓	HE209	J1		
100	5V @ 12A	+12V @ 1.5A	−12V @ 1.5A		✓	HE222	J2		
100	5V @ 12A	+15V @ 1.5A	−15V @ 1.5A		✓	HE225	J2		
QUAD OUTPUT MODELS									
70	5V @ 6A	−5V @ 1A	+12V @ 2A (3A)	−12V @ 1A	✓	HE210	J1		
70	5V @ 6A	−5V @ .5A	+12V @ 1.5A	−12V @ 1A	✓	HE211	J1		
70	5V @ 6A	24V @ 1.5A (3A)	+12V @ 1A	−12V @ 1A	✓	HE213	J1		
100	5V @ 12A	+12V @ 3A	−12V @ 3A	−5V @ 2A	✓	HE226	J2		
100	5V @ 12A	+12V @ 3A	−12V @ 3A	+24V @ 1A	✓	HE227	J2		
100	5V @ 12A	+15V @ 3A	−15V @ 3A	−5V @ 2A	✓	HE228	J2		
100	5V @ 12A	+15V @ 1A	−15V @ 3A	+24V @ 1A	✓	HE229	J2		

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For More Information. Circle No. 528

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
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PACKAGED POWER

Switching Power Supplies
50-200 WATT SERIES

MAX. WATTS	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	INPUT EMI FILTER	MODEL NUMBER	PKG.	PRICE 1-9	PRICE 100's
SINGLE OUTPUT MODELS									
150	5V @ 30A				✓	HE230	J2		
150	12V @ 12.5A				✓	HE231	J2		
150	15V @ 10A				✓	HE232	J2		
150	24V @ 6.5A				✓	HE233	J2		
200	5V @ 40A				✓	HE244	J3		
200	12V @ 17A				✓	HE245	J3		
200	15V @ 13.5A				✓	HE246	J3		
200	24V @ 8.5A				✓	HE247	J3		
DUAL OUTPUT MODELS									
150	5V @ 24A	−5V @ 6A			✓	HE234	J3		
150	12V @ 10A	−12V @ 5A			✓	HE235	J3		
150	15V @ 9A	−15V @ 5A			✓	HE236	J3		
TRIPLE OUTPUT MODELS									
150	5V @ 20A	+12V @ 1.5A	−12V @ 1.5A		✓	HE238	J3		
150	5V @ 20A	+15V @ 1.5A	−15V @ 1.5A		✓	HE239	J3		
QUAD OUTPUT MODELS									
150	5V @ 20A	+12V @ 3A	−12V @ 3A	−5V @ 3A	✓	HE240	J3		
150	5V @ 20A	+12V @ 3A	−12V @ 3A	+24V @ 1.5A	✓	HE241	J3		
150	5V @ 20A	+15V @ 3A	−15V @ 3A	−5V @ 3A	✓	HE242	J3		
150	5V @ 20A	+15V @ 3A	−15V @ 3A	+24V @ 1.5A	✓	HE243	J3		

OTHER SPECIFICATIONS

Ripple and Noise 20MHz BW	1% P-P Max.
Line/Load Regulation	±0.2%
Hold-up Time	30mS
Input Voltage Range, 115 VAC	90-130 VAC
Input Voltage Range, 230 VAC	180-260 VAC
Input Frequency	47-450 Hz.
Operating Temperature	0°-71°C

CASE DIMENSIONS	
Package J1	4.88 x 7.00 x 2.70 Inches
Package J2	4.88 x 9.00 x 2.70 Inches
Package J3	4.88 x 12.00 x 2.70 Inches

* Does not include connector.
Please Consult Factory for Custom Models.

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

COMPUTER PRODUCTS
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4603
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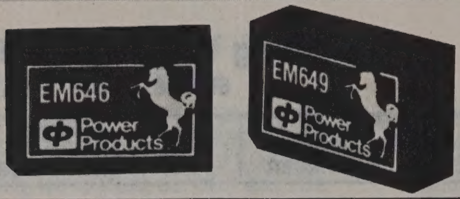
PACKAGED POWER

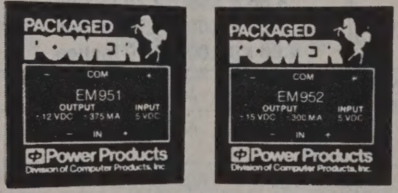

EM646
Power Products
EM649
Power Products

DC/DC Converters
24-PIN DIP COMPATIBLE ECONOMY

- Power to 1.5 Watts
- Unregulated Outputs
- 70% Efficiency
- Internal Input Filtering Available

INPUT VOLTAGE	OUTPUT VOLTAGE/mA	REGULATION		REFLECTED RIPPLE	EFFICIENCY	CASE SIZE	MODEL NUMBER	PRICE	
		LINE*	LOAD†					1-9	100's
ECONOMY EM600 SERIES WITH INPUT FILTER									
5V	5V/220 mA	1.2%	8%	90 mA P-P	70%	F	EM621	$40.00	$28.00
	12V/125 mA	1.2%	8%	90 mA P-P	70%	F	EM623	40.00	28.00
	15V/100 mA	1.2%	8%	90 mA P-P	70%	F	EM624	40.00	28.00
12V	5V/220 mA	1.2%	8%	90 mA P-P	70%	F	EM631	40.00	28.00
	12V/125 mA	1.2%	8%	90 mA P-P	70%	F	EM633	40.00	28.00
	15V/100 mA	1.2%	8%	90 mA P-P	70%	F	EM634	40.00	28.00
5V	±12V/±62 mA	1.2%	8%	90 mA P-P	70%	F	EM671	42.00	29.40
	±15V/±50 mA	1.2%	8%	90 mA P-P	70%	F	EM672	42.00	29.40
12V	±12V/±62 mA	1.2%	8%	90 mA P-P	70%	F	EM681	42.00	29.40
	±15V/±50 mA	1.2%	8%	90 mA P-P	70%	F	EM682	42.00	29.40
ECONOMY EM600 SERIES WITHOUT INPUT FILTER									
5V	5V/220 mA	1.2%	8%	2500 mA P-P	70%	F	EM641	$36.00	$25.20
	12V/125 mA	1.2%	8%	2500 mA P-P	70%	F	EM643	36.00	25.20
	15V/100 mA	1.2%	8%	2500 mA P-P	70%	F	EM644	36.00	25.20
12V	5V/220 mA	1.2%	8%	2500 mA P-P	70%	F	EM646	36.00	25.20
	12V/120 mA	1.2%	8%	2500 mA P-P	70%	F	EM648	36.00	25.20
	15V/100 mA	1.2%	8%	2500 mA P-P	70%	F	EM649	36.00	25.20
5V	±12V/±62 mA	1.2%	8%	2500 mA P-P	70%	F	EM691	38.00	26.60
	±15V/±50 mA	1.2%	8%	2500 mA P-P	70%	F	EM692	38.00	26.60
12V	±12V/±62 mA	1.2%	8%	2500 mA P-P	70%	F	EM696	38.00	26.60
	±15V/±50 mA	1.2%	8%	2500 mA P-P	70%	F	EM697	38.00	26.60

* Per 1.0% Change in Input Voltage.
† From 100% Load to 20% Load.


PACKAGED POWER
COM
EM951
OUTPUT
12 VDC
375 MA
INPUT
5 VDC
IN
Power Products
Division of Computer Products, Inc
PACKAGED POWER
COM
EM952
OUTPUT
15 VDC
300 MA
INPUT
5 VDC
IN
Power Products
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DC/DC Converters
LOW-COST UNREGULATED

- Power to 9 Watts
- Pi Input Filter
- Excellent Isolation
- High Efficiency

INPUT VOLTAGE	OUTPUT VOLTAGE/mA	REGULATION		REFLECTED RIPPLE	EFFICIENCY	CASE SIZE	MODEL NUMBER	PRICE	
		LINE*	LOAD†					1-9	100's
ECONOMY EM900 SERIES									
5V	5V/1000 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM901	$71.00	$49.70
	12V/600 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM903	71.00	49.70
	15V/500 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM904	71.00	49.70
12V	5V/1000 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM911	71.00	49.70
	12V/600 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM913	71.00	49.70
	15V/500 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM914	71.00	49.70
5V	±12V/±375 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM951	76.00	53.20
	±15V/±300 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM952	76.00	53.20
12V	±12V/±375 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM961	76.00	53.20
	±15V/±300 mA	1.2%	8%	75 mA P-P	70%-85%	G	EM962	76.00	53.20

* Per 1.0% Change in Input Voltage.
† From 100% Load to 20% Load.

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For More Information. Circle No. 528

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIVISION
2881 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
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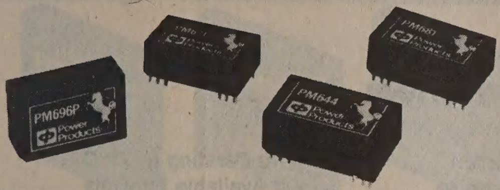
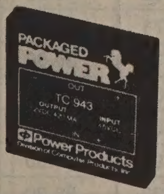
PACKAGED POWER



DC/DC Converters
24-PIN DIP COMPATIBLE

- Power to One Watt
- Regulated Outputs
- Low Ripple and Noise
- Internal Input Filtering Available

INPUT VOLTAGE	OUTPUT VOLTAGE/mA	REGULATION LINE	REGULATION LOAD	REFLECTED RIPPLE	EFFICIENCY	CASE SIZE	MODEL NUMBER	PRICE 1-9	PRICE 100's
PM600 SERIES WITH INTERNAL FILTER									
5V	5V/100 mA	±0.3%	±0.4%	15 mA P-P	50%	F	PM621	$48.00	$33.60
	12V/80 mA	±0.3%	±0.4%	15 mA P-P	50%	F	PM623	48.00	33.60
	15V/65 mA	±0.3%	±0.4%	15 mA P-P	50%	F	PM624	48.00	33.60
12V	5V/100 mA	±0.3%	±0.4%	45 mA P-P	50%	F	PM631	48.00	33.60
	12V/80 mA	±0.3%	±0.4%	45 mA P-P	50%	F	PM633	48.00	33.60
	15V/65 mA	±0.3%	±0.4%	45 mA P-P	50%	F	PM634	48.00	33.60
5V	±12V/±40 mA	±0.3%	±0.4%	15 mA P-P	50%	F	PM671	52.00	36.40
	±15V/±33 mA	±0.3%	±0.4%	15 mA P-P	50%	F	PM672	52.00	36.40
12V	±12V/±40 mA	±0.3%	±0.4%	45 mA P-P	50%	F	PM681	52.00	36.40
	±15V/±33 mA	±0.3%	±0.4%	45 mA P-P	50%	F	PM682	52.00	36.40
PM600 SERIES UNFILTERED									
5V	5V/100 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM641	$43.00	$30.10
	12V/80 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM643	43.00	30.10
	15V/65 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM644	43.00	30.10
12V	5V/100 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM646	43.00	30.10
	12V/80 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM648	43.00	30.10
	15V/65 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM649	43.00	30.10
5V	±12V/±40 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM691	46.00	32.20
	±15V/±33 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM692	46.00	32.20
12V	±12V/±40 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM696	46.00	32.20
	±15V/±33 mA	±0.3%	±0.4%	1500 mA P-P	50%	F	PM697	46.00	32.20



DC/DC Converters
TELECOMMUNICATIONS

- 78% Efficiency
- 35 to 70 VDC Input Range
- Input Surge Protected
- Pi Input Filter
- Six-Sided Continuous Shield

INPUT VOLTAGE	OUTPUT VOLTAGE/mA	REGULATION LINE	REGULATION LOAD	REFLECTED RIPPLE	EFFICIENCY	CASE SIZE	MODEL NUMBER	PRICE 1-9	PRICE 100's
5 WATT TELECOM TC900 SERIES									
48V	5V/1000 mA	±0.2%	±0.1%	30 mA P-P	78%	G	TC941	$119.00	$83.30
	12V/420 mA	±0.2%	±0.1%	30 mA P-P	78%	G	TC943	119.00	83.30
	15V/335 mA	±0.2%	±0.1%	30 mA P-P	78%	G	TC944	119.00	83.30

CASE DIMENSIONS		
F	1.25 x 0.80 x 0.4 Inches	(31.8 x 20.3 x 9.8 mm)
G	2.00 x 2.00 x 0.4 Inches	(50.8 x 50.8 x 9.8 mm)

OPTIONS	PM600 SERIES DC/DC CONVERTERS	OPTION	SUFFIX
		EXTERNAL BALANCE PIN	P
		ALTERNATE PIN CONFIGURATION	R

ALL MODELS HAVE OPERATING TEMPERATURE RANGE OF −25°C TO +71°C AND STORAGE TEMPERATURE RANGE OF −25°C to +85°C

TWO-YEAR WARRANTY

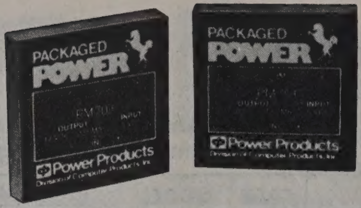
All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 528

COMPUTER PRODUCTS
POWER CONVERSION

POWER PRODUCTS DIVISION
2861 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TELEPHONE (305) 975-7660 • TWX 510-956-3098

PACKAGED POWER



DC/DC Converters
3 WATT

- Excellent Regulation
- Low Ripple and Noise
- 500 VDC Isolation
- No Derating to 71°C
- 3 Available Pin-Outs

INPUT VOLTAGE	OUTPUT VOLTAGE/mA	REGULATION LINE	REGULATION LOAD	REFLECTED RIPPLE	EFFICIENCY	CASE SIZE	MODEL NUMBER	PRICE 1-9	PRICE 100's
3-WATT GENERAL PURPOSE PM700 SERIES									
5V	5V/600 mA	±0.02%	±0.04%	32 mA P-P	60%	G	PM701	$81.00	$56.70
	12V/250 mA	±0.02%	±0.04%	31 mA P-P	60%	G	PM703	81.00	56.70
	15V/200 mA	±0.02%	±0.04%	30 mA P-P	60%	G	PM704	81.00	56.70
12V	5V/600 mA	±0.02%	±0.04%	24 mA P-P	60%	G	PM711	81.00	56.70
	12V/250 mA	±0.02%	±0.04%	23 mA P-P	60%	G	PM713	81.00	56.70
	15V/200 mA	±0.02%	±0.04%	22 mA P-P	60%	G	PM714	81.00	56.70
24V	5V/600 mA	±0.02%	±0.04%	22 mA P-P	60%	G	PM721	81.00	56.70
	12V/250 mA	±0.02%	±0.04%	22 mA P-P	60%	G	PM723	81.00	56.70
	15V/200 mA	±0.02%	±0.04%	21 mA P-P	60%	G	PM724	81.00	56.70
28V	5V/600 mA	±0.02%	±0.04%	21 mA P-P	60%	G	PM731	81.00	56.70
	12V/250 mA	±0.02%	±0.04%	21 mA P-P	60%	G	PM733	81.00	56.70
	15V/200 mA	±0.02%	±0.04%	20 mA P-P	60%	G	PM734	81.00	56.70
48V	5V/600 mA	±0.02%	±0.04%	21 mA P-P	60%	G	PM741	81.00	56.70
	12V/250 mA	±0.02%	±0.04%	20 mA P-P	60%	G	PM743	81.00	56.70
	15V/200 mA	±0.02%	±0.04%	19 mA P-P	60%	G	PM744	81.00	56.70
5V	±12V/±125 mA	±0.02%	±0.02%	34 mA P-P	60%	G	PM751	86.00	60.20
	±15V/±100 mA	±0.02%	±0.02%	33 mA P-P	60%	G	PM752	86.00	60.20
12V	±12V/±125 mA	±0.02%	±0.02%	25 mA P-P	60%	G	PM761	86.00	60.20
	±15V/±100 mA	±0.02%	±0.02%	24 mA P-P	60%	G	PM762	86.00	60.20
24V	±12V/±125 mA	±0.02%	±0.02%	23 mA P-P	60%	G	PM771	86.00	60.20
	±15V/±100 mA	±0.02%	±0.02%	22 mA P-P	60%	G	PM772	86.00	60.20
28V	±12V/±125 mA	±0.02%	±0.02%	22 mA P-P	60%	G	PM781	86.00	60.20
	±15V/±100 mA	±0.02%	±0.02%	21 mA P-P	60%	G	PM782	86.00	60.20
48V	±12V/±125 mA	±0.02%	±0.02%	21 mA P-P	60%	G	PM791	86.00	60.20
	±15V/±100 mA	±0.02%	±0.02%	20 mA P-P	60%	G	PM792	86.00	60.20

CASE DIMENSIONS		
G	2.00 x 2.00 x 0.4 Inches	(50.8 x 50.8 x 9.8 mm)

INPUT VOLTAGE RANGES		
INPUT VOLTAGE	DERATE 2.5%/°C FROM 50°C to 71°C	NO DERATING −25°C to +71°C
5V	4.4-6.5V	4.5-5.5V
12V	10.56-15.6V	10.8-13.2V
24V	21.12-31.2V	21.6-26.4V
28V	24.64-36.4V	25.2-30.8V
48V	42.24-62.4V	43.2-52.8V

ALL MODELS HAVE OPERATING TEMPERATURE RANGE OF −25°C TO +71°C AND STORAGE TEMPERATURE RANGE OF −40°C to +125°C

TWO-YEAR WARRANTY

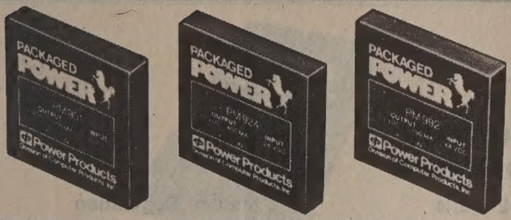
All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 528

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
POMPANO BEACH, FL 33069-4803
TELEPHONE (305) 975-7660 • TWX 510-956-3098

PACKAGED POWER



DC/DC Converters

HIGH PERFORMANCE

- Power 5 to 6 Watts
- High Efficiency
- Excellent Regulation
- EMI/RFI Six-Sided Shielding
- 3 Available Pin-Outs

INPUT VOLTAGE	OUTPUT VOLTAGE/mA	REGULATION		REFLECTED RIPPLE	EFFICIENCY	CASE SIZE	MODEL NUMBER	PRICE	
		LINE	LOAD					1-9	100's
5-WATT HIGH-PERFORMANCE PM900 SERIES									
5V	5V/1000 mA	±.02%	±.04%	54 mA P-P	61%	G	PM901	$107.00	$74.90
	12V/470 mA	±.02%	±.04%	61 mA P-P	61%	G	PM903	107.00	74.90
	15V/400 mA	±.02%	±.04%	64 mA P-P	61%	G	PM904	107.00	74.90
12V	5V/1000 mA	±.02%	±.04%	22 mA P-P	61%	G	PM911	107.00	74.90
	12V/470 mA	±.02%	±.04%	26 mA P-P	61%	G	PM913	107.00	74.90
	15V/400 mA	±.02%	±.04%	27 mA P-P	61%	G	PM914	107.00	74.90
24V	5V/1000 mA	±.02%	±.04%	22 mA P-P	61%	G	PM921	107.00	74.90
	12V/470 mA	±.02%	±.04%	25 mA P-P	61%	G	PM923	107.00	74.90
	15V/400 mA	±.02%	±.04%	27 mA P-P	61%	G	PM924	107.00	74.90
28V	5V/1000 mA	±.02%	±.04%	22 mA P-P	61%	G	PM931	107.00	74.90
	12V/470 mA	±.02%	±.04%	25 mA P-P	61%	G	PM933	107.00	74.90
	15V/400 mA	±.02%	±.04%	26 mA P-P	61%	G	PM934	107.00	74.90
48V	5V/1000 mA	±.02%	±.04%	22 mA P-P	61%	G	PM941	107.00	74.90
	12V/470 mA	±.02%	±.04%	25 mA P-P	61%	G	PM943	107.00	74.90
	15V/400 mA	±.02%	±.04%	27 mA P-P	61%	G	PM944	107.00	74.90
5V	±12V/±230 mA	±.02%	±.02%	58 mA P-P	62%	G	PM951	112.00	78.40
	±15V/±190 mA	±.02%	±.02%	60 mA P-P	62%	G	PM952	112.00	78.40
12V	±12V/±230 mA	±.02%	±.02%	24 mA P-P	62%	G	PM961	112.00	78.40
	±15V/±190 mA	±.02%	±.02%	25 mA P-P	62%	G	PM962	112.00	78.40
24V	±12V/±230 mA	±.02%	±.02%	24 mA P-P	62%	G	PM971	112.00	78.40
	±15V/±190 mA	±.02%	±.02%	25 mA P-P	62%	G	PM972	112.00	78.40
28V	±12V/±230 mA	±.02%	±.02%	23 mA P-P	62%	G	PM981	112.00	78.40
	±15V/±190 mA	±.02%	±.02%	24 mA P-P	62%	G	PM982	112.00	78.40
48V	±12V/±230 mA	±.02%	±.02%	24 mA P-P	62%	G	PM991	112.00	78.40
	±15V/±190 mA	±.02%	±.02%	25 mA P-P	62%	G	PM992	112.00	78.40

INPUT VOLTAGE RANGES VS. PERCENTAGE OF RATED OUTPUT LOAD

INPUT VOLTAGE	5V	12V	24V	28V	48V
100% Load	4.65-5.5V	11.16-13.2V	22.32-26.4V	26.04-30.8V	44.64-52.8V
80% Load	4.50-6.0V	10.80-14.4V	21.60-28.8V	25.20-33.6V	43.20-57.6V
60% Load	4.40-6.5V	10.56-15.6V	21.12-31.2V	24.64-36.4V	42.24-62.4V

CASE DIMENSIONS		
G	2.00 x 2.00 x 0.4 Inches	(50.8 x 50.8 x 9.8 mm)

ALL MODELS HAVE OPERATING TEMPERATURE RANGE OF −25°C TO +71°C AND STORAGE TEMPERATURE RANGE OF −40°C to +125°C

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

COMPUTER PRODUCTS™
POWER CONVERSION

POWER PRODUCTS DIVISION
2981 GATEWAY DRIVE
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PACKAGED POWER

PACKAGED POWER
PM844
Power Products
PACKAGED POWER
PM892
Power Products

DC/DC Converters
HIGH PERFORMANCE

- Power 10 to 12 Watts
- High Efficiency
- Excellent Regulation
- EMI/RFI Six-Sided Shielding

INPUT VOLTAGE	OUTPUT VOLTAGE/mA	REGULATION LINE	REGULATION LOAD	REFLECTED RIPPLE	EFFICIENCY	CASE SIZE	MODEL NUMBER	PRICE 1-9	PRICE 100's
10 WATT HIGH-PERFORMANCE PM800 SERIES									
5V	5V/2000 mA	±.02%	±.05%	108 mA P-P	61%	B1	PM801	$130.00	$91.00
	12V/940 mA	±.02%	±.05%	122 mA P-P	61%	B1	PM803	130.00	91.00
	15V/800 mA	±.02%	±.05%	130 mA P-P	61%	B1	PM804	130.00	91.00
12V	5V/2000 mA	±.02%	±.05%	45 mA P-P	61%	B1	PM811	130.00	91.00
	12V/940 mA	±.02%	±.05%	51 mA P-P	61%	B1	PM813	130.00	91.00
	15V/800 mA	±.02%	±.05%	54 mA P-P	61%	B1	PM814	130.00	91.00
24V	5V/2000 mA	±.02%	±.05%	32 mA P-P	61%	B1	PM821	130.00	91.00
	12V/940 mA	±.02%	±.05%	36 mA P-P	61%	B1	PM823	130.00	91.00
	15V/800 mA	±.02%	±.05%	38 mA P-P	61%	B1	PM824	130.00	91.00
28V	5V/2000 mA	±.02%	±.05%	33 mA P-P	61%	B1	PM831	130.00	91.00
	12V/940 mA	±.02%	±.05%	37 mA P-P	61%	B1	PM833	130.00	91.00
	15V/800 mA	±.02%	±.05%	39 mA P-P	61%	B1	PM834	130.00	91.00
48V	5V/2000 mA	±.02%	±.05%	32 mA P-P	61%	B1	PM841	130.00	91.00
	12V/940 mA	±.02%	±.05%	36 mA P-P	61%	B1	PM843	130.00	91.00
	15V/800 mA	±.02%	±.05%	38 mA P-P	61%	B1	PM844	130.00	91.00
5V	±12V/±525 mA	±.02%	±.02%	132 mA P-P	62%	B1	PM851	135.00	94.50
	±15V/±412 mA	±.02%	±.02%	130 mA P-P	62%	B1	PM852	135.00	94.50
12V	±12V/±525 mA	±.02%	±.02%	55 mA P-P	62%	B1	PM861	135.00	94.50
	±15V/±412 mA	±.02%	±.02%	54 mA P-P	62%	B1	PM862	135.00	94.50
24V	±12V/±525 mA	±.02%	±.02%	39 mA P-P	62%	B1	PM871	135.00	94.50
	±15V/±412 mA	±.02%	±.02%	38 mA P-P	62%	B1	PM872	135.00	94.50
28V	±12V/±525 mA	±.02%	±.02%	40 mA P-P	62%	B1	PM881	135.00	94.50
	±15V/±412 mA	±.02%	±.02%	39 mA P-P	62%	B1	PM882	135.00	94.50
48V	±12V/±525 mA	±.02%	±.02%	39 mA P-P	62%	B1	PM891	135.00	94.50
	±15V/±412 mA	±.02%	±.02%	38 mA P-P	62%	B1	PM892	135.00	94.50

INPUT VOLTAGE RANGES VS. PERCENTAGE OF RATED OUTPUT LOAD

INPUT VOLTAGE	5V	12V	24V	28V	48V
100% Load	4.65-5.5V	11.16-13.2V	22.32-26.4V	26.04-30.8V	44.64-52.8V
80% Load	4.50-6.0V	10.80-14.4V	21.60-28.8V	25.20-33.6V	43.20-57.6V
60% Load	4.40-6.5V	10.56-15.6V	21.12-31.2V	24.64-36.4V	42.24-62.4V

CASE DIMENSIONS		
B1	3.50 x2.50 x 0.88 Inches	(88.9 x 63.5 x 22.4 mm)

ALL MODELS HAVE OPERATING TEMPERATURE RANGE OF −25°C TO +71°C AND STORAGE TEMPERATURE RANGE OF −40°C to +125°C

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 528

COMPUTER PRODUCTS
POWER CONVERSION

STEVENS-ARNOLD DIVISION
7 ELKINS STREET
SOUTH BOSTON, MA 02127
TELEPHONE (617) 268-1170 • TWX 710-339-0855

PACKAGED POWER

PACKAGED POWER
WP24S05/5000U
CONTROL
INPUT 24 VDC
Stevens-Arnold

DC/DC Converters 25 Watt Ultra-Wide Input Range

ISO-PAK® SINGLE OUTPUT

- 4:1 Input Range
- Efficiency to 85%
- Direct Output Paralleling
- Adjustable Output ±10%
- Remote On-Off Control
- 100 kHz Switching
- Isolated

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
5 VDC	5000 mA	±0.5%	±0.5%	77%	U	629	WP24S05/5000U	$209.00	$146.30
6 VDC	4500 mA	±0.5%	±0.5%	78%	U	629	WP24S06/4500U	209.00	146.30
12 VDC	2500 mA	±0.5%	±0.5%	84%	U	629	WP24S12/2500U	209.00	146.30
15 VDC	2000 mA	±0.5%	±0.5%	85%	U	629	WP24S15/2000U	209.00	146.30

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
5 VDC	5000 mA	±0.5%	±0.5%	77%	U	629	WP48S05/5000U	$209.00	$146.30
6 VDC	4500 mA	±0.5%	±0.5%	78%	U	629	WP48S06/4500U	209.00	146.30
12 VDC	2500 mA	±0.5%	±0.5%	84%	U	629	WP48S12/2500U	209.00	146.30
15 VDC	2000 mA	±0.5%	±0.5%	85%	U	629	WP48S15/2000U	209.00	146.30

INPUT VOLTAGE RANGES	
NOMINAL	INPUT RANGE
24 VDC	9-36 VDC
48 VDC	20-72 VDC

CASE DIMENSIONS		
U	4.56 x 2.56 x .83 In.	(116 x 65 x 21 mm)

OTHER VOLTAGE AND CURRENT COMBINATIONS AVAILABLE — PLEASE CONSULT FACTORY.
OPERATING TEMPERATURE RANGE: −25°C TO +71°C. NO DERATING.
100% BURN-IN @ FULL LOAD.

TWO-YEAR WARRANTY

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COMPUTER PRODUCTS
POWER CONVERSION

STEVENS-ARNOLD DIVISION
7 ELKINS STREET
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PACKAGED POWER

PACKAGED POWER
WR SERIES
WIDE INPUT
SINGLE OUTPUT
ISOLATED
5VDC, 5AMP
Stevens-Arnold

DC/DC Converters 15 & 30 Watt Wide Input Range

ISO-PAK® SINGLES & DUALS

- 2:1 Input Range
- Economically Priced
- Efficiency to 86%
- Remote On-Off Control
- 100 kHz Switching Frequency
- Isolated Output

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
5 VDC	3000 mA	±1%	±1%	75%	XC	639	WR12S05/3000XC	$119.00	$ 83.30
	3000 mA	±1%	±1%	77%	XC	639	WR24S05/3000XC	119.00	83.30
	3000 mA	±1%	±1%	77%	XC	639	WR48S05/3000XC	119.00	83.30
	5000 mA	±1%	±1%	75%	U	639	WR12S05/5000U	159.00	111.30
	5000 mA	±1%	±1%	77%	U	639	WR24S05/5000U	159.00	111.30
	5000 mA	±1%	±1%	78%	U	639	WR48S05/5000U	159.00	111.30
12 VDC	1250 mA	±1%	±1%	78%	XC	639	WR12S12/1250XC	119.00	83.30
	1250 mA	±1%	±1%	80%	XC	639	WR24S12/1250XC	119.00	83.30
	1250 mA	±1%	±1%	80%	XC	639	WR48S12/1250XC	119.00	83.30
	2500 mA	±1%	±1%	78%	U	639	WR12S12/2500U	159.00	111.30
	2500 mA	±1%	±1%	80%	U	639	WR24S12/2500U	159.00	111.30
	2500 mA	±1%	±1%	81%	U	639	WR48S12/2500U	159.00	111.30
15 VDC	1000 mA	±1%	±1%	78%	XC	639	WR12S15/1000XC	119.00	83.30
	1000 mA	±1%	±1%	80%	XC	639	WR24S15/1000XC	119.00	83.30
	1000 mA	±1%	±1%	80%	XC	639	WR48S15/1000XC	119.00	83.30
	2000 mA	±1%	±1%	78%	U	639	WR12S15/2000U	159.00	111.30
	2000 mA	±1%	±1%	80%	U	639	WR24S15/2000U	159.00	111.30
	2000 mA	±1%	±1%	81%	U	639	WR48S15/2000U	159.00	111.30
±12 VDC	±625 mA	±0.2%	±1%	82%	XC	635	WR12D12/625XC	125.00	87.50
	±625 mA	±0.2%	±1%	84%	XC	635	WR24D12/625XC	125.00	87.50
	±625 mA	±0.2%	±1%	86%	XC	635	WR48D12/625XC	125.00	87.50
	±1250 mA	±0.2%	±1%	82%	U	635	WR12D12/1250U	169.00	118.30
	±1250 mA	±0.2%	±1%	84%	U	635	WR24D12/1250U	169.00	118.30
	±1250 mA	±0.2%	±1%	86%	U	635	WR24D12/1250U	169.00	118.30
±15 VDC	±500 mA	±0.2%	±1%	82%	XC	635	WR12D15/500XC	125.00	87.50
	±500 mA	±0.2%	±1%	84%	XC	635	WR24D15/500XC	125.00	87.50
	±500 mA	±0.2%	±1%	86%	XC	635	WR48D15/500XC	125.00	87.50
	±1000 mA	±0.2%	±1%	82%	U	635	WR12D15/1000U	169.00	118.30
	±1000 mA	±0.2%	±1%	84%	U	635	WR12D15/1000U	169.00	118.30
	±1000 mA	±0.2%	±1%	86%	U	635	WR12D15/1000U	169.00	118.30

INPUT VOLTAGE RANGES

NOMINAL	INPUT RANGE
12 VDC	9-18 VDC
24 VDC	18-36 VDC
48 VDC	36-72 VDC

CASE DIMENSIONS

U	4.56 x 2.56 x 0.83 In.	(116 x 65 x 21 mm)
XC	3.0 x 2.56 x 0.83 In.	(76 x 65 x 21 mm)

OTHER VOLTAGE AND CURRENT COMBINATIONS AVAILABLE — PLEASE CONSULT FACTORY.
OPERATING TEMPERATURE RANGE: −25°C TO +71°C. NO DERATING.
100% BURN-IN @ FULL LOAD

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 529

COMPUTER PRODUCTS™
POWER CONVERSION

STEVENS–ARNOLD DIVISION
7 ELKINS STREET
SOUTH BOSTON, MA 02127
TELEPHONE (617) 268-1170 • TWX 710-339-0855

PACKAGED POWER

PACKAGED
POWER
ES SERIES
TRIPLE OUTPUT
±15VDC ±250mA
5VDC 1.5 AMPS
Stevens-Arnold
Subsidiary of Computer Products, Inc.

DC/DC Converters 15 Watt Wide Input Range

ISO-PAK® TRIPLE OUTPUT

- 2:1 Input Range
- Economically Priced
- Efficiency to 82%
- 100 kHz Switching Frequency
- Short-Circuit Protected
- Isolated Output

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
+5 VDC ±12 VDC	SEE TABLE 1 BELOW	±0.5%	±3.0%	78%	XC	640	ES12T12/310X	$119.00	$ 83.30
		±0.5%	±3.0%	80%	XC	640	ES24T12/310X	119.00	83.30
		±0.5%	±3.0%	82%	XC	640	ES48T12/310X	119.00	83.30
+5 VDC ±15 VDC	SEE TABLE 1 BELOW	±0.5%	±3.0%	78%	XC	640	ES12T15/250X	119.00	83.30
		±0.5%	±3.0%	80%	XC	640	ES24T15/250X	119.00	83.30
		±0.5%	±3.0%	82%	XC	640	ES48T15/250X	119.00	83.30
+5 VDC +12 VDC −5 V	SEE TABLE 1 BELOW	±0.5%	±3.0%	78%	XC	640	ES12T05/500X	119.00	83.30
		±0.5%	±3.0%	80%	XC	640	ES24T05/500X	119.00	83.30
		±0.5%	±3.0%	82%	XC	640	ES48T05/500X	119.00	83.30

TABLE 1

OUTPUT LOADING & PROTECTION TABLE

OUTPUT	OUTPUT VOLTAGE	OUTPUT CURRENT			OVP (±5%)
		MIN.	NOM.	MAX.	
1	+5V	250 mA	1.5A	2.0A	6.8V
2 & 3	+12V or −12V	100 mA	310 mA	500 mA	15.0V
2 & 3	+15V or −15V	100 mA	250 mA	500 mA	18.0V
2 & 3	+12V, −5V	.1/.1A	.31/.5A	.5/.5A	6.8V

NOTES:
1. Max. total power from all outputs limited to 15 watts. No output may exceed max. current shown.
2. Min. current on each output required to maintain regulation spec.
3. Load regulation is specified from min. to nom. load on each output with nom. load on other outputs.
4. Will not cause the equipment to fail FCC requirements.
5. Specifications apply at 25°C ambient.

CASE DIMENSIONS		
XC	3.0 x 2.56 x 0.83 In.	(76 x 65 x 21 mm)

INPUT VOLTAGE RANGES	
NOMINAL	INPUT RANGE
12 VDC	9-18 VDC
24 VDC	18-36 VDC
48 VDC	36-72 VDC

OTHER VOLTAGE AND CURRENT COMBINATIONS AVAILABLE — PLEASE CONSULT FACTORY.
OPERATING TEMPERATURE RANGE: −25°C TO +71°C. NO DERATING.
100% BURN-IN @ FULL LOAD

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

COMPUTER PRODUCTS™
POWER CONVERSION

STEVENS–ARNOLD DIVISION
7 ELKINS STREET
SOUTH BOSTON, MA 02127
TELEPHONE (617) 268-1170 • TWX 710-339-0855

PACKAGED POWER

PACKAGED POWER
LWM SERIES
WIDE INPUT
DC/DC SUPPLY
5V 3A
Stevens-Arnold
PACKAGED POWER
LWM SERIES
WIDE INPUT
DC/DC SUPPLY
5V 1A
Stevens-Arnold

DC/DC Converters 15-45 Watt High Power Density

SWITCH-PAK® SINGLE OUTPUT

- Ultra Wide Input
- 4:1 Input Range
- 75 kHz Switching Frequency
- Efficiency to 89%
- Low Profile
- Non-Isolated

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
5 VDC	3000 mA	±0.5%	±0.5%	80%	XA	642	LWM12S05/3000XA	$ 89.00	$ 62.30
	5000 mA	±0.5%	±0.5%	80%	XC	642	LWM12S05/5000XC	101.00	70.70
12 VDC	2000 mA	±0.5%	±0.5%	85%	XA	642	LWM24S12/2000XA	89.00	62.30
	3500 mA	±0.5%	±0.5%	87%	XC	642	LWM24S12/3500XC	101.00	70.70
15 VDC	1500 mA	±0.5%	±0.5%	87%	XA	642	LWM24S15/1500XA	89.00	62.30
	3000 mA	±0.5%	±0.5%	89%	XC	642	LWM24S15/5000XC	101.00	70.70

PACKAGED POWER
WM SERIES
WIDE INPUT
DC/DC SUPPLY
5VDC, 3 AMP
Stevens-Arnold
PACKAGED POWER
WF SERIES
WIDE INPUT
DC/DC SUPPLY
5VDC, 1 AMP
Stevens-Arnold

DC/DC Converters 5-50 Watt Ultra-Wide Input Range

SWITCH-PAK® SINGLE OUTPUT

- 4:1 Input Range
- Efficiency to 88%
- Non-Isolation
- Six-Sided Sheilding

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
5 VDC	1000 mA	±0.5%	±1.0%	75%	Z	632	WF12S05/1000Z	$ 65.00	$ 45.50
	3000 mA	±1.0%	±1.0%	75%	X	618	WM7-40S05/3000X	91.00	72.80
	5000 mA	±1.0%	±1.0%	75%	U	618	WM7-40S05/5000U	124.00	99.20
12 VDC	2000 mA	±1.0%	±1.0%	85%	X	618	WM14-40S12/2000X	91.00	72.80
	4000 mA	±1.0%	±1.0%	85%	U	618	WM14-40S12/4000U	124.00	99.20
15 VDC	1500 mA	±1.0%	±1.0%	88%	X	618	WM17-40S15/1500X	91.00	72.80
	3000 mA	±1.0%	±1.0%	85%	U	618	WM17-40S15/3000U	124.00	99.20

INPUT VOLTAGE RANGES

NOMINAL	INPUT RANGE
12 VDC	7-32 VDC (WF)
12 VDC	7-40 VDC (WM/LWM)
24 VDC	14-40 VDC (WM/LWM)
24 VDC	17-40 VDC (WM/LWM)

CASE DIMENSIONS

U	2.56 x 4.56 x .83 In.	(65 x 116 x 21 mm)
X	3.0 x 2.56 x 0.75 In.	(76 x 65 x 19 mm)
Z	2.0 x 2.0 x 0.38 In.	(51 x 51 x 9.6 mm)
XA	2.56 x 3.0 x 0.38 In.	(65 x 76 x 9.6 mm)
XC	2.56 x 3.0 x 0.83 In.	(65 x 76 x 21 mm)

OTHER VOLTAGE AND CURRENT COMBINATIONS AVAILABLE — PLEASE CONSULT FACTORY.
OPERATING TEMPERATURE RANGE: −25°C TO +71°C. NO DERATING.
100% BURN-IN @ FULL LOAD

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 529

COMPUTER PRODUCTS
POWER CONVERSION

STEVENS-ARNOLD DIVISION
7 ELKINS STREET
SOUTH BOSTON, MA 02127
TELEPHONE (617) 268-1170 • TWX 710-339-0855

PACKAGED POWER

PACKAGED POWER
M SERIES
SINGLE OUTPUT
DC/DC CONVERTER
5VDC, 2 AMP
Stevens-Arnold
PACKAGED POWER
F SERIES
DC/DC CONVERTER
5VDC, 1 AMP
Stevens-Arnold

DC/DC Converters 1-25 Watt High Performance

ISO-PAK® SINGLE OUTPUT

- Linear Performance
- Low Noise
- Isolated
- Regulated
- Six-Sided Shielding
- Efficiency to 71%

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
5 VDC	200 mA	±1.0%	±1.0%	46%	W	607	H*S05/200W	$ 54.00	$ 43.20
	600 mA	±0.1%	±0.2%	60%	Z	606	F*S05/600Z	94.00	65.80
	1000 mA	±0.1%	±0.1%	67%	Z	606	F*S05/1000Z	108.00	75.60
	2000 mA	±0.2%	±0.2%	65%	X	608	M*S05/2000X	130.00	104.00
	5000 mA	±0.2%	±0.2%	63%	V	609	P*S05/5000V	250.00	175.00
12 VDC	125 mA	±1.0%	±1.0%	56%	W	607	H*S12/125W	54.00	43.20
	300 mA	±0.1%	±0.2%	65%	Z	606	F*S12/300Z	94.00	65.80
	500 mA	±0.1%	±0.1%	67%	Z	606	F*S12/500Z	108.00	75.60
	1000 mA	±0.2%	±0.2%	71%	X	608	M*S12/1000X	130.00	104.00
	2000 mA	±0.2%	±0.2%	67%	V	609	P*S12/2000V	250.00	175.00
15 VDC	100 mA	±0.1%	±1.0%	59%	W	607	H*S15/100W	54.00	43.20
	200 mA	±0.1%	±0.2%	60%	Z	606	F*S15/200Z	94.00	65.80
	350 mA	±0.1%	±0.1%	69%	Z	606	F*15/350Z	108.00	75.60
	670 mA	±0.2%	±0.2%	71%	X	608	M*S15/670X	130.00	104.00
	1600 mA	±0.2%	±0.2%	66%	V	609	P*S15/1600V	250.00	175.00

NOTE: P Series not available with 5 Volt Input.
* Select Desired Nominal Input Voltage (Table Below) and Insert in Place of Asterisk to Complete Model Number.

INPUT VOLTAGE RANGES	
NOMINAL	
5 VDC	4.5-5.5 VDC
12 VDC	10-14.5 VDC
24 VDC	21-28 VDC
28 VDC	24-32 VDC
48 VDC	42-56 VDC

CASE DIMENSIONS		
V	6.32 x 4.32 x .81 In.	(161 x 110 x 21 mm)
W	1.0 x 2.0 x 0.38 In.	(25 x 51 x 9.6 mm)
X	3.0 x 2.56 x 0.75 In.	(76 x 65 x 19 mm)
Z	2.0 x 2.0 x 0.38 In.	(51 x 51 x 9.6 mm)

OTHER VOLTAGE AND CURRENT COMBINATIONS AVAILABLE — PLEASE CONSULT FACTORY.
OPERATING TEMPERATURE RANGE: −25°C TO +71°C. NO DERATING.
100% BURN-IN @ FULL LOAD

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

COMPUTER PRODUCTS™
POWER CONVERSION

STEVENS-ARNOLD DIVISION
7 ELKINS STREET
SOUTH BOSTON, MA 02127
TELEPHONE (617) 268-1170 • TWX 710-339-0855

PACKAGED POWER

PACKAGED POWER
N SERIES
DUAL OUTPUT
DC/DC CONVERTER
± 15VDC, ± 330mA
Stevens-Arnold
Subsidiary of Computer Products, Inc.
PACKAGED POWER
BA SERIES
Stevens-Arnold

DC/DC Converters High Performance

ISO-PAK® DUAL OUTPUT

- Linear Performance
- Low Noise
- Isolated
- Regulated
- Six-Sides Shielding
- Efficiency to 71%

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
±12 VDC	±310 mA	±0.1%	±0.1%	65%	L	641	BA*D12/310L	$101.00	$ 70.70
±15 VDC	±250 mA	±0.1%	±0.1%	66%	L	641	BA*D15/250L	101.00	70.70

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
±12 VDC	±60 mA	±0.07%	±0.07%	52%	Z	602	A*D12/60Z	$ 96.00	$ 66.50
	±150 mA	±0.07%	±0.07%	65%	Z	602	A*D12/150Z	110.00	77.00
	±330 mA	±0.1%	±0.1%	65%	X	637	N*D12/330X	133.00	106.40
	±830 mA	±0.1%	±0.1%	67%	V	609	R*D12/830V	260.00	182.00
±15 VDC	±60 mA	±0.07%	±0.07%	57%	Z	602	A*D15/60Z	96.00	66.50
	±150 mA	±0.07%	±0.07%	67%	Z	602	A*D15/150Z	110.00	77.00
	±330 mA	±0.1%	±0.1%	71%	X	637	N*D15/330X	133.00	106.40
	±830 mA	±0.1%	±0.1%	69%	V	609	R*D15/830V	260.00	182.00

NOTE: R Series not available with 5 Volt Input.
* Select Desired Nominal Input Voltage (Table Below) and Insert in Place of Asterisk to Complete Model Number.

INPUT VOLTAGE RANGES	
NOMINAL	
5 VDC	4.5-5.5 VDC
12 VDC	10-14.5 VDC
24 VDC	21-28 VDC
28 VDC	24-32 VDC
48 VDC	42-56 VDC

CASE DIMENSIONS		
V	6.32 x 4.32 x .81 In.	(161 x 110 x 21 mm)
L	1.95 x 1.95 x 0.88 In.	(51 x 51 x 22 mm)
X	3.0 x 2.56 x 0.75 In.	(76 x 65 x 19 mm)
Z	2.0 x 2.0 x 0.38 In.	(51 x 51 x 9.6 mm)

OTHER VOLTAGE AND CURRENT COMBINATIONS AVAILABLE — PLEASE CONSULT FACTORY.
OPERATING TEMPERATURE RANGE: −25°C TO +71°C. NO DERATING.
100% BURN-IN @ FULL LOAD

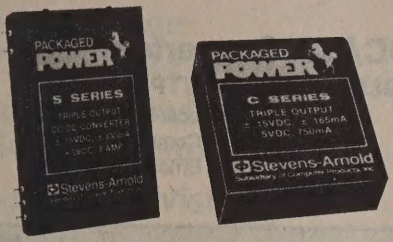
TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

COMPUTER PRODUCTS™
POWER CONVERSION

STEVENS-ARNOLD DIVISION
7 ELKINS STREET
SOUTH BOSTON, MA 02127
TELEPHONE (617) 268-1170 • TWX 710-339-0855

PACKAGED POWER



DC/DC Converters 10 & 25 Watt High Performance

ISO-PAK® TRIPLE OUTPUT

- Linear Performance
- Low Noise
- Isolated
- Regulated
- Six-Sided Shielding
- Efficiency to 71%

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL. EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
5 VDC ±12 VDC	750/±165 mA	±0.1%	±0.1%	51%	X	604	C05T12/165X	$160.00	$112.00
	750/±165 mA	±0.1%	±0.1%	51%	X	604	C12T12/165X	160.00	112.00
	750/±165 mA	±0.1%	±0.1%	51%	X	604	C24T12/165X	160.00	112.00
	750/±165 mA	±0.1%	±0.1%	51%	X	604	C28T12/165X	160.00	112.00
	750/±165 mA	±0.1%	±0.1%	51%	X	604	C48T12/165X	160.00	112.00
5 VDC ±15 VDC	750/±165 mA	±0.1%	±0.1%	54%	X	604	C05T15/165X	160.00	112.00
	750/±165 mA	±0.1%	±0.1%	54%	X	604	C12T15/165X	160.00	112.00
	750/±165 mA	±0.1%	±0.1%	54%	X	604	C24T15/165X	160.00	112.00
	750/±165 mA	±0.1%	±0.1%	54%	X	604	C28T15/165X	160.00	112.00
	750/±165 mA	±0.1%	±0.1%	54%	X	604	C48T15/165X	160.00	112.00
5 VDC ±12 VDC	3000/±330 mA	±0.2% ±0.1%	±0.2% ±0.1%	60%	V	609	S12T12/330V	298.00	208.60
	3000/±330 mA	±0.2% ±0.1%	±0.2% ±0.1%	65%	V	609	S24T12/330V	298.00	208.60
	3000/±330 mA	±0.2% ±0.1%	±0.2% ±0.1%	63%	V	609	S28T12/330V	298.00	208.60
	3000/±330 mA	±0.2% ±0.1%	±0.2% ±0.1%	65%	V	609	S48T12/330V	298.00	208.60
5 VDC ±15 VDC	3000/±330 mA	±0.2% ±0.1%	±0.2% ±0.1%	61%	V	609	S12T15/330V	298.00	208.60
	3000/±330 mA	±0.2% ±0.1%	±0.2% ±0.1%	65%	V	609	S24T15/330V	298.00	208.60
	3000/±330 mA	±0.2% ±0.1%	±0.2% ±0.1%	64%	V	609	S28T15/330V	298.00	208.60
	3000/±330 mA	±0.2% ±0.1%	±0.2% ±0.1%	65%	V	609	S48T15/330V	298.00	208.60

NOTE: S Series not available with 5 Volt input.

INPUT VOLTAGE RANGES

NOMINAL	INPUT RANGE
5 VDC	4.5-5.5 VDC
12 VDC	10-14.5 VDC
24 VDC	21-28 VDC
28 VDC	24-32 VDC
48 VDC	42-56 VDC

CASE DIMENSIONS

V	6.32 x 4.32 x .81 in.	(161 x 110 x 21 mm)
X	3.0 x 2.56 x 0.75 in.	(76 x 65 x 19 mm)

OTHER VOLTAGE AND CURRENT COMBINATIONS AVAILABLE — PLEASE CONSULT FACTORY.
OPERATING TEMPERATURE RANGE: −25°C TO +71°C. NO DERATING.
100% BURN-IN @ FULL LOAD.

TWO-YEAR WARRANTY

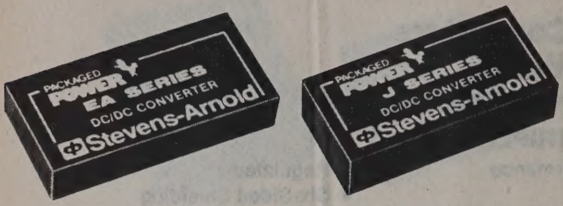
All Prices and Specifications Subject to Change Without Notice.

COMPUTER PRODUCTS™
POWER CONVERSION

STEVENS–ARNOLD DIVISION

7 ELKINS STREET
SOUTH BOSTON, MA 02127
TELEPHONE (617) 268-1170 • TWX 710-339-0855

PACKAGED POWER



Economy DC/DC Converters

ISO-PAK® SINGLE & DUAL OUTPUT

- 1.8 to 6 Watts
- Isolated
- Low Cost
- Low Prfofile (.376″)
- Compact Size
- Efficiency to 80%

OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		FL EFF.	CASE SIZE	DATA SHEET NO.	MODEL SERIES	PRICE	
		LINE	LOAD					1-9	100's
±15 VDC	±60 mA	1%/1%	±0.5%	60%	R	603	EA*D15/60R	$ 57.00	$ 39.00
	±200 mA	1%/1%	±10%	80%	W	619	J*D15/200W	69.00	48.30
±18 VDC	±70 mA	1%/1%	±10%	75%	R	626	EJ*D18/70R	51.00	35.70
	±165 mA	1%/1%	±10%	80%	W	619	J*D18/165W	69.00	48.30
5 VDC	200 mA	1%/1%	±10%	65%	R	626	EK*S05/200R	49.00	34.10
	1000 mA	1%/1%	±10%	75%	W	619	K*S05/1000W	69.00	48.30
12 VDC	500 mA	1%/1%	±10%	75%	W	619	K*S12/500W	69.00	48.30

NOTE: Other Input/Output Combinations Available — Consult Factory.
* Select Desired Nominal Input Voltage (Table Below) and Insert in Place of Asterisk to Complete Model Number.

INPUT VOLTAGE RANGES	
NOMINAL	INPUT RANGE
5 VDC	4.65-5.5 VDC (EA)
5 VDC	4.5-5.5 VDC (K, EK, J, EJ)

CASE DIMENSIONS		
R	2.0 x 1.0 x 0.38 In.	(51 x 25 x 9.6 mm)
W	2.0 x 1.0 x 0.38 In.	(51 x 25 x 9.6 mm)

OTHER VOLTAGE AND CURRENT COMBINATIONS AVAILABLE — PLEASE CONSULT FACTORY.
OPERATING TEMPERATURE RANGE: −25°C TO +71°C. NO DERATING.
100% BURN-IN @ FULL LOAD

We Specialize in Specials

Design Capabilities

- 1 to 150 Watts
- Single & Multiple Outputs
- Standard, Wide, or Ultra-Wide Input Ranges
- Encapsulated, Cased or Open-Card Design
- Special Options to Standard Products

WE OFFER THE LEADING EDGE OF TECHNOLOGY IN DESIGN AND PERFORMANCE.

FOR MORE INFORMATION CONTACT OUR APPLICATIONS DEPT. AT 617-268-1170 OR THE LOCAL SALES OFFICE NEAREST YOU.

TWO-YEAR WARRANTY

All Prices and Specifications Subject to Change Without Notice.

For More Information. Circle No. 529

ORDERING INFORMATION

Please use this information when ordering any of the products featured on the preceding 25 pages.

ORDER HOTLINES

For immediate order placement call the appropriate Order Hotline:

Compower Division
(408) 942-1434 (Western Time)

Power Products Division
(305) 975-7660 (Eastern Time)

Stevens-Arnold Division
(617) 268-1170 (Eastern Time)

Local Distributor Information
(617) 933-0237 (Eastern Time)

ORDER PLACEMENT

When ordering any product in this catalog, be sure to specify the complete part number or model number, including suffix letter if you desire a non-standard input voltage and/or pin configuration. Orders may be placed with your local distributor, area field sales representative (see list in manufacturer's directory) or directly with the factory.

For small quantity orders contact your closest distributor or local sales representative. For information regarding your closest distributor call (617) 933-0237. When ordering products directly from the factory, place each order separately with the division that manufactures those products; products made by the Power Products Division are *not* available through Stevens-Arnold or Compower and vice versa. Orders may be placed by mail, telephone, Telex or TWX.

PRICES

All prices quoted are F.O.B. manufacturer in U.S. dollars. Applicable federal, state, and local taxes are extra. Prices subject to change without notice.

DISCOUNTS

Substantial discounts are available for large quantities. Consult your area representative or contact the manufacturer directly for quantity pricing.

TERMS

Terms of payment are 30 days from date of shipment subject to prior credit approval.

MINIMUM ORDER

Minimum net billing per order . . . $50.00.

QUOTATIONS

Price and delivery quotations made by Power Products Division, Stevens-Arnold Division, Compower Division, or their authorized field sales representatives are valid for thirty (30) days, unless specified otherwise.

DELIVERY

All orders placed with Power Products Division, Stevens-Arnold Division, Compower Division, or their authorized field sales representatives are acknowledged within one week after receipt of customer's written purchase order by a Customer Acknowledgement copy of the Sales Order form. The copy contains all information pertinent to the sale including standard terms and conditions, plus the scheduled shipping date. Unless a specific method of shipment is indicated by the customer, the best available method will be used.

WARRANTY

All products carry a TWO-YEAR warranty against defects in materials and workmanship.

SPECIAL AND CUSTOM PRODUCTS

We manufacture many special and custom power supplies and DC/DC converters. For further help on your requirement call one of our divisions or your local sales office.

COMPUTER PRODUCTS
POWER CONVERSION

COMPOWER DIVISION

2220 LUNDY AVENUE • SAN JOSE, CA 95131 • (408) 942-1434

POWER PRODUCTS DIVISION

2981 GATEWAY DR., POMPANO BEACH, FL 33069 •(305) 975-7660

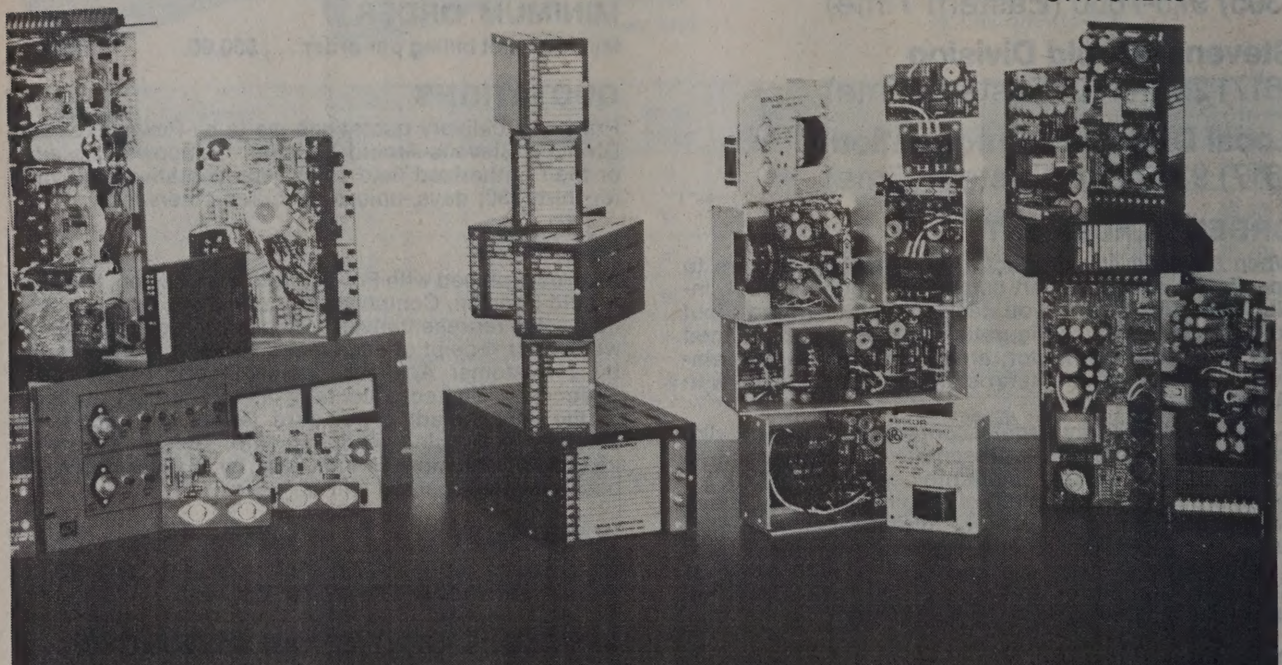
STEVENS-ARNOLD DIVISION

7 ELKINS STREET • SOUTH BOSTON, MA 02127 • (617) 268-1170

POWER PRODUCTS LIMITED

YOUGHAL, COUNTY CORK • REPUBLIC OF IRELAND • (024) 9-3130

We've been building towers of strength for years. Until now we kept it quiet.



COST-EFFICIENT CUSTOMIZED CONFIGURATIONS

Drawing on more than 30 standard sub-assembly module designs and over a decade of specialized power conditioning expertise, BIKOR is in a position to provide customized solutions that best fit your particular requirements — even on fairly limited production runs — and it's done accurately, quickly and at economically attractive prices.

- **AC/DC Uninterruptable Power Systems — available with or without batteries and battery chargers.**
- **Broad range of standard enclosures and sub-modules result in lower costs.**
- **Configurations can range from miniature 6-Watt units, for use in flow control applications, all the way up to 3KW power control assemblies.**

ACROSS-THE-BOARD DC/DC AND AC/DC MODULAR SYSTEMS

For over 10 years, BIKOR has been systematically building up the most comprehensive line of modular systems in the power conditioning field. The result. You can now choose from hundreds of cost-consciously priced DC/DC and AC/DC models to best fit your particular application requirements.

- **Unregulated and regulated single and multi-output DC/DC units — 12Vdc; 24Vdc; 48Vdc; 110Vdc and 220Vdc input versions.**
- **115VAC or dual 115VAC/230VAC input, single and multiple output AC/DC line and load regulated types.**
- **Output voltages range from 2Vdc to 250Vdc. Currents from 100mA to 50A.**

AC/DC LINEAR 115/230VAC OPEN-FRAME UNITS

Offering as standards those most sought after features normally only available as extra charge options with other brands, BIKOR's open-frame "L" Series will prove a boon for the discriminating seeker of peak-performance power supplies at bargain prices.

- **Single, dual, triple and multi-output types (ideal for micro-computer based equipment).**
- **115VAC/230VAC inputs.**
- **Tight regulation of both line and load.**
- **Reverse voltage, overvoltage, and overload protection.**
- **Built-in remote sensing.**
- **Meets UL and CSA standards.**
- **Wide range of case sizes and voltage/ current output combinations.**

30W—125W 90-130VAC & 180-260VAC MULTI-OUTPUT SWITCHERS

These premium switching-mode units provide protection against brown-outs. Their reliable peak-performance — yet small size and light weight — combine with cost-conscious price tags to provide best-buy solutions for most every application where weight, compactness, prime quality, and reliability are called for.

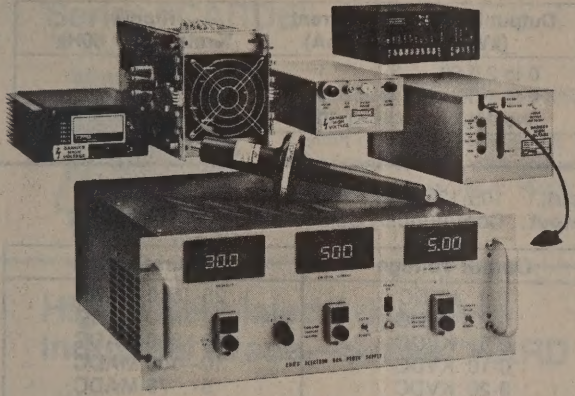
- **30, 40, 55, 75 and 125-Watt output versions — in PC board, "L" bracket and enclosed housings.**
- **Built to UL, CSA and VDE safety standards.**
- **Built-in protection against overvoltage, overloads and short circuits.**
- **90-130VAC and 180-260VAC input ranges.**

For technical and local sales/stocking information contact our headquarters at:

BIKOR CORPORATION

1504 W. 228TH ST., TORRANCE, CA 90501 ☐ PHONE NO.: (213) 539-6320 ☐ TWX: 910-349-6667

High Voltage-High Precision POWER SUPPLIES from CPS



CRT • SEM • Radiographics • Beam-Penetration • Optics • PMT • X-Ray • Lithography • COM • LAB • Phototypeset.

FEATURES • Output voltages to 50 kV • Low ripple, precision regulation—high stability • Remote programming and metering models • Short circuit and arc protection • Self restoring • Multiple output voltage options • Solid state design • UL approved.

CPS offers a full range of standard and custom high voltage power supplies for commercial, industrial and mil-spec OEM's having applications requiring high-precision control of an electron beam. All power supply designs feature state-of-the-art production-proven techniques. Many years of experience in encapsulation of high voltage components provide compact packaging without compromise of performance reliability. All designs incorporate short-circuit and arc protection.

GENERAL PURPOSE—PRECISION & ULTRA PRECISION HIGH VOLTAGE POWER SUPPLIES

Series*	Output Voltage	Output Current	Regulation (·%)		Ripple (P-P)	Stability (%)		Temp. Coeff.** PPM/°C	Input Power	Operating Temperature Range (°C)	Features	Size (Inches) H W D
			Line	Load		1-Hour	8-Hour					
100	1 to 30kV	500 μA	0.001	0.001	200mV	0.005	0.01	25	115/220 Vac 47-65 Hz	0 to +50	Single and bipolar output versions; output voltage programmable remotely; output metering. Model 100R–Reversible polarity.	4-21/32 x 8 x 10-3/4
100R	1 to 30kV	1.0 mA	0.001	0.001	200mV	0.005	0.01	25				5-1/4 x 19 x 13-9/16
101	1 to 50kV	500 μA	0.001	0.001	500mV	0.005	0.01	25				5-1/4 x 19 x 13-9/16
130	1 to 30kV	500 μA	0.001	0.001	200mV	0.005	0.01	25				4-19/32 x 8 x 10-3/32
131	1 to 50kV	500 μA	0.001	0.001	500mV	0.005	0.01	25				5-1/4 x 19 x 13-9/16
132	1 to 30kV	500 μA	0.01	0.01	3V	0.05	0.1	250				4-19/32 x 8 x 10-3/32
133	1 to 50kV	500 μA	0.01	0.01	5V	0.05	0.1	250				5-1/4 x 19 x 13-9/16
136	1 to 30kV	500 μA	0.0002	0.0002	60mV	0.0002	–	5				5-1/4 x 19 x 13-9/16
5001A-2	1 to 2.0kV	5.0 mA	0.01	0.01	200mV	0.01	0.02	250	100/115/220 Vac, 47 to 440 Hz	0 to +50	Output voltage programmable remotely. UL approved.	2-11/16 x 5-1/2 x 9
5001A-5	1 to 5.0kV	2.0 mA	0.01	0.01	500mV	0.01	0.02	250				
5001A-10	1 to 10.0kV	1.0 mA	0.01	0.01	1V	0.01	0.02	250				
5001A-20	1 to 20.0kV	250 μA	0.01	0.01	2V	0.01	0.02	250				
5003A-DC	1V to 2kV	5.0 mA, 20 mA, 10 mA,	0.01	0.01	5mV	0.01	0.02	100	24-28 Vdc @ 900 mA	0 to +60	Output voltage programmable remotely. UL approved.	4-1/2 x 2-1/2 x 7-1/2
5003A-AC	1V to 2kV	5.0 mA, 10 mA,	0.01	0.01	5mV	0.01	0.02	100	100/115/220 Vac, 47 to 65 Hz			7 x 3-3/8 x 7-1/2

**Above items available in positive or negative versions.*

MULTIPLE OUTPUT—HIGH VOLTAGE POWER SUPPLIES FOR COMMERCIAL & MILITARY APPLICATIONS

1487												
(Anode)	+15kV to ±5%	30μA	.01	.01	.1	.1	–	100	+28 Vdc ±10%	-54°C to +71°C	Full MIL Spec, Airborne application	3.83 x 4 x 6
(Focus)	3.2 to 5.3	300μA	.01	.01	.1	.1	–	100				
(G2)	+500V ±5%	50μA	.01	.01	.1	.1	–	100				
1617											Output voltage programmable remotely; HV output monitor; can be dynamically modulated; static focus externally programmable.	2-3/4 x 6-1/4 x 9
(Anode)	+20kV	200 μA	0.03	0.03	5V	0.01	0.02	100	+28 Vdc	0 to +70		
(Focus)	+3 to 5.5kV	500 μA	0.03	0.03	5V	0.01	0.02	100				
(G-2)	+300V	1.0 mA	0.05	0.05	1V	0.01	0.02	100				
1786											Provision for dynamic focus.	6-1/2 x 7 x 9-1/2
(Anode)	+19kV	250 μA	0.02	0.005	2V	0.01	0.02	250	115 Vac ± 15 Vac	0 to +50		
(Focus)	+4 to 5.25kV	2 mA	0.01	0.005	500 mV	0.01	0.02	250				
1805											Dynamic focus 0 to +300V. Replaceable modules.	5 x 6 x 10
(Anode)	+18kV	400 μA	0.02	0.03†	3V	–	0.2	200	± 15 Vdc ± 2% @ 1.0 amp	0 to +50		
(Focus)	+2 to 5kV	400 μA	2.0V†	1.0 †	8V	–	0.2	200				
(G-1)	-110V	1 mA	0.1 †	0.3 †	<50 mV	–	0.2	200				
(G-2)	+300 to +500V	100 μA	1.0 †	3.0 †	0.1%†	–	1.0	1000				
1871												
(Anode)	+18kV	500μA	.01	.01	.1	.01	–	100	+25 Vdc ±15%	-55°C to 75°C	Hybrids Processed to MIL 883, Airborne application	4.85 x 4.65 x 1.6
(Focus)	+2.8 to 3.9	5μA	.01	.01	.1	.001	–					
(G2)	+180 to +550	5μA	.01	.01	.1		–					
6001											Self-biasing, regulated grid and unregulated cathode. (Option 1405: unregulated grid, regulated cathode.)	5-1/4 x 19 x 16
(Anode)	-1kV to -30kV	500 μA	0.001	0.001	200mV	0.005	0.01	25	115/220 Vac, 47-440 Hz	0 to +50		
(Filament)	0 to +8V	5 A	–	–	0.25% rms	0.005	0.01	25				
6002											Self-biasing, regulated grid and unregulated cathode. (Option 1405: unregulated grid, regulated cathode.)	5-1/4 x 19 x 16
(Anode)	-1kV to -50kV	500 μA	0.001	0.001	500 mV	0.005	0.01	25	115/220 Vac, 47-440 Hz	0 to +50		
(Filament)	0 to +8V	5 A	–	–	0.25% rms	0.005	0.01	25				
6004									115/220 Vac, 47-440 Hz; 220 Vac opt.	0 to +50	Closed loop emission current regulation.	7 x 19 x 16
(Anode)	-1kV to -30kV	500 μA	200mV	<50V	200 mV	0.005	0.01	25				
(Filament)	0 to 5.0V	5 A	<1%	–	250 mV	–	400 mV	–				

SLEWING HIGH VOLTAGE POWER SUPPLIES FOR BEAM PENETRATION CRT APPLICATIONS

Series	Output Voltage	Output Current	Regulation (·%)		Ripple (P-P)	Stability (%)		Temp. Coeff.** PPM/°C	Input Power	Operating Temperature Range (°C)	Slewing Time (μ sec)	Output Load (capacitance)	Size (Inches) H W D
			Line	Load		1-Hour	8-Hour						
7010 7011*/	+8kV to +18kV	500μA	0.01	0.1	0.1%	0.1	0.2	100	+28 Vdc ±10% @ 2.0 amp	0 to +50	200	700 pf	3 x 5-3/4 x 7-7/8
7020													
(Anode)	+9kV to +18kV	1mA	0.01	0.1	0.1%	0.1	0.2	100	+28 Vdc ±10% @ 2.0 amp	0 to +50	200	500 pf	4-1/2 x 5-29/32 x 6
(Focus)	+2.4kV to +3.4kV	25μA	0.01	0.1	0.1%	–	–	100			200	10 pf	
(G2)	+720V to +1080V	50μA	0.01	0.1	0.1%	–	–	–			–	–	
7030													
(Anode #1)	+15kV ±5%	250μA	0.05	0.1	0.05%	0.1	0.2	200	±24 Vdc ±10% @ 2.5 amp		–	–	7 x 5-7/16 x 11-7/8
(Anode #2)	+9kV to +18kV	750μA	0.05	0.1	0.1%	0.05	0.05	100		0 to +50	300	500 pf	
(Focus)	+2.2kV to +3.5kV	300μA†	0.05	0.1	0.1%	–	–	200			–	–	
(G1)	-55V	25μA	0.1	0.1	0.3%	–	–	–			–	–	
(G2)	+350V to +700V	25μA	0.1	0.6	0.3%	–	–	–			–	–	

***Specifications apply after 30 minute warm-up. †Maximum */ Mil-spec *† Over Maximum Switching Range*

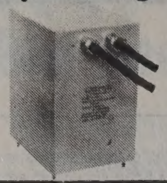
CPS

A Division of Vector V.6. Systems

For complete information and applications assistance, contact the precision high voltage power supply specialists at:

110 Wolfe Road • Sunnyvale, California 94086 • Phone (408) 738-0530 Telex 357-450

Unregulated Modules Compact High Voltage—Series "S"

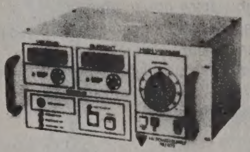


- ▼ Output: Two shielded poly-ethylene cables insulated for reversible polarity
- ▼ Construction: Solid state rectifiers, all units hermetically sealed in epoxy, vacuum filled, metal case

Input: 0-115-125V, 50/60Hz
400 Hz available upon request
Output: Variable with input ac line

Output Range (kV)	Current (mA)	Ripple %rms/mA @ 60Hz
0 to 2.5-60	1	0.25
0 to 1-30	5	0.25
0 to 1-40	10	0.15

Rack Mounted Power Supplies RIU Series 875 and 1400

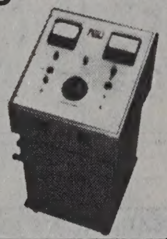


- ▼ Easy to read 3 digit DPM for voltage and current
- ▼ Adjustable overcurrent and overvoltage
- ▼ All solid state technology
- ▼ Low RMS ripple
- ▼ External and HV interlock
- ▼ Zero start interlock and bypass
- ▼ Polarity reversible (Below 60KDVC)

Input: 105-125 VAC 50/60 Hz
Output: Continuously adjustable 0-100%

Output Voltage	Output Current
0-1 KVDC	25-1500 MADC
0-2.5 KVDC	10-1000 MADC
0-5 KVDC	10- 300 MADC
0-10 KVDC	10- 100 MADC
0-20 KVDC	5- 75 MADC
0-30 KVDC	5- 10 MADC
0-40 KVDC	3 MADC
0-60 KVDC	1 MADC
0-90 KVDC	1 MADC

High Pot Testers—Series "TC"

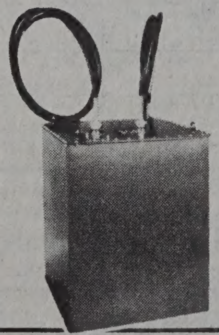


- ▼ Multi-purpose power supplies fully instrumented and protected. Ratings up to 80,000 volts dc
- ▼ Solid State
- ▼ Oil insulated

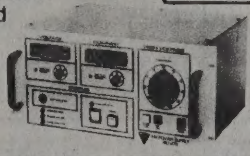
Input: 105-125V, 50/60 Hz
Output: Continuously adjustable

F. L. Voltage (kV)	Current Range (mA)	Ripple Type %rms/mA @ 60Hz
0 to 30	5, 20	0.4
0 to 40	5, 20	0.4
0 to 50	5, 10	0.4
0 to 60	5, 10	0.4
0 to 70	5	0.4
0 to 80	5	0.4

High Voltage DC Supplies Series "HVOU"



- ▼ Input, 120 & 208VAC, 50/60 Hz
- ▼ Front Panel DPM's
- ▼ Adjustable overcurrent and overvoltage
- ▼ Continuously adjustable 0-100%
- ▼ Remote polarity reversible
- ▼ Fully instrumented
- ▼ Fully interlocked



Standard Voltage & Currents

Output Voltage (KV)	Output Current (MA)
0-40	10 to 250
0-50	8 to 200
0-75	5.5 to 130
0-100	4 to 100
0-150	2.5 to 66

DC-DC Proportional Converters for Photomultiplier Tube—Series "PMS"

- ▼ Reverse polarity protected
- ▼ Output isolated
- ▼ Momentary short circuit protected
- ▼ Small size
- ▼ Low cost

Model Number	Input Range (dc volts)	Output Range (dc volts)	Size D&L
PMS 1-1	3 to 15	300 to 1500@1mA	1 X 2¼
PMS 1-4	3 to 19	300 to 2000@1mA	1 X 2¼
PMS 1-6	3 to 15	400 to 2500@0.5mA	1 X 2¼
PMS 1-7-7	4 to 12	500 to 1500@0.5mA	2.4 X 1.5 X 0.812
PMSB 2-.025	3 to 12	300 to 2000@0.025mA	1 X 2¼
PMS 3-.5	3 to 15	300 to 3000@0.5mA	1¼ X 2⅜
PMS 5-.5	3 to 15	500 to 5000@0.5mA	1⁷⁄₁₆ X 3⅛
PMS 10-.025*	3 to 10	3kV to 10kV@0.025mA	2.07 X 2.32 X 3.13

*Specify positive or negative output

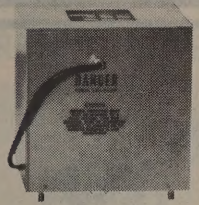
DEL

DEL ELECTRONICS CORPORATION

250 East Sandford Boulevard, Mount Vernon, New York 10550
Phone: 914/699-2000 TWX 710-562-0130

Highly Regulated Adjustable Hermetic Sealed, Epoxy Filled Series "CARDE"

Input: 115V ±10%, 47-420Hz
Output: Line and load regulation ±0.005%
Ripple: 0.03% rms
Temp. coeff: 0.02%/°C
Temp. range: −25°C to 65°C
Polarity: specify pos. or neg.

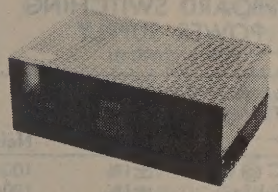


- ▼ Adjustable output (50 to 100%) (Resistance programmed)
- ▼ Short circuit proof—foldback
- ▼ Designed to meet environmental requirements of MIL-E-16400

Outputs			
Voltage Range (dc)	Current Max.	Voltage Range (dc)	Current Max.
600V to 1200V	8mA	5.0kV to 10kV	1mA
1200V to 2500V	4mA	7.5kV to 15kV	0.6mA
2.5kV to 5.0kV	2mA	10kV to 20kV	0.5mA
3.5kV to 7.0kV	1.4mA		

Highly Regulated Adjustable Industrial Grade—Series "HARD"

Input: 115V ±10%, 50/400Hz
Output: Line and load regulation: ±0.005%
Temp. coeff: ±0.02%/°C
Temp. range: −20°C to 55°C
Polarity: specify pos. or neg.
Ripple: 0.03% rms

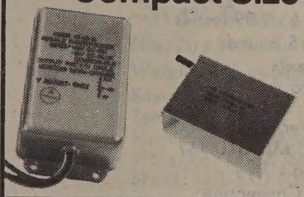


- ▼ High frequency design Low energy storage
- ▼ Adjustable output (50 to 100%) (Resistance programmed)
- ▼ Short circuit proof

Outputs			
Voltage Max.	Current Max.	Voltage Max.	Current Max.
1200V	2,10,20mA	15kV	0.25, 0.5, 1mA
2500V	1, 4, 8mA	20kV	0.2, 0.5, 1mA
5000V	0.5, 2, 4mA	30kV	0.75mA
10kV	0.25, 1, 2mA	40kV	0.5mA

Highly Regulated Adjustable Compact Size—Series "PMSR"

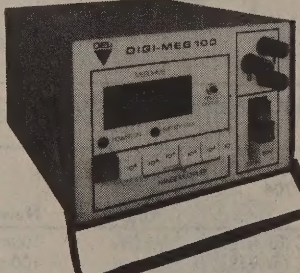
Input: ±15V dc
Output: Regulation: line and load ±0.002%
Temp. coeff: 100ppm/°C
Temp. range: 0 to 60°C
Ripple: 25mV, peak to peak max.



- ▼ DC-DC converter
- ▼ Adjustable output (Resistance programmed)
- ▼ Short circuit proof

Outputs			
Voltage (+)	Current	Size (in.)	Construction
600 to 1400V	0 to 1.5mA	1.25 X 2.5 X 4.0	A metal case
600 to 1400V	0 to 1.5mA	1.25 X 2.5 X 3.5	B plastic case
300 to 1500V	0 to 2mA	1.25 X 2.5 X 4.0	A metal case

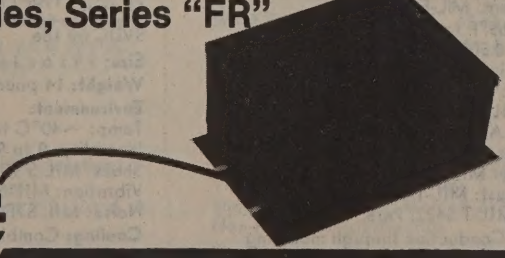
Digi-Meg 100 Digital Megohmeter



- ▼ Solid state LED panel meter
- ▼ Ranges to 10,000,000 Megohms in 6 ranges
- ▼ 50/500VDC test voltages
- ▼ Short circuit proof
- ▼ Optional battery pack available
- ▼ Size: 7½" W × 5" H × 10" D

Ferro-Resonant HV Line Regulation Power Supplies, Series "FR"

- ▼ Simple, reliable design
- ▼ Low cost
- ▼ 1% line regulation
- ▼ Short circuit proof



Input: 115VAC + 10%, 50 or 60 Hz
Output: Models to 20KVDC & 600 Watts
Line Regulation: ± 1%
Load Regulation: ± 10% NL to FL.

DEL

DEL ELECTRONICS CORPORATION

250 East Sandford Boulevard, Mount Vernon, New York 10550
Phone: 914/699-2000 TWX 710-562-0130

EG&G ALMOND INSTRUMENTS

LEADERSHIP IN MILITARY POWER SUPPLIES

MIL-Q-9858A

REPRESENTATIVE CUSTOM DESIGNS

SHIPBOARD SWITCHING POWER SUPPLY

P/N 2-12150-01

Input Power: 115VAC, 60Hz, 3φ per MIL-STD-1399, Sec. 103, Type I

Outputs	Reg.	Noise
+5VDC @ 70a	±1%	50mV
−5VDC @ 1a	±1%	50mV
+12VDC @ 1a	±1%	120mv
−12VDC @ 2a	±1%	120mv

Size: 10 x 6.25 x 3 inches

Weight: 12 pounds

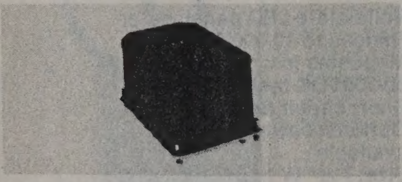
Environment: (MIL-E-16400):
Temp: 0 to 75°C
Humidity: to 95%
Fungus: Per MIL-E-16400
Vibration: MIL-STD-167
Shock: 75g's

Cooling: Convection/Conduction

Efficiency: 66%

EMI: MIL-STD-461 Notice I

MTBF: 40,000 hours



SHIPBOARD POWER SUPPLY

P/N 2-10703

Input Power: 115VAC, 400Hz, 3φ per MIL-STD-1399 Sec. 103 Type I Power

Outputs	Reg.	Noise
+15VDC @ 7a	±0.15	20mv
−15VDC @ 7a	±0.15	20mv

Size: 9 x 6 x 4.75 inches

Weight: 9.8 pounds

Environment:
Temp: −40°C to +65°C
Shock: MIL-STD-202 Method 213A Test Condition A
Vibration: MIL-STD-167 Table I (increased by a factor of 2)

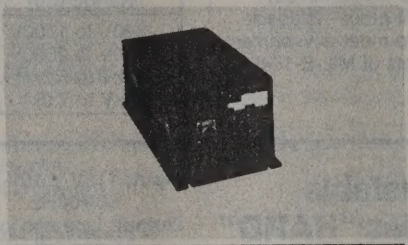
Noise: MIL-STD-740

Cooling: Cold plate conduction

Efficiency: 60%

EMI: MIL-STD-461, Type D

MTBF: 40,000 hours



MILITARY POWER SUPPLY

P/N 2-10568

Input Power: 115 ±10VAC, 47-420, 1φ

Output	Reg.	Noise
+28VDC @ 14a	±0.5%	50mv

Size: 11.5 x 6 x 5 in. (incl. mfg. flanges)

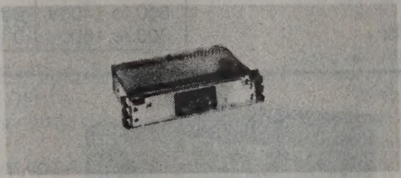
Weight: 14 pounds

Environment:
Temp: −20°C to +55°C
Magnetic Radiation — Less than 0.5 gauss
Magnetic Radiation—Less than 0.5 gauss one inch from top surface

Cooling: Circulating air

Efficiency: 60%

Application: Military type recorders.



AIRBORNE POWER SUPPLY

P/N 2-11470

Input Power: +28 VDC per MIL-STD-704

Outputs	Reg.	Noise
+20VDC @ .69a	±5%	100mv
+12VDC @ .975a	±5%	100mv
+5VDC @ 11.28a	±5%	100mv
−14.7VDC @ 2.3a	±2%	100mv

Size: 7.63 x 5.6 x 1.69 (incl. mounting flanges)

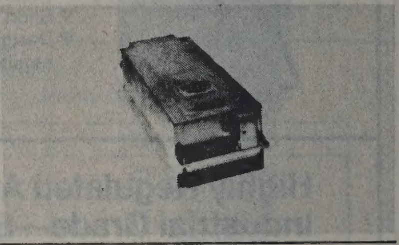
Weight: 4 pounds

Environment: MIL-E-5400
Temp: −65°F to +212°F
Altitude: 0.506 to 15.5 psia
Acceleration: ±10g's, all aids
Vibration: MIL-E-5400, Curve IV
Shock: MIL-T-5422, 30g's
Explosive Atmosphere: MIL-E-5400
Humidity: MIL-T-5422, Para. 4.4
Salt Spray: MIL-T-5422, Para. 4.5
Sand & Dust: MIL-T-5422, Para. 4.7
Fungus: MIL-T-5422, Para. 4.8

Cooling: Conduction through mounting flanges

EMI: MIL-STD-461A (CE01, CE03. RS02, RS03, RE02, CS01, CS02)

MTBF: 27,000 hours



SHIPBOARD SWITCHING POWER SUPPLY

P/N 2-12090-01

Input Power: 115VAC, 60Hz 3φ per MIL-STD-1399, Sec. 103, Type I

Outputs	Reg.	Noise
+5.15VDC @ 1.5a	±1%	100mv
−5VDC @ 1.5a	±1%	100mv
+12VDC @ 1a	±1%	60mv
−12VDC @ 0.3a	±1%	60mv
+15VDC @ 7a	±0.5%	40mv
−15VDC @ 2a	±0.5%	75mv
+55VDC @ 0.1a	±0.1%	55mv

Size: 14 x 6 x 2.89 inches

Weight: 15 pounds

Environment:
Temp: 0 to +75°C
Humidity: to 95%
Fungus: Per MIL-E-16400
Vibration: MIL-STD-167
Shock: 75g's

Cooling: Convection

Efficiency: 56%

EMI: MIL-STD-461 Notice I

MTBF: 35.000 hours

SHIPBOARD POWER SUPPLY

P/N 2-10500

Input Power: 115VAC, 400Hz, 3φ per MIL- per MIL-STD-1399-SEC 103 Type I Power

Output	Reg.	Noise
5VDC @ 15a	±2%	28mv

Size: 9.9 x 6 x 3 inches

Weight: 14 pounds

Environment:
Temp: −40°C to +80°C
Humidity: 0 to 95%
Shock: MIL-S-901 Grade A Class I
Vibration: MIL-STD-740
Noise: MIL-STD-740

Cooling: Combination convection & cold plate

Efficiency: 45%

EMI: MIL-STD-461

MTBF: 70,000 hours

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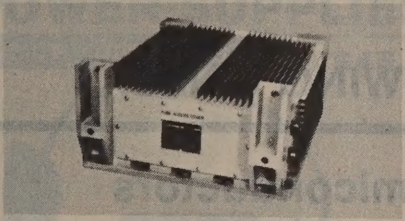
EG&G ALMOND INSTRUMENTS

MIL-Q-9858A

LEADERSHIP IN MILITARY POWER SUPPLIES

REPRESENTATIVE CUSTOM DESIGNS



SHIPBOARD SWITCHING POWER SUPPLY

P/N 5498058

Input Power: 115VAC, 60 or 400Hz, 3 ϕ per MIL-STD-1399, Sec. 103, Type I

Outputs	Reg.	Noise
+20VDC @ 2.5a	±1%	3% max.
−20VDC @ 2.5a	±1%	3% max.
+28.5VDC @ 10a	±1%	3% max.
−28.5VDC @ 10a	±1%	3% max.
+30VDC @ 10a	±1.5%	3% max.
−30VDC @ 10a	±1.5%	3% max.
+33VDC @ 10a	±1%	3% max.
+33VDC @ 10a	±1%	3% max.
−33VDC @ 10a	±1%	3% max.

Size: 26 x 21.6 x 9.1 inches

Weight: 185 pounds

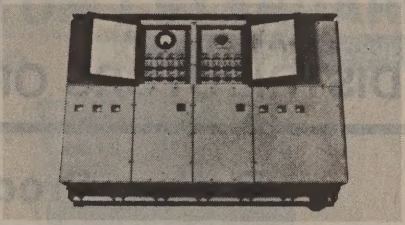
Environment: (MIL-E-16400G(1))
Temp: 0° to 50°C
Humidity: 0 to 95%
Vibration: MIL-STD-167-1
Shock: MIL-STD-901C(1)

Cooling: Conduction/Convection

Efficiency: 75%

EMI: MIL-STD-461A(1)

MTBF: 8,200 hours per MIL-HDBK-217C
(75,000 to 110,000 hours each regulator)



SUBMARINE SWITCHING POWER SUPPLY

P/N 2-14400-01

Input Power: 115VAC, 60Hz, 3ϕ per MIL-STD-1399, Sec. 103, Type I

Outputs	Reg.	Noise
5V @ 0 to 80a	±0.1%	75mv
5V @ 0 to 80a	±0.1%	75mv
−28V @ 0 to 2a	±0.4%	300mv
−28V @ 0 to 2a	±0.4%	300mv
+15V @ 0 to 4a	±0.4%	150mv
+15V @ 0 to 4a	±0.4%	150mv
−15V @ 0 to 4a	±0.4%	150mv
−15V @ 0 to 4a	±0.4%	150mv

Size: 49.5 x 35 x 8 inches

Weight: 320 pounds

Environment: (MIL-E-16400)
Temp: −20 to +70°C
Humidity: 0 to 95%
Vibration: MIL-STD-167-1
Shock: MIL-STD-901C, Class I

Cooling: Conduction/Convection

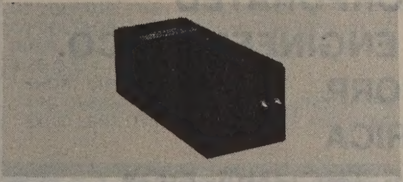
Efficiency: 70%

EMI: MIL-STD-461

MTBF: 20,000 hours per MIL-HDBK-217C
(80,000 hours each regulator)

MTTR: <15 min.

INDUSTRIAL — COMPUTER GRADE — MARINE APPLICATIONS



SINGLE OUTPUT SWITCHING POWER SUPPLY

Input Power: 115/230VAC, 47-63 Hz, 1 ϕ

Output Power: 5, 12, 15, 18, 24, & 28VDC
(Mainframe output 375 watts)

Size: 12 x 5 x 4.18 inches

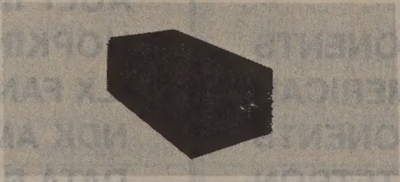
Weight: 8.5 pounds

Environment:
Temp: −10°C to +60°C (No derating)
Vibration: MIL-STD-167 Type I
Shock: MIL-STD-202, Method 213, Cond. A
Non-corrosive construction

Cooling: Internal blower

Efficiency: To 83%

Listed in UL recognized
Component Directory



DUAL OUTPUT SWITCHING POWER SUPPLY

Input Power: 115/230VAC, 47-63 Hz, 1 ϕ

Output Power: 5, 12, 15, 18, 24, & 28VDC
(Mainframe output 375 watts)

Size: 12 x 6.12 x 4.18 inches

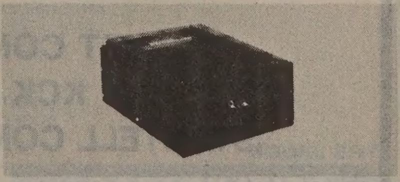
Weight: 10 pounds

Environment:
Temp: −10°C to +60°C (No derating)
Vibration: MIL-STD-167 Type I
Shock: MIL-STD-202, Method 213, Cond. A
Non-corrosive construction

Cooling: Internal blower

Efficiency: To 70% +

Listed in UL recognized
Component Directory



TRIPLE OR QUAD OUTPUT SWITCHING POWER SUPPLY

Input Power: 115/230VAC, 47-63 Hz, 1 ϕ

Output Power: 5, 12, 15, 18, 24, & 28VDC
(Mainframe output 375 watts)

Size: 12 x 8.12 x 4.18 inches

Weight: 11.7 pounds

Environment:
Temp: −10°C to +60°C (No derating)
Vibration: MIL-STD-167 Type I
Shock: MIL-STD-202, Method 213, Cond. A
Non-corrosive construction

Cooling: Internal blower

Efficiency: To 70% +

Listed in UL recognized
Component Directory

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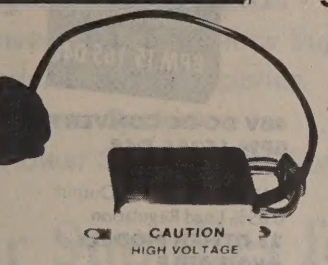
MINIATURE C.R.T. 12,000 VOLTS

$45.00

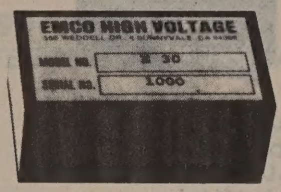


HIGH VOLTAGE OUTPUT: +12.000 Volts DC @ 50 UA
OUTPUT NO. 2: +400 Volts @ 500UA (±10%)
OUTPUT NO. 3: −100 Volts @ 500UA (±10%)
REGULATION: Output Tracks Input Voltage (5% @ 5UA)
RIPPLE: 0.05% CL=500PF
INPUT VOLTAGE: +15 Volts DC
SIZE: 1.25" X 2.0" X 2.5"
- OTHER INPUTS AND OUTPUTS ARE AVAILABLE

MODEL 350

P.C. MOUNT DC/DC CONVERTERS

$33.00



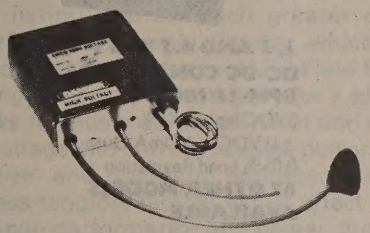
INPUT VOLTAGE: 4 thru 12 Volts DC
OUTPUT VOLTAGE: 500 thru 1.500 Volts DC @ 2MA
RIPPLE: .05% PK to PK
REGULATION: Output Proportional to Input
- PLUS and MINUS INUPT/OUTPUT
- INPUT/OUTPUT ISOLATION: 3.500 Volts
- RFI FILTERING
- SHORT CIRCUIT PROTECTION
- FLOATING INPUT/OUTPUT

SIZE: 2.5" X 1.5" X .85"

MODEL E15

PRECISION COLOR CRT

$125.00



HIGH VOLTAGE OUTPUT: +25.000 Volts DC @ 1.5MA
Adjustment Range: ±300 Volts
REGULATION: Line — .05%
Load — (Static) 0.1%
Load — (Dynamic) 0.1%/100UA
RIPPLE: 0.1% (P-P) CL=1000PF
TEMP. COEFFICIENT: 200 PPM/°C
FOCUS VOLTAGE: Adjustable from 22% to 36% of Anode Voltage @ ±20UA
G1 VOLTAGE: Fixed — 120 Volts DC ±10% @ 1MA
G2 VOLTAGE: Adjustable from 0 to 750 Volts DC ±10% @ ±20UA
INPUT VOLTAGE: +28 Volts DC ±10%
SIZE: 5.1" X 4.2" X 1.7"
- SHORT CIRCUIT PROTECTION
- ARC OVER AND OVER VOLTAGE PROTECTED
- EXCELLENT DYNAMIC RESPONSE AND STABLE PERFORMANCE

MODEL EHV

REGULATED 18,000 VOLTS

$69.00

EMCO HIGH VOLTAGE
HIGH VOLTAGE

OUTPUT VOLTAGE: +18.000 Volts DC @ 500UA
(Adjustable ±5%)
REGULATION: Line — .05%
Load (Static) — .05%
Load (Dynamic) — 5 Volts @ 100UA
RIPPLE: .05% (P-P) CL=1000PF
OUTPUT NO. 2: +1.000 Volts DC @ 1MA
OUTPUT NO. 3: −100 Volts DC @ 5MA
INPUT VOLTAGE: +24 Volts DC
INPUT REGULATION: .005%
SIZE: 4.2" X 3.1" X 1.2"
- OVERVOLTAGE PROTECTION
- SHUTDOWN CONTROL CIRCUIT
- FULLY ENCAPSULATED

MODEL EHT

APPLICATIONS

X-Ray
Photomultiplier
Video
Computer
Capacitor Charging
Electronic Accelerator
Sem-ion Sources
Image Intensifiers

Cad/Cam
Shadow Mask
CRT
Laser
Medical
Airborne Navigation
Marine Navigation
Military Equipment
Energy Storage

CAPABILITIES

OUTPUTS: +5 Volts thru +30,000 Volts DC

CURRENT: Up to 10 AMPS

INPUTS: +5 to +40 Volts DC
110/220 Volts AC 50-400 HZ

REGULATION, RIPPLE & NOISE: .001%

Off the Shelf Prices and Deliveries for Standard Models

Custom Designs with your Custom Specifications

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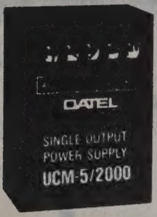
POWER SUPPLIES AND DC-DC CONVERTERS

DATEL
DUAL OUTPUT POWER SUPPLY
BPM-15/300

LINE OPERATED MODULES
BPM-15/300
±15VDC at 300mA
0.05% Load Regulation
3.5 x 2.5 x 1.56 Inches
9 OTHER MODELS AVAILABLE


DATEL
SINGLE OUTPUT POWER SUPPLY
UCM-5/2000

CHASSIS MOUNT MODULES
UCM-5/2000
5VDC at 2.0A
0.1% Load Regulation
3.5 x 2.5 x 2.00 Inches
8 OTHER MODELS AVAILABLE

DATEL
DC DC CONVERTER
BPM 15/165 D48

48V DC-DC CONVERTERS
BPM-15/165-D48
48VDC Input
±15VDC at 165mA Output
0.05% Load Regulation
23 OTHER MODELS AVAILABLE

DATEL
DUAL OUTPUT POWER SUPPLY
BPM 120/25
DATEL
DUAL OUTPUT POWER SUPPLY
BPM 150/20

HIGH VOLTAGE DUAL OUTPUT
±120V/25mA Out
±150V/20mA Out
±180V/16mA Out

DATEL
SWITCHING POWER SUPPLY
SINGLE OUTPUT
USM-5/3
DATEL
SWITCHING POWER SUPPLY
SINGLE OUTPUT
USM-5/5

MODULAR SWITCHING SUPPLIES
5V/3A Out
5V/5A Out
PC or Chassis Mount
80% Efficiency

DATEL
DC DC CONVERTER
BPM-15/100-D5

1, 3 AND 4.5 WATT DC-DC CONVERTERS
BPM-15/100-D5
5VDC Input ±10%
±15VDC at 100mA Output
0.05% Load Regulation
67 OTHER MODELS AVAILABLE

DATEL
TRIPLE OUTPUT POWER SUPPLY
TPM-15/150-5/1000

TRIPLE OUTPUT MODELS
TPM-15/150-5/1000
±15VDC at 150mA & 5VDC at 1.0A
0.05% and 0.1% Load Regulation
3.5 x 2.5 x 1.56 Inches
5 OTHER MODELS AVAILABLE

DATEL
Power Supply Engineering Handbook

For complete information on our wide selection of Power Supply products, please send for our new 40 page Engineering Power Supply Handbook or call our literature Hot-Line at (617) 339-9341, Ext. 100

DATEL
AC-DC REGULATED POWER ADAPTER
UPA-5/500

LOW COST, REGULATED PLUG-IN POWER ADAPTERS
UPA-5/500
115 VAC ±10% Input
+4.8 – +5.3 VDC @ 500 mA Out
0.3% Load Regulation
2 OTHER MODELS AVAILABLE

AC MODELS ALSO AVAILABLE WITH 230VAC IN (E SUFFIX) OR 100VAC IN (J SUFFIX)

DATEL

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HEWLETT PACKARD

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- ***Low-Cost Lab Supplies***
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Power Supplies for the Lab or System

Hewlett-Packard power supplies are available in many types, sizes, and ratings. You can choose from bench-type supplies for circuit testing and development, modular supplies to power systems, high-power supplies used in industrial processes, and many special purpose supplies ranging from bipolar power supply/amplifiers to digital power sources. Most are covered briefly in this short-form listing and in much greater detail in the 128-page DC Power Supply Catalog which can be obtained free of cost from your local HP Field Engineer.

In selecting the best power supply for a given job, one usually looks to satisfy all the physical and electrical criteria first: voltage and current ratings, performance specifications, size, and operating features. However, there are other less tangible factors which affect the usability and long-range performance of a power supply. Reliability, for example, is closely related to design thoroughness and the use of quality parts. Service assistance in the form of helpful advice, excellent operating and service manuals, and worldwide availability of spare parts can help return a failed instrument to service in a minimum of time. These factors do not appear on a data sheet, but are closely related to a company's capability and responsibility towards its customers. When you purchase a power supply from Hewlett-Packard, you receive guaranteed product performance plus all the intangibles that add up to long-term value — and it usually costs no more.

Ordering Information

Although Hewlett-Packard products are manufactured throughout the world, the Hewlett-Packard field office or distributor in your area is best equipped to handle all your needs concerning products described in this catalog, and for parts and service on Hewlett-Packard products you already own. A listing of field offices current at the time of publication, can be found on the back page of this section.

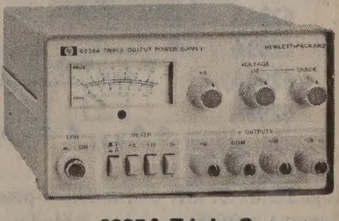
10-Watt General Purpose Bench Supplies

- Single, Dual & Triple Output Models
- Short-Circuit Proof
- Compact Packages
- Impact-Resistant Case

Ratings—Single, Dual & Triple Outputs

Volts	Amps	Model	Load Effect	Source Effect	PARD Rms/p-p	Price
0-6	1.0	Triple 6235A	10mV	15mV	1mV/5mV	$400
0to+18	0.2					
0to−18	0.2					
0-25	0.2	Dual 6234A	4mV	4mV	200μV/1mV	$380
0-25	0.2					
0-10	0-1	6214B	4mV	4mV	200μ/1mV	$325
0-25	0-0.4	6216B	4mV	4mV	200μ/1mV	$325
0-50	0-0.2	6218B	4mV	4mV	200μ/1mV	$325
0-100	0-0.1	6212B	8mV	4mV	200μ/1mV	$400

6212B, 6214B
6216B, 6218B



6235A Triple Output
6234A Dual Output

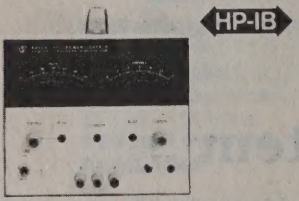
These popular low-cost bench supplies are designed for general laboratory use. All models have front-panel voltage controls, a combination volt/ammeter, and output binding posts. Output voltage is continuously variable from 0V to 15% above the maximum rated output of the supply. A meter function switch selects either output voltage or current for display on the panel meter. Models 6212B-6218B are Constant Voltage/Constant Current (CV/CC)-type supplies and have concentric coarse and fine current controls which allow the current limit point to be set to any value within the current rating. They can also be operated as constant current sources with 500 μA load regulation.

HEWLETT PACKARD

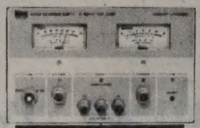
20-200 Watt Lab/System Supplies

- Constant Voltage/Constant Current Operation
- Auto-Series, - Parallel, - Tracking
- Remote Programming and Sensing
- Single -, Dual -, Triple - Output Models
- Autoranging Models

6002A Autoranging



6024A Autoranging

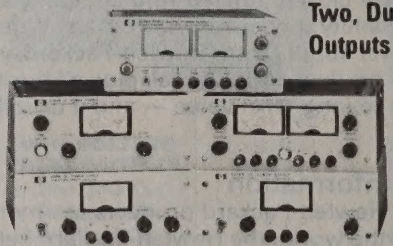


6236B, 6237B CV/CL Triple Output

6205C CV/CL Two, Dual Range Outputs

6384A CV/CL

6206B

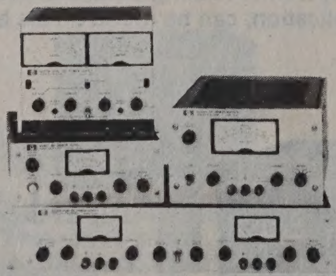


6227B, 6228B

6281A, 6284A, 6289A, 6294A, 6299A

6282A, 6286A, 6291A, 6296A

6253A, 6255A



This series of low and medium-power Constant Voltage/Constant Current power supplies includes both single and dual output models. All supplies have separate front-panel voltage/current controls that allow the voltage and current outputs to be varied from zero to the maximum rated values. Crossover from constant voltage to constant current operation occurs automatically when the load current exceeds the value established by the current control setting.

The dual-output supplies each contain two identical, independently-adjustable supplies. By combining the versatility of a dual power supply with the flexibility of auto-series and auto-parallel operation, twice the maximum rated output voltage or current of each section can be obtained from the one supply. In addition, using the autotracking capability, opposite-polarity voltages can be obtained.

Autoranging supplies employ a regulation control that automatically yields a continuous span of voltage and current ratings within the basic power rating boundry. More current is available at lower voltages, and higher voltages are available at a given current level. Autoranging supplies have features for system applications and have the flexibility for multi-application or multi-user situations. The 6002A has a maximum 200 watts output from 20V to 50V, the 6024A and 6034A from 20V to 60V. Model 6012A has 1000 watts output from 20V to 60V.

Ratings for Autoranging Supplies

Volts	Amps	Model	Load Effect	Source Effect	PARD Rms/p-p	Price
0-50	0-10	6002A	.01% +1mV	.01% +1mV	1mV/10mV	$1,775*
0-60	0-10	6024A	.01%	.01%	3mV/30mV	$1,220
0-60	0-10	6034A	.01%	.01%	3mV/30mV	$2,740
0-60	0-50	6012A	+5mV	+3mV	5mV/50mV	$2,080

*HP-IB (IEEE 488) control for Model 6002A is optional; add $560

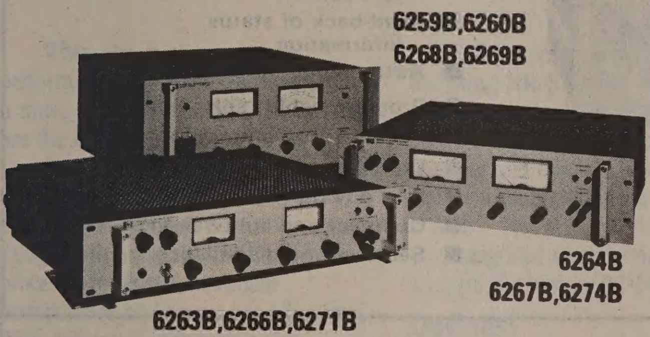
Ratings for Lab/System Supplies

Volts	Amps	Model	Load Effect	Source Effect	PARD Rms/p-p	Price
4.4-5.5	8	6384A	2mV	2mV	1mV/5mV	$650
0-6/0±20 0-18/0±20	2.5/.5 1/.5	6236B 6237B	0.01% +2mV	0.01% +2mV	0.35mV/ 1.5mV	$635
0-7.5	0-3	6203B	5mV	3mV	200μV/1mV	$600
0-7.5	0-5	6281A	5mV	0.01% +2mV	200μV/1mV	$750
0-10	0-10	6282A	0.01% +1mV	0.01% +1mV	500μV/25mV	$950
0-20/0-40	0-1.5/ 0-0.75	6200B	0.01% +4mV	0.01% +4mV	200μV/1mV	$550
0-20/0-40 0-20/0-40	0.6/0.3 0.6/0.3	6205C	0.01% +4mV	0.01% +4mV	.2mV/1mV	$600
0-20 0-20	0-3 0-3	6253A	0.01% +4mV	0.02% +2mV	200μV/1mV	$1,195
0-20	0-3	6284A	0.01% +4mV	0.01% +2mV	200μV/1mV	$650
0-20	0-10	6286A	0.01% +1mV	0.01% +1mV	500μV/25mV	$1,005
0-25 0-25	0-2 0-2	6227B	0.01% +1mV	1mV	250μV/4mV	$1,500
0-30/0-60	1/0.5	6206B	0.01% +4mV	0.01% +4mV	.2mV/1mV	$550
0-40 0-40	0-1.5 0-1.5	6255A	0.01% +2mV	0.01% +2mV	200μV/1mV	$1,195
0-40	0-1.5	6289A	0.01% +2mV	0.01% +2mV	200μV/1mV	$650
0-40	0-5	6291A	0.01% +1mV	0.01% +1mV	500μV/25mV	$1,005
0-50 0-50	0-1 0-1	6228B	0.01% +1mV	1mV	250μV/4mV	$1,500
0-60	0-1	6294A	0.01% +2mV	0.01% +2mV	200μV/1mV	$700
0-60	0-3	6296A	0.01% +1mV	0.01% +1mV	500μV/25mV	$1,005
0-100	0-750mA	6299A	0.01% +2mV	0.01% +2mV	200μV/1mV	$700
0-160	0-0.2	6207B	0.02% +2mV	0.02% +2mV	5mV/40mV	$700
0-320	0-0.1	6209B	0.02% +2mV	0.02% +2mV	1mV/40mV	$700

HEWLETT PACKARD

200-2,000 Watt High-Performance Supplies for Systems or the Lab

- Constant Voltage/Constant Current Operation
- Built-in Overvoltage Protection
- Auto-Series, - Parallel, - Tracking



All models in this series employ a transistor series-regulator/triac preregulator circuit to achieve high efficiency, excellent regulation, low ripple and noise, and moderate programming speeds in a compact full-rack width package.

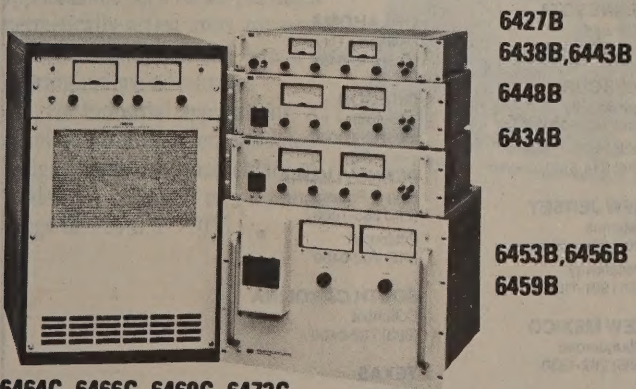
Separate coarse and fine voltage and current controls allow the voltage and current outputs to be varied from zero to the maximum rated value.

Ratings for High-Efficiency Supplies

Volts	Amps	Model	Load Effect	Source Effect	PARD Rms/p-p	Price
0-10	0-50	6259B	0.01% +200μV	0.01% +200μV	500μV/ 5mV	$1,775
0-10	0-100	6260B	0.01% +200μV	0.01% +200μV	500μV/ 5mV	$2,105
0-20	0-10	6263B	0.01% +200μV	0.01% +200μV	200μV/ 10mV	$1,295
0-20	0-20	6264B	0.01% +200μV	0.01% +200μV	200μV/ 10mV	$1,370
0-20	0-50	6261B	0.01% +200μV	0.01% +200μV	500μV/ 5mV	$1,880
0-40	0-5	6266B	0.01% +200μV	0.01% +200μV	200μV/ 10mV	$1,295
0-40	0-10	6267B	0.01% +200μV	0.01% +200μV	200μV/ 10mV	$1,370
0-40	0-30	6268B	0.01% +200μV	0.01% +200μV	1mV/ 5mV	$1,830
0-40	0-50	6269B	0.01% +200μV	0.01% +200μV	1mV/ 5mV	$1,925
0-60	0-3	6271B	0.01% +200μV	0.01% +200μV	200μV/ 10mV	$1,295
0-60	0-15	6274B	0.01% +200μV	0.01% +200μV	200μV/ 20mV	$1,525

300-11,000 Watt High-Power, High-Efficiency Supplies

- Constant Voltage/Constant Current Operation
- Low Cost/Watt
- Up to 75% Efficiency
- Auto-Series, -Parallel, -Tracking



This series of SCR-regulated power supplies is designed for high-power applications requiring a fixed or variable DC source with moderate regulation and ripple. Typical applications include battery charging and discharging, computer mainframe and memory system power, life testing and aging of large quantities of components, etc.

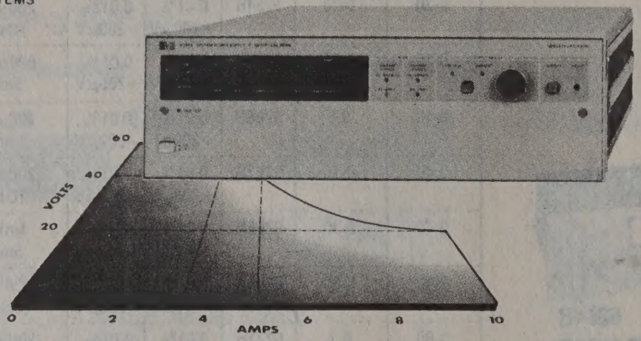
Ratings for High-Performance Supplies

Volts	Amps	Model	Load Effect	Source Effect	PARD Rms/p-p	Price
0-8	0-1000	6464C	0.05% +5mV	0.05% +5mV	80mV/ 1V	$8,110
0-15	0-200	6453A	0.2%+10mV Com		150mVrms	$4,010
0-16/ 0-18	0-600/ 0-500	6466C	0.05% +5mV	0.05% +5mV	180mV/ 1V	$7,455
0-36	0-100	6456B	0.2%+10mV Com		180mVrms	$3,655
0-36	0-300	6469C	0.05% +5mV	0.05% +5mV	180mV/ 1V	$7,305
0-40	0-25	6434B	40mV	18mV	40mV/ 500mV	$1,620
0-60	0-5	6438B	60mV	30mV	120mV/ 400mV	$1,215
0-64	0-50	6459A	0.2%+10mV Com		160mVrms	$3,600
0-64	0-150	6472C	0.05% +100mV	0.05% +100mV	160mV/ 2V	$7,305
0-110	0-100	6475C	0.05% +100mV	0.05% +100mV	220mV/ 2V	$7,305
0-120	0-2.5	6443B	120mV	60mV	240mV/ 400mV	$1,195
0-220	0-50	6477C	0.05% +100mV	0.05% +100mV	330mV/ 2V	$7,305
0-300	0-35	6479C	0.05% +100mV	0.05% +100mV	330mV/ 3V	$7,305
0-400, 500,600	0-25, 20,15	6483C	0.05% +100mV	0.05% +100mV	600mV/ 5V	$7,605
1-600	5mA- 1.5A	6448B	1%+ 400mV	600mV	600mV/ 2V	$1,575

HEWLETT PACKARD

The 6034A *Autoranging* DC Power Supply with HP-IB has expanded systems capability . . . a comprehensive solution for system-controlled DC power.

DESIGNED FOR HP-IB SYSTEMS



- HP-IB programming of voltage, current and OVP
- HP-IB measurement of voltage and current
- Read-back of status information
- Autoranging output
- Programmable "soft" limits
- Friendly programming format
- Digital panel meters
- Fast down-programming
- Compact and lightweight
- Self-test and diagnostics

AND SERVICE OFFICES

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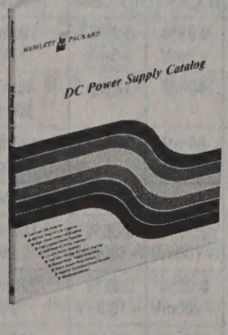

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1820 Embarcadero Road, Palo Alto, CA 94303

Integrated Circuits Incorporated
10301 Willows Road, Redmond, WA 98052
(206) 882-3100 TWX: 910-443-2302

MINIATURE DC-DC CONVERTERS

When size is at a premium, performance is critical, and reliability is a must, ICI Miniature DC-DC Converters are the industry leaders.

Since 1969, ICI has been developing innovative designs of on-board power devices. ICI combines unique electrical design with proven thick-film hybrid processes to obtain maximum performance and power per cubic inch. With dedicated engineering and production, the power devices group conducts a continuous development program in DC-DC converter technology. This program assures state-of-the-art products for demanding applications. At ICI, every unit receives individual testing; every unit carries ICI's one-year warranty.

Standard models, normally shipped from inventory, are available for both military/airborne and industrial applications. With over 100 models in production and power ratings to 20 watts, the ICI product line provides the customer with a wide selection of devices for his application.

For military and airborne applications, ICI's metal-packaged hermetically-sealed units are available in several configurations—each series offering unique advantages.

For industrial applications, ICI's standard families of encapsulated designs provide a broad choice of models for operation over a tempera range of −20°C to +70°C.

And for custom applications, including MIL-STD-883 requirements, ICI can provide design expertise based on solid experience to achieve quick response and expedited delivery of an end-item that will do the job—and do it well.

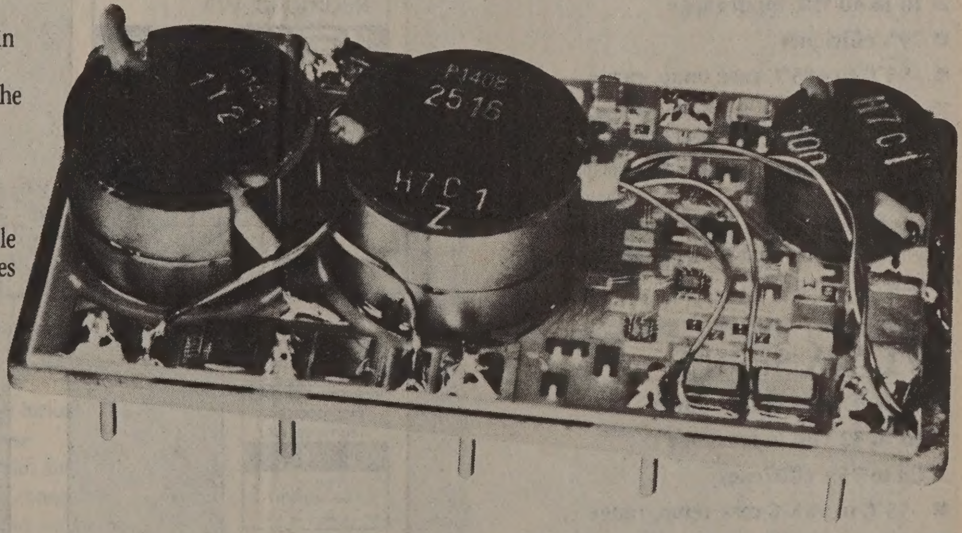
Integrated Circuits Incorporated . . . for the best in DC-DC converters.

Optional Environmental Screening

All ICI metal-packaged units are available with environmental screening, referenced to MIL-STD-883, per ICI's in-house screening procedure, as follows:

- Pre-cap internal visual inspection: Method 2017.
- Stabilization bake: 24 hours at 125°C, Method 1008, Cond. B.
- Temperature cycle: 10 times, −55°C/+125°C, Method 1010.
- Constant Acceleration: 500 g, Method 2001.
- Gross Leak: Method 1014.
- Fine Leak: Method 1014, Cond. A.
- Burn-in: 96 hour, at max. rated case temp., Method 1015
- Final electrical test: Per specification.
- Final external visual inspection: Method 2009

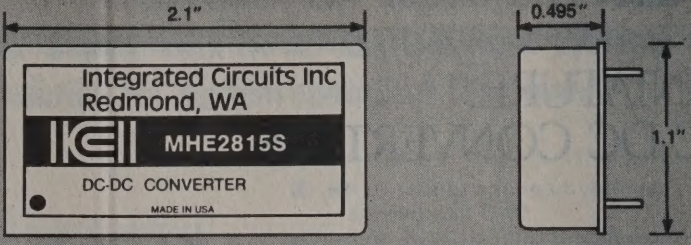
To order optional screening, add suffix /ES to part number. Example: MHE2805S/ES. Consult ICI for prices.



MHE SERIES

- **Up to 20 watts output power**
- **16 to 40 VDC input range**
- **Up to 86% typical efficiency**
- **-55°C to +85°C case temp. range**

The MHE models are high efficiency, isolated, regulated DC-DC converters that require no external components. Various output voltages are available in these hermetically-sealed, metal-packaged models that are suitable for military and airborne applications.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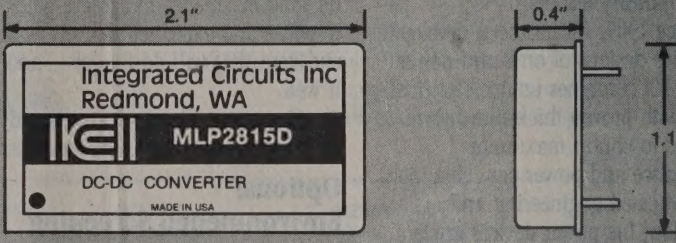
Integrated Circuits Inc
Redmond, WA
MHE2815S
DC-DC CONVERTER
MADE IN USA

PRICE GROUP	MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
M	MHE2805S	16.0 to 40.0	5.0	3000	81	15
	MHE2812S	16.0 to 40.0	12.0	1667	86	20
	MHE2815S	16.0 to 40.0	15.0	1333	86	20
	MHE2812D	16.0 to 40.0	± 12.0	± 625	78	15
	MHE2815D	16.0 to 40.0	± 15.0	± 500	78	15

MLP SERIES

- **Up to 15 watts output power**
- **Low profile: 0.4 inches high**
- **16 to 40 VDC input range**
- **-55°C to +85°C case temp. range**

The MLP series devices are similar to the MHE series except for a lower case profile. Isolation, regulated outputs, high efficiency, wide input voltage range, and metal hermetic package make the MLP series ideal for military, aerospace, or other high reliability applications.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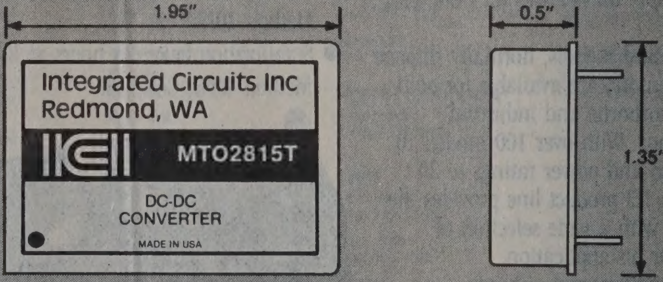
Integrated Circuits Inc
Redmond, WA
MLP2815D
DC-DC CONVERTER
MADE IN USA

PRICE GROUP	MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
M	MLP2805S	16.0 to 40.0	5.0	2000	81	10
	MLP2812S	16.0 to 40.0	12.0	1250	86	15
	MLP2815S	16.0 to 40.0	15.0	1000	86	15
	MLP2812D	16.0 to 40.0	± 12.0	± 417	78	10
	MLP2815D	16.0 to 40.0	± 15.0	± 333	78	10

MTO SERIES

- **15 watts—triple output**
- **16 to 40 VDC input range**
- **79% efficiency**
- **-55°C to +85°C case temp. range**

The MTO models have three output voltages, with a common ground. All three regulated outputs are fully isolated from the input. The full rated output power can be drawn from the +5 VDC output, or the dual outputs can be loaded up to the limits shown. Total output power must be limited to 15 watts. Metal, hermetic package.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1.35"
Integrated Circuits Inc
Redmond, WA
MTO2815T
DC-DC
CONVERTER
MADE IN USA

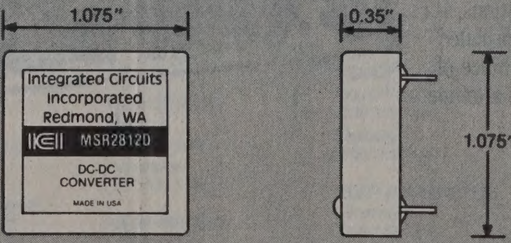
PRICE GROUP	MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
O	MTO2812T	16.0 to 40.0	+ 5.0 ± 12.0	2000 ± 208	77	15
	MTO2815T	16.0 to 40.0	+ 5.0 ± 15.0	2000 ± 167	79	15

MSR SERIES

- **Up to 4 watts output power**
- **16 to 32 VDC input range**
- **Up to 75% efficiency**
- **-55°C to +85°C case temp. range**

The MSR models offer the high efficiency and wide input range of flyback switching regulators, yet have full input/output isolation. There are single, dual and triple output models, with all outputs fully regulated. The packages are metal, hermetically-sealed.

NOTE: EXTERNAL OUTPUT CAPACITORS ARE REQUIRED.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Redmond, WA
MSR2812D
DC-DC
CONVERTER
MADE IN USA

PRICE GROUP	MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
K	MSR2805S	16.0 to 32.0	5.0	700	72	3.5
	MSR2812D	16.0 to 32.0	± 12.0	± 167	75	4.0
	MSR2815D	16.0 to 32.0	± 15.0	± 133	75	4.0
N	MSR28512T	16.0 to 32.0	+ 5.0 ± 12.0	300 ± 63	70	3.0
	MSR28515T	16.0 to 32.0	+ 5.0 ± 15.0	300 ± 50	70	3.0

Integrated Circuits Incorporated

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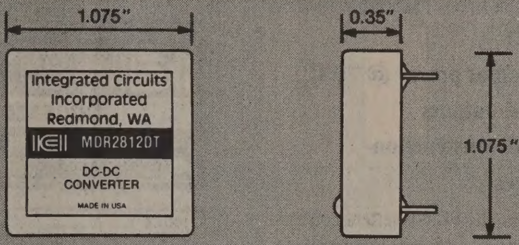
For More Information. Circle No. 330

MDR SERIES

- **3 watts of output power**
- **Input voltages of 12, 24, and 28 VDC**
- **Regulated, isolated outputs**
- **-55°C to +85°C case temp. range**

The MDR series of DC-DC converters offers the excellent regulation and low output ripple provided by a series output regulator, in a hermetically-sealed metal package. No external components are required, and the outputs are fully isolated from the input.

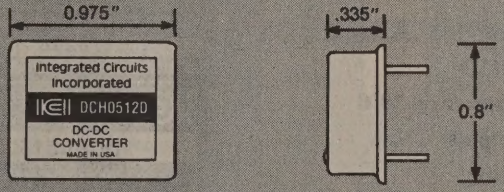


PRICE GROUP	MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
I	MDR1212DT	10.8 to 14.0	± 12.0	± 125	60	3.0
	MDR1215DT	10.8 to 14.0	± 15.0	± 100	60	3.0
	MDR2412DT	20.0 to 28.0	± 12.0	± 125	60	3.0
	MDR2415DT	20.0 to 28.0	± 15.0	± 100	60	3.0
	MDR2812DT	24.0 to 32.0	± 12.0	± 125	60	3.0
	MDR2815DT	24.0 to 32.0	± 15.0	± 100	60	3.0

DCH SERIES

- **Up to 3 watts output power**
- **Unregulated**
- **Input voltages of 5, 12, and 28 VDC**
- **-55°C to +100°C case temp. range**

The DCH series consists of isolated, unregulated models that deliver up to 3 watts of output power. They can be used with external series regulators or in applications not requiring well regulated voltages. The metal packages are hermetically sealed.



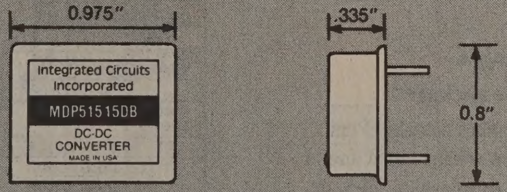
PRICE GROUP	MODEL	NOMINAL VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
L	DCH0505S	5.0	5.0	400	67	2.0
	DCH0512S	5.0	12.0	208	72	2.5
	DCH0512D	5.0	± 12.0	± 104	72	2.5
	DCH0515D	5.0	± 15.0	± 83	72	2.5
	DCH1205S	12.0	5.0	500	70	2.5
	DCH1212S	12.0	12.0	250	72	3.0
	DCH1212D	12.0	± 12.0	± 125	72	3.0
	DCH1215D	12.0	± 15.0	± 100	72	3.0
	DCH1228S	12.0	28.0	107	75	3.0
	DCH1228D	12.0	± 28.0	± 53	75	3.0
	DCH2805S	28.0	5.0	500	68	2.5
	DCH2812S	28.0	12.0	250	75	3.0
	DCH2812D	28.0	± 12.0	± 125	75	3.0
	DCH2815D	28.0	± 15.0	± 100	75	3.0

MDP SERIES

- **Up to 1.5 watts output power**
- **Wide input voltage ranges**
- **High efficiency/non-isolated**
- **-55°C to +85°C case temp. range**

The MDP miniature switching regulators include models with one regulated output and one unregulated output, as well as models with dual regulated outputs. The input common is connected internally to the output common. They are contained in metal, hermetically-sealed packages.

NOTE: EXTERNAL OUTPUT CAPACITORS ARE REQUIRED.



PRICE GROUP	MODEL	VDC INPUT	OUTPUT VDC	EFF. %	MAX. WATTS
P	MDP50505DP	+ 3 to + 7	+ 5 REGULATED/- 5 UNREG.	75	1.25
	MDP505SN	+ 3 to + 7	- 5 REG. SINGLE OUTPUT	72	1.25
	MDP51205DP	+ 3 to + 7	+ 12 REGULATED/- 5 UNREG.	75	1.25
	MDP51212DP	+ 3 to + 7	+ 12 REGULATED/- 12 UNREG.	75	1.25
	MDP51212DN	+ 3 to + 7	- 12 REGULATED/+ 12 UNREG.	75	1.25
	MDP51212DB	+ 3 to + 7	± 12 REG./BALANCE UNREG.	75	1.25
	MDP51515DB	+ 3 to + 7	± 15 REG./BALANCE UNREG.	75	1.25
	MDP120505DP	+ 9 to + 15	+ 5 REGULATED/- 5 UNREG.	72	1.50
	MDP1205SN	+ 9 to + 15	- 5 REG. SINGLE OUTPUT	72	1.50
	MDP121205DN	+ 9 to + 15	- 12 REGULATED/+ 5 UNREG.	78	1.50
	MDP121212DB	+ 9 to + 15	± 12 REG./BALANCE UNREG.	80	1.50
	MDP121515DB	+ 9 to + 15	± 15 REG./BALANCE UNREG.	80	1.50
	MDP240505DP	+ 16 to + 32	+ 5 REGULATED/- 5 UNREG.	72	1.50
	MDP241212DP	+ 16 to + 32	+ 12 REGULATED/- 12 UNREG.	80	1.50
	MDP241212DN	+ 16 to + 32	- 12 REGULATED/+ 12 UNREG.	80	1.50
	MDP241212DB	+ 16 to + 32	± 12 REG./BALANCE UNREG.	80	1.50
	MDP241515DB	+ 16 to + 32	± 15 REG./BALANCE UNREG.	80	1.50

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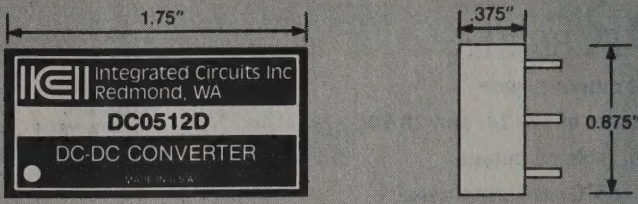
For More Information. Circle No. 330

DC SERIES

- **Up to 6.4 watts of output power @ 70°C**
- **Isolated, unregulated outputs**
- **Rugged encapsulated construction**
- **4 input voltage ranges**

The DC series of unregulated DC-DC converters consists of single and dual output models, in four input voltage ranges. They can be used with external regulators or in applications that do not require regulated voltages. Operating ambient temperature range for these plastic, encapsulated devices is −20°C to +70°C.

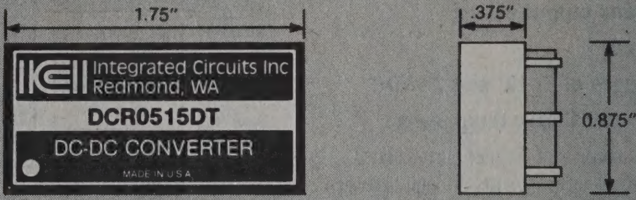


PRICE GROUP	MODEL	NOMINAL VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
A	DC0512D	5	± 12	± 208	75	5.0
	DC0515D	5	± 15	± 167	77	5.0
	DC0525D	5	± 25	± 100	77	5.0
	DC1205S	12	5	1000	67	5.0
	DC1212D	12	± 12	± 267	77	6.4
	DC1215D	12	± 15	± 213	77	6.4
	DC1218D	12	± 18	± 178	77	6.4
	DC2805S	28	5	1000	73	5.0
	DC2812D	28	± 12	± 267	81	6.4
	DC2815D	28	± 15	± 213	81	6.4
	DC2818D	28	± 18	± 178	81	6.4
	DC4805S	48	5	1000	70	5.0
	DC4812S	48	12	530	80	6.4
	DC4812D	48	± 12	± 267	80	6.4
	DC4815D	48	± 15	± 213	80	6.4
	DC4818D	48	± 18	± 178	80	6.4

DCR SERIES

- **Up to 4 watts output power @ 70°C**
- **Isolated, regulated outputs**
- **Foldback current limiting**
- **High efficiency—no external components**

The DCR series features isolated, dual-tracking outputs and four different input voltage ranges. They have input pi filters for good ripple rejection and the non-saturating core design minimizes radiated and conducted noise. These plastic, encapsulated converters can be operated over an ambient temperature range of −20°C to +70°C.



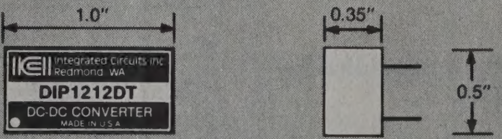
PRICE GROUP	MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
B	DCR0512DT	4.5 to 5.5	± 12.0	± 156	65	3.75
	DCR0515DT	4.5 to 5.5	± 15.0	± 125	65	3.75
	DCR1212DT	10.8 to 14.0	± 12.0	± 167	65	4.0
	DCR1215DT	10.8 to 14.0	± 15.0	± 133	65	4.0
	DCR2812DT	24.0 to 32.0	± 12.0	± 167	65	4.0
	DCR2815DT	24.0 to 32.0	± 15.0	± 133	65	4.0
	DCR4812DT	44.0 to 56.0	± 12.0	± 167	65	4.0
	DCR4815DT	44.0 to 56.0	± 15.0	± 133	65	4.0

DIP SERIES

- **Up to 1.5 watts output power**
- **High efficiency**
- **Wide input voltage ranges**
- **14 pin DIP compatible package**

The DIP switching regulator series consists of units that operate over a wide input voltage range, over a wide range of loads, with high efficiency. They are ideal for battery applications or wherever high efficiency and small size are important. The output common is connected internally to the input common. They are encapsulated in plastic packages and will operate over the ambient temperature range of −20°C to +70°C.

NOTE: EXTERNAL OUTPUT CAPACITORS ARE REQUIRED.



PRICE GROUP	MODEL	VDC INPUT	OUTPUT VDC	EFF. %	MAX. WATTS
D	DIP370505DP	+ 3 to + 7	+ 5 REGULATED/− 5 UNREG.	75	1.25
E	DIP371205DP	+ 3 to + 7	+ 12 REGULATED/− 5 UNREG.	75	1.25
	DIP371212DP	+ 3 to + 7	+ 12 REGULATED/− 12 UNREG.	75	1.25
	DIP371212DN	+ 3 to + 7	− 12 REGULATED/+ 12 UNREG.	75	1.25
	DIP371212DB	+ 3 to + 7	± 12 REG./BALANCE UNREG.	75	1.25
	DIP371515DB	+ 3 to + 7	± 15 REG./BALANCE UNREG.	75	1.25
D	DIP505SN	+ 3 to + 7	− 5 REG. SINGLE OUTPUT	72	1.25
	DIP1205SN	+ 9 to + 15	− 5 REG. SINGLE OUTPUT	72	1.50
	DIP1205SP	+ 9 to + 15	+ 5 REG. SINGLE OUTPUT	72	1.50
E	DIP121212DB	+ 9 to + 15	± 12 REG./BALANCE UNREG.	78	1.50
	DIP121515DB	+ 9 to + 15	± 15 REG./BALANCE UNREG.	78	1.50
D	DIP240505DP	+ 16 to + 32	+ 5 REGULATED/− 5 UNREG.	72	1.50
E	DIP241212DP	+ 16 to + 32	+ 12 REGULATED/− 12 UNREG.	80	1.50
	DIP241212DN	+ 16 to + 32	− 12 REGULATED/+ 12 UNREG.	80	1.50
	DIP241212DB	+ 16 to + 32	± 12 REG./BALANCE UNREG.	80	1.50
	DIP241515DB	+ 16 to + 32	± 15 REG./BALANCE UNREG.	80	1.50

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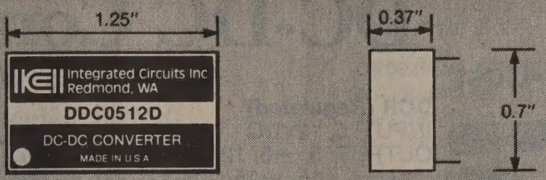
For More Information Circle No. 330

DDC SERIES

- **Up to 5 watts output power @ 70°C**
- **Isolated, unregulated outputs**
- **24 pin DIP compatible package**
- **4 input voltage ranges**

The DDC models are unregulated and are designed to be used in applications where regulated voltages are not needed, or with external regulators. The outputs are isolated from the input. They can be operated over an ambient temperature range of −20°C to +70°C, and they are encapsulated in plastic packages.

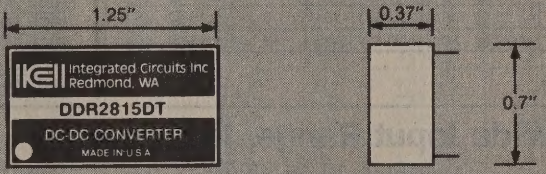


PRICE GROUP	MODEL	NOMINAL VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
F	DDC0505S	5	5	800	63	4.0
	DDC0512D	5	± 12	± 167	75	4.0
	DDC0515D	5	± 15	± 133	75	4.0
	DDC1205S	12	5	1000	68	5.0
	DDC1212D	12	± 12	± 208	80	5.0
	DDC1215D	12	± 15	± 167	80	5.0
	DDC2805S	28	5	1000	70	5.0
	DDC2812D	28	± 12	± 208	83	5.0
	DDC2815D	28	± 15	± 167	83	5.0
	DDC4805S	48	5	1000	72	5.0
	DDC4812D	48	± 12	± 208	84	5.0
	DDC4815D	48	± 15	± 167	84	5.0

DDR SERIES

- **Up to 3 watts output power @ 70°C**
- **Isolated, regulated outputs**
- **24 pin DIP compatible package**
- **5 input voltage ranges**

The DDR series DC-DC converters are isolated and regulated. They have short-term short-circuit protection and are built with a non-saturating core design to minimize reflected ripple and radiated noise. The rugged plastic 24-pin DIP packages are rated for operation from −20°C to +70°C ambient.

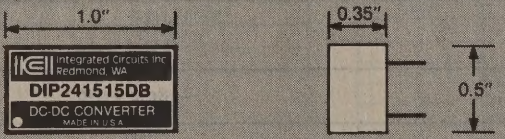


PRICE GROUP	MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
G	DDR0505S	4.5 to 5.5	5.0	400	45	2.0
H	DDR0512DT	4.5 to 5.5	± 12.0	± 104	52	2.5
	DDR0515DT	4.5 to 5.5	± 15.0	± 83	52	2.5
G	DDR1205S	10.8 to 14.0	5.0	500	45	2.5
H	DDR1212DT	10.8 to 14.0	± 12.0	± 125	55	3.0
	DDR1215DT	10.8 to 14.0	± 15.0	± 100	55	3.0
G	DDR2405S	20.0 to 28.0	5.0	500	45	2.5
H	DDR2412DT	20.0 to 28.0	± 12.0	± 125	55	3.0
	DDR2415DT	20.0 to 28.0	± 15.0	± 100	55	3.0
G	DDR2805S	24.0 to 32.0	5.0	500	46	2.5
H	DDR2812DT	24.0 to 32.0	± 12.0	± 125	55	3.0
	DDR2815DT	24.0 to 32.0	± 15.0	± 100	55	3.0
G	DDR4805S	44.0 to 56.0	5.0	500	45	2.5
H	DDR4812D	44.0 to 56.0	± 12.0	± 125	55	3.0
	DDR4815D	44.0 to 56.0	± 15.0	± 100	55	3.0

DIP___DT SERIES

- **1 watt output power @ 70°C**
- **Isolated, regulated outputs**
- **14 pin DIP compatible package**
- **5 input voltage ranges**

The DIP___ DT series converters can provide up to one watt of regulated, isolated output power. The ±12 VDC and ±15 VDC outputs are regulated by monolithic dual-tracking series regulators, which provide good regulation and ripple characteristics. Also available as non-catalog standards are 5 VDC output models that provide up to 0.5 watts. The plastic, encapsulated packages are rated for operation from −20°C to +70°C ambient.



PRICE GROUP	MODEL	VDC INPUT	OUTPUT @ FULL LOAD			MAX. WATTS
			VDC	mA	EFF. %	
C	DIP512DT	4.5 to 5.5	± 12.0	± 42	52	1.0
	DIP515DT	4.5 to 5.5	± 15.0	± 33	52	1.0
	DIP1212DT	10.8 to 14.0	± 12.0	± 42	55	1.0
	DIP1215DT	10.8 to 14.0	± 15.0	± 33	55	1.0
	DIP2412DT	20.0 to 28.0	± 12.0	± 42	55	1.0
	DIP2415DT	20.0 to 28.0	± 15.0	± 33	55	1.0
	DIP2812DT	24.0 to 32.0	± 12.0	± 42	55	1.0
	DIP2815DT	24.0 to 32.0	± 15.0	± 33	55	1.0
	DIP4812DT	44.0 to 56.0	± 12.0	± 42	55	1.0
	DIP4815DT	44.0 to 56.0	± 15.0	± 33	55	1.0

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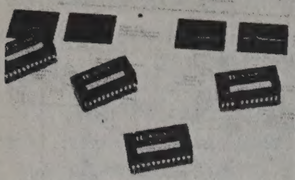
For More Information. Circle No. 330

Intronics-1 Watt to 100 Watt DC-DC Converters

1 Watt Low-Cost



DCR (Regulated)
INPUT: 5, 12VDC
OUTPUT: 5, ±5, 12, ±12, 15, ±15
DCU (Unregulated)
INPUT: 5, 12VDC
OUTPUT: 5, ±12, ±15
24-Pin DIP Package

Individual Model Characteristics (Typical at +25°C)

Model	Input Voltage VDC	Output VDC @ mA	Model	Input Voltage VDC	Output VDC @ mA
DCR 5/5	5	5 @ 100	DCR 12/12-12	12	±12 @ 80
DCR 12/5	12	5 @ 100	DCR 5/15-15	5	±15 @ 65
DCR 5/12	5	12 @ 80	DCR 12/15-15	12	±15 @ 65
DCR 12/12	12	12 @ 80	DCU 5/5	5	5 @ 200
DCR 5/15	5	15 @ 65	DCU 12/5	12	5 @ 200
DCR 12/15	12	15 @ 65	DCU 5/12-12	5	±12 @ 80
DCR 5/5-5	5	±5 @ 100	DCU 5/15-15	5	±15 @ 65
DCR 5/12-12	5	±12 @ 80	DCU 12/15-15	12	±15 @ 65

5 Watt Low-Noise

SINGLE
INPUT: 5, 12, 24, 28, 48VDC
OUTPUT: 5, 12, 15VDC
DUAL
INPUT: 5, 12, 24, 28
OUTPUT: ±12, ±15

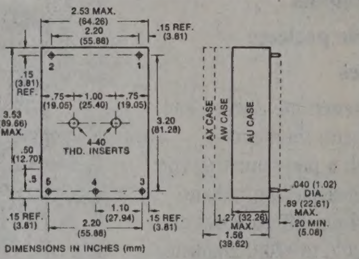
- Small 2″ Square Package
- High 70% Efficiency

Model	Input Voltage VDC	Output VDC @ mA	Model	Input Voltage VDC	Output VDC @ mA
DCE 5/5S/1000	5	5 @ 1A	DCE 48/5S/1000	48	12 @ 1A
DCE 5/12S/500	5	12 @ 500	DCE 48/12S/500	48	12 @ 500
DCE 5/15S/350	5	15 @ 350	DCE 48/15S/350	48	15 @ 350
DCE 12/5S/1000	12	5 @ 1A	DCE 5/12/150	5	±12 @ 150
DCE 12/12S/500	12	12 @ 500	DCE 5/15/150	5	±15 @ 150
DCE 12/15S/350	12	15 @ 350	DCE 12/12/150	12	±12 @ 150
DCE 24/5S/1000	24	5 @ 1A	DCE 12/15/150	12	±15 @ 150
DCE 24/12S/500	24	12 @ 500	DCE 24/12/150	24	±12 @ 150
DCE 24/15S/350	24	15 @ 350	DCE 24/15/150	24	±15 @ 150
DCE 28/5S/1000	28	5 @ 1A	DCE 28/12/150	28	±12 @ 150
DCE 28/12S/500	28	12 @ 500	DCE 28/15/150	28	±15 @ 150
DCE 28/15S/350	28	15 @ 350			

12-22 Watt Wide Input Range, Isolated

INPUT: 12, 24, 48VDC
OUTPUT: ±12, ±15VDC

- Wide 2:1 Input Range
- No Heat Sink Required
- Low Output Ripple
- High Input/Output Isolation
- Short Circuit Protection



DIMENSIONS IN INCHES (mm)

Specifications Typical at +25°C. After 15 minute warm-up unless otherwise noted.

Model DCWD	12/12D/500	12/15D/400	24/12D/500	24/15D/400	48/12D/500	48/15D/400	5/12/425	5/15/330
Input Voltage	9-18DC	9-18VDC	18-36VDC	18-36VDC	36-72VDC	36-72VDC	4.5-5.5 VDC	4.5-5.5VDC
Input Current (Nom. Line) No Load Full Load	200mA 1.67A	200mA 1.67A	100mA 830mA	100mA 830mA	50mA 420mA	50mA 420mA	480mA 3300mA	480mA 3300mA
Input/Output Isolation	$10^{11}\Omega \| 120pF$ 300VDC						$10^{11}\Omega \| 120pF$ 300VDC	
Output Voltage	±12VDC, 1%	±15VDC, 1%	±12VDC, 1%	±15VDC, 1%	±12VDC, 1%	±15VDC, 1%	+12VDC, ±2%	+15VDC, ±2%
Output Ripple	7mV rms (100mV p-p)						1.0mV rms	
Regulation Line Load vs. Temperature	0.1% max. 0.1% max. 0.05%/°C						0.02% max. 0.05% max. 0.02%/°C	
Temperature Range Operating, 100% Load Storage	−25°C to +71°C −25°C to +85°C						−25°C to +71°C −25°C to +85°C	
Case Size	(AU)						AU	AU

Models DCW	5VDC OUT @ 3000mA			5VDC OUT @ 4000mA			12VDC OUT @ 1700mA			15VDC OUT @ 1500mA		
	12/5/3000	24*/5/3000	48/5/3000	12/5/4000	24/5/4000	48/5/4000	12/12/1700	24/12/1700	48/12/1700	12/15/1500	24/15/1500	48/15/1500
Input Voltage	9 to 18VDC	18 to 36VDC	36 to 72VDC	9 to 18VDC	18 to 36VDC	36 to 72VDC	9 to 18VDC	18 to 36 VDC	36 to 72VDC	9 to 18VDC	18 to 36VDC	36 to 72VDC
Input Current (Nom. Line) No Load Full Load	125mA 1800mA	100mA 900mA	75mA 450mA	250mA 2500mA	130mA 1350mA	100mA 675mA	250mA 2500mA	130mA 1250mA	100mA 625mA	250mA 2500mA	130mA 1250mA	100mA 625mA
Input/Output Isolation	$10^{10}\Omega \| 100pF$ 300VDC			$10^{10}\Omega \| 250pF$ 300VDC			$10^{10}\Omega \| 470pF$ 300VDC			$10^{10}\Omega \| 540pF$ 300VDC		
Output Voltage	5VDC ±1%**			5VDC ±1%**			12VDC ±1%**			15VDC ±1%**		
Output Ripple	7.0mV rms			7.0mV rms			7.0mV rms			7.0mV rms		
Regulation Line Load vs. Temperature	.5% max. 1% max. 0.02%/°C			.5% max. 1% max. 0.02%/°C			.5% max. 1% max. 0.02%/°C			.5% max. 1% max. 0.02%/°C		
Temperature Range Operating, 100% Load Storage	−25°C to +71°C −25°C to +85°C			−25°C to +60°C −25°C to +85°C			−25°C to +60°C −25°C to +85°C			−25°C to +60°C −25°C to +85°C		
Case Height	AW			AX			AW			AW		

** For applications requiring closer preset accuracy, please consult factory.

intronics

INTRONICS, INCORPORATED, 57 CHAPEL STREET
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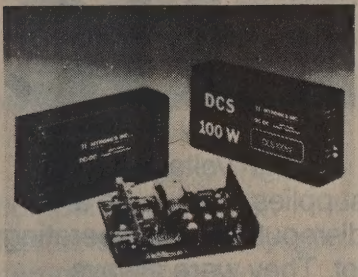
For More Information. Circle No. 331

30 to 100 Watt High Performance



- DISPLAY INDICATORS
- EXTERNAL DISABLE
- PROTECTION MODES
  Input Polarity
  Output OVP
  Output Overcurrent
- EXTERNAL SYNC
- REMOTE SENSE
- ISOLATION
  Input to Output: 1000VDC
  Primary to Derived: 500VDC
- TEMPERATURE RATINGS:
  Operation: −25°C to +85°C
  (Base Plate)
  Storage: −40°C to +85°C
- EFFICIENCY:
  71% typical (depends on model)
  Varies <3% over 2:1 input range
- REGULATION: Line/Load: 0.2%
- SIZE:
  30-Watt: 6.55″ x 4.22″ x 1.55″
  50-Watt: 8.05″ x 4.22″ x 4.50″
  100-Watt: 9.00″ x 4.50″ x 1.20″

ORDERING GUIDE **DCS A-X/YY**

A — Series (30, 50, 100)
X — Input Code
Y — Output Code

INPUT CODES

Code	Input Range
1	9-18VDC (except 100W)
2	18-36VDC
3	36-72VDC

	30-Watt				50-Watt				100-Watt			
Output Code	Output Voltage(s)	Nom.	Output Current(s) Min.	Max.	Output Voltage(s)	Nom.	Output Current(s) Min.	Max.	Output Voltage(s)	Nom.	Output Current(s) Min.	Max.
1	+ 5VDC	6A	0.6A	6A	+ 5VDC	10A	1A	10A	+ 5VDC	20A	2A	20A
2	+12VDC	2.5A	0.25A	2.5A	+12VDC	4A	0.4A	4A	+12VDC	8A	0.8A	8A
3	+15VDC	2A	0.2A	2A	+15VDC	3.3A	0.3A	3.3A	+15VDC	6.6A	0.67A	6.6A
4	+24VDC	1.25A	0.12A	1.25A	+24VDC	2A	0.2A	2A	+24VDC	4A	0.4A	4A
5	+28VDC	1A	0.1A	1A	+28VDC	1.8A	0.18A	1.8A	+28VDC	3.6A	0.36A	3.6A
6	+ 5VDC − 5VDC	4.8A 1.0A	0.48A 0.12A	6A 1.0A	+ 5VDC − 5VDC	8A 2A	0.8A 0.2A	10A 4A	+ 5VDC − 5VDC	16A 4A	1.6A 0.4A	20A 8A
7	+12VDC −12VDC	1.25A 1.0A	.125A .125A	2.0A 1.0A	+12VDC −12VDC	2A 2A	0.2A 0.2A	3.2A 3.2A	+12VDC −12VDC	4A 4A	0.4A 0.4A	6.4A 6.4A
8	+15VDC −15VDC	1A 1A	0.1A 0.1A	1.6A 1.0A	+15VDC −15VDC	1.7A 1.7A	0.17A 0.17A	2.7A 2.7A	+15VDC −15VDC	3.4A 3.4A	0.34A 0.34A	5.4A 5.4A
9	+18VDC −18VDC	0.8A 0.8A	0.08A 0.08A	1.38A 1.38A	+18VDC −18VDC	1.4A 1.4A	0.15A 0.15A	2.3A 2.3A	+18VDC −18VDC	2.8A 2.8A	0.3A 0.3A	4.6A 4.6A
10	+ 5VDC +12VDC	3A 1.2A	0.3A 0.12A	4.8A 1.6A	+ 5VDC +12VDC	5A 2A	0.5A 0.2A	8A 3A	+ 5VDC +12VDC	10A 4A	1A 0.4A	16A 6A
11	+ 5VDC +15VDC	3A 1A	0.3A 0.10A	4.8A 1.6A	+ 5VDC +15VDC	5A 1.7A	0.5A 0.17A	8A 2.8A	+ 5VDC +15VDC	10A 3.4A	1A 0.34A	16A 5.6A
12	+ 5VDC +24VDC	3A 0.6A	0.3A 0.06A	4.8A 0.8A	+ 5VDC +24VDC	5A 1A	0.5A 0.1A	8A 1.6A	+ 5VDC +24VDC	10A 2A	1A 0.2A	16A 3.2A
13	+ 5VDC +12VDC − 5VDC	3A 0.9A 0.6A	0.3A 0.09A 0.06A	4.8A 1.4A 1.2A	+ 5VDC +12VDC − 5VDC	5A 1.5A 1A	0.5A 0.15A 0.1A	8A 2.3A 1.5A	+ 5VDC +12VDC − 5VDC	10A 3A 2A	1A 0.3A 0.2A	16A 4.6A 3A
14	+ 5VDC +15VDC − 5VDC	3A 0.72A 0.6A	0.3A 0.07A 0.06A	4.8A 1.2A 1.2A	+ 5VDC +15VDC − 5VDC	5A 1.2A 1A	0.5A 0.12A 0.1A	8A 2A 1.5A	+ 5VDC +15VDC − 5VDC	10A 2.4A 2A	1A 0.24A 0.2A	16A 4A 3A
15	+ 5VDC +12VDC −12VDC	3A 0.6A 0.6A	0.3A 0.06A 0.06A	4.8A 1.0A 1.0A	+ 5VDC +12VDC −12VDC	5A 1A 1A	0.5A 0.1A 0.1A	8A 1.0A 1.0A	+ 5VDC +12VDC −12VDC	10A 2A 2A	1A 0.2A 0.2A	16A 3A 3A
16	+ 5VDC +15VDC −15VDC	3A 0.48A 0.48A	0.3A 0.05A 0.05A	4.8A 0.72A 0.72A	+ 5VDC +15VDC −15VDC	5A 0.8A 0.8A	0.5A 0.08A 0.08A	8A 1.0A 1.0A	+ 5VDC +15VDC −15VDC	10A 1.6A 1.6A	1A 0.16A 0.16A	16A 2.4A 2.4A
17	+ 5VDC +18VDC −18VDC	3A 0.42A 0.42A	0.3A 0.04A 0.04A	4.8A 0.6A 0.6A	+ 5VDC +18VDC −18VDC	5A 0.7A 0.7A	0.5A 0.07A 0.07A	8A 1A 1A	+ 5VDC +18VDC −18VDC	10A 1.4A 1.4A	1A 0.14A 0.14A	16A 2A 2A

40-Watt Low-Cost Isolated

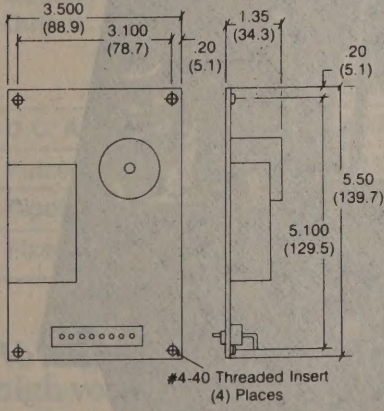
ORDERING GUIDE **DCC 40-A/X**

A — Input Code
X — Output Code

INPUT CODES

Code	Input Range
1	10-35VDC
2	20-70VDC

Output Code	Output Voltage(s)	Output Current
1	5VDC	8.0A
2	12VDC	3.0A
3	15VDC	3.0A
4	±12VDC	1.3A
5	±15VDC	1.3A
6	5VDC ±12VDC	3.0A .5A
7	5VDC ±15VDC	3.0A .5A



Input Voltage Rated Operation	10-35VDC	20-70VDC
Input Current (Nom Line) No Load Full Load	200mA 2.2A	100mA 1.1A
Reflected Input Riple Current	200mA P-P	100mA P-P
Output Noise	10mV RMS 100mV P-P	
Line Regulation Load Regulation (10% to 100% Load): 5V Output Balanced Load on Dual Output Unbalanced Load on Dual Outputs Output vs. Temperature	.2% .2% .2% 10% .05%/C	
Short Circuit Protection	Indefinite	
Temperature Range: Operating Storage	0° to +70°C −25°C to +105°C	

intronics

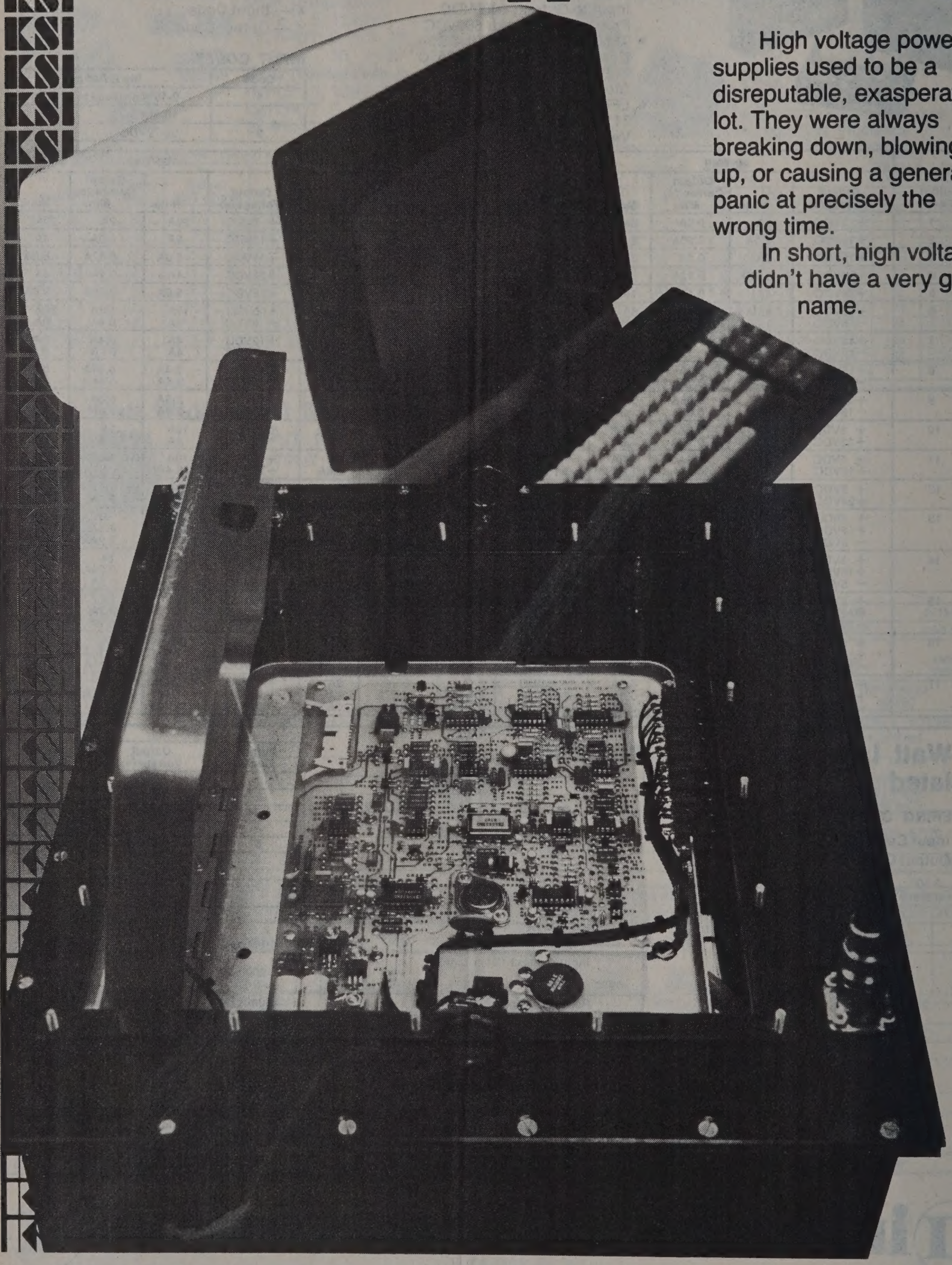
INTRONICS, INCORPORATED, 57 CHAPEL STREET
NEWTON, MA 02158 • TEL.: (617) 964-4000 • TWX: 710-335-6835

For More Information. Circle No. 331

High Voltage Power Supplies: The

High voltage power supplies used to be a disreputable, exasperating lot. They were always breaking down, blowing up, or causing a general panic at precisely the wrong time.

In short, high voltage didn't have a very good name.



For More Information. Circle No. 332

Inside Story.

Then along came a company called KSI. Remarkably, KSI brought common sense (and uncommon engineering) to the uncertain world of high voltage.

First, KSI invented the Arc Quencher™—an ingenious new design that makes high voltage power supplies short-circuit proof. And unlike other "fail-safe" systems, the Arc Quencher doesn't preserve itself at the expense of the load.

KSI then added double shielding, RFI filtering, isolated control power, and many other protective features.

Finally!!! High voltage power supplies were becoming reliable, upstanding citizens!

But KSI didn't stop here. High voltage power supplies were still notoriously behind the times. Who wanted to put an antique bucket of bolts into a highly advanced system?

So KSI went to work. It employed the latest vacuum-tube and control-circuit technology. It housed the components in compact tanks and modern control modules. And it used plug-in PCBs with LED indicators and test points.

To make matters even better, KSI taught its power supplies to speak ASCII with computers. Through fiber optics, computers precisely control each critical aspect of power-supply operation.

What's more, KSI is applying the same sensible engineering approach to high-frequency switchmode and resonant supplies.

And now for the happy ending: KSI custom designs high voltage *systems* for a whole range of applications, including:

- Ion implantation
- X-ray systems
- Lasers
- E-beam systems
- Ion deposition
- Ion milling.

To find out the latest developments in this exciting and continuing story, call or write: Kaiser Systems, Inc., 33 Cherry Hill Drive, Danvers, MA 01923. Phone (617) 777-5102. TWX: 887159. FAX: (617) 777-3340.

Typical Specifications

Description	Output Voltage	Reg.	Max. Current	Technology	Application
Multiple Output	Quad 0 to 10kV	.05%	4x 4mA	High-freq.	Beam optics
	0 to 10V 0 to 1.5kV 0 to 10kV	1% 1% 1%	300A 2.2A 40mA	High-freq. resonant	Deposition systems
D.C. Adjustable	+5 to +100kV	.01%	40mA	Output tube regulation	Ion implanters
Pulsed	+40 to +130kV	.1%	800mA		X-ray
Bipolar	−75, +75kV	.01%	200mA	High-freq. resonant	
Fixed voltage	25kV	1%	100mA		Lasers

We've given high voltage power supplies a good name...

KSI Kaiser Systems, Inc.

33 Cherry Hill Drive, Danvers, MA 01923 · Phone: 617-777-5102

For More Information. Circle No. 332

KSI

High Voltage Power Supply Selection Guide

Selecting the right high voltage power supply for a specific application requires careful consideration of many parameters. The following table, which compares the performance characteristics of several types of high voltage supplies, will provide guidance in making the appropriate choice for your application.

Type	Unregulated	Input Regulated			Output Regulated
Technology	—	linear	switch mode	resonant converter	linear
Frequency	50 Hz to 400 Hz	50 Hz to 400 Hz	10 kHz to 50 kHz	10 kHz to 50 kHz	50 Hz to 400 Hz
Output Voltage (Max.)	to > 1 MV	to > 1 MV	to 500 kV	to 500 kV	to 150 kV
Power Level	any	any	to 3 kW	to 50 kW	200 W to 200 kW
Regulation Method	N/A	var. transf. SCR	pulse width modulation	freq., phase modulation	series pass element
Stored Energy*	high	high	low	low	lowest
Output Current Limit Δt	≥ 10 ms	≈ 10 ms	≈ .1 ms	≈ .5 ms	< 1 μs
Transient Response	N/A	slow	medium	medium	very fast
EMI	very low	medium	high	medium	very low
Efficiency	≈ 95%	≈ 90%	≈ 85%	≈ 85%	75 to 90%
Parts Count	lowest	low	high	high	low
Size per Watt	large	large	small	small	large
Cost per Watt	low	medium–high	medium	medium	high
Insulation Medium	air, oil, SF6		air, oil, SF6, encapsulation		air, oil, SF6

*Stored energy at output due to output filter. Low filter requirements (higher ripple) reduce stored energy.

Choose your supplier as carefully as you choose your supplies. Ask yourself the following: are his designs modern, efficient, and reliable? Does he care as much about quality as you do? Will he deliver on time and to specifications?

Then call KSI.

We've given high voltage power supplies a good name...

KSI Kaiser Systems, Inc.

33 Cherry Hill Drive, Danvers, MA 01923 · Phone: 617-777-5102

For More Information. Circle No. 332

NOW. . . High Voltage Power Sources for the OEM
Consistent Top Quality in OEM Quantities

There's no need to compromise in high voltage power sources for your CRT requirements just because you find a catalog item that's "close". Nor any need to build your own. At Keltron, you can develop your special HVPS from one of our standards. . . modify to your specs. . . package to your needs. . . and buy it at off-the-shelf prices.

Since 1961, the Keltron team has been designing and producing solid state power supplies, and by using field-proven designs, we are able to produce custom units without high engineering costs.

For the finest balance in the business between performance and cost. . . for warranted reliability and the tightest specs, plus consistent delivery schedules. . . call Keltron.

APPLICATIONS: CRT typesetting – Computer Graphics – Projection TV – Word processors – TV studio monitors – Patient monitors – Automotive analyzers – Electrostatic copiers – Beam penetration color displays – Computer output microfilm recorders – Medical X-ray image intensifiers – Electronic amusement devices – Shadow mask color

LOW RIPPLE CRT ANODE SUPPLIES, SERIES P400

* Ripple 1 volt p-p (typical to 1,000pF)
* Dynamic load regulation ± 0.04% peak/watt typical
* Any fixed voltage between 10 and 20KV; calibration trimmer
* 10-watt rating in 50° still air
* Three low voltage outputs available to ± 1KV
* Static line, load regulation 0.01% typ, 0.05% max
* Small Size, 3.75″ × 5″ × 1.38″
* + 24VDC ± 5% input; 12V to 50V inputs available
* Conversion frequencies from 40KHz to 100KHz available
* Controlled fault overvoltage

Where high-resolution displays require lower anode ripple for elimination of beat-frequency bar patterns, lower dynamic load regulation peaks, more power, or more flexible low-voltage outputs than are possible with our miniature P500 series, we recommend the new P400 series.

A somewhat larger case permits the use of HV capacitors five times larger than in the P500 for a significant improvement in ripple while retaining superior dynamic performance. The larger case also allows an increase in power rating and more space for developing special low voltage outputs for the CRT.

SHADOW-MASK COLOR SUPPLIES, SERIES HP25

Linear

* 25-27.5KV to 1.2mA (30W max)
* Ripple 8V pp typical, 10V max to 1,500pF
* Case only 5.70″ square by 2.15″ high
* 28VDC ± 10% input
* Adjustable focus over any 2KV range from 4.5 to 9.5KV
* Static line, load regulation 1V typical, 5V max
* Dynamic load regulation 30V peak max, 0-1.0mA, 1,500pF
* Adjustable G2 voltage to 750V
* G1 voltage – 120V
* Unlimited overload and arc protection
* Remote TTL on-off control
* Overvoltage shutdown
* Designed to meet UL and CSA

Switching-Mode (Resonant Flyback^{TM})
Similar to the linear designs, except for:

* Output to 40W or more
* Wide range AC input available (95-130VAC)
* Can be synchronized to TV raster scan frequencies 15.5-19KHz, (for higher frequencies, consult factory) for complete elimination of beat-frequency bars
* High efficiency of 85-90% (unsynchronized) over **entire input. voltage range** means lower temperature rise, longer life, less system heat.

Color shadow-mask displays require much more power at higher voltages compared to monochrome displays, usually resulting in higher anode ripple. There is also an unusual sensitivity in the color CRT to anode ripple, which can cause beat-frequency bar patterns. Keltron has two solutions:

1) LINEAR: Selection of conversion frequency between 25 and 90KHz to eliminate visible beat frequencies on the displays using the highest possible for minimum ripple voltage.

2) SWITCHING: Synchronization to raster scan frequency for ABSOLUTE elimination of bar patterns.

The increased power required by color displays tends to cause higher operating temperatures in the power supply and consequent shorter life. In the linear series, Keltron utilizes the best magnetics and thermal design to keep efficiency high and temperature rise to a minimum. The Resonant Flyback^{TM} designs are more efficient because of their switching-mode circuitry and operate at a substantially lower temperature rise.

CRT PROJECTION POWER SUPPLIES

* Anode voltages from 30 to 50KV
* Anode power 15 to 120 watts for monochrome or color
* Low ripple (as low as 2vpp at 36KV) for clear display
* Used for digital graphics, teleconferencing, or theater television
* AC or DC inputs (unregulated)
* Line, load regulation 0.1% max
* High frequency power conversion (small size, weight, energy storage)
* Arc, overload protected, automatic recovery
* Triple output for color
* Repairable

Present production designs include

* HP45M: 45KV, 500μA (22.5w), 0.1% ripple, monochrome or color, + 24VDC input at 2A, 9.25″ × 6.88″ × 3″, 6 lb.
* HP48C: 48KV, 2.5mA (120w), 0.1% ripple, color, + 35VDC input at 5.5A, 14.5″ × 7.75″ × 5″, 16 lb.
* HP370216: 37KV, 800μA (30w) for high-resolution monochrome 1000-line-projection, 60KHz Resonant Flyback^{TM} conversion frequency, 1.5V p-p ripple (3V p-p max), 68% power efficiency, 9.05″ × 7.35″ × 2.4″, 5.8 lb.
* HP37C: 37KV, 1.5mA (56w), 0.1% ripple, for theatre color television, 117VAC input, 10KV output for focus control, no 60Hz magnetics, 12″ × 6.9″ × 3.7″, 8.25 lb.

LOW COST CRT POWER SUPPLY, SERIES P500

* 10 watt output at 50°C case; 6 watts in 50°C still air
* Any fixed voltage between + 1 and + 20KV; calibration trimmer
* Miniature package, 3″ × 4″ × 1.38$_0$
* + 24VDC ± 10% input; 12V to 30V inputs available
* Optional G1, G2, and/or focus voltages available
* Anode ripple 0.05% p-p typical, 0.075% p-p max at 500pF standard
* Anode ripple to 0.01% p-p (1.8V at 18KV) at 1,000pF available
* Conversion frequencies from 40 to 100KHz available
* Controlled fault overvoltage
* Unlimited overload and arc protection
* Static line, load regulation 0.01% typ, 0.05% max
* UL Recognized, CSA approved

Keltron's reliability has not been sacrificed in this miniature design. Voltage stresses and deratings have not been compromised, and an improved thermal design minimizes temperature rise.

Improved magnetics have made possible conversion frequencies in the 40 to 100KHz region, permitting selection of a frequency which eliminates beat-frequency bar patterns in raster displays. The higher frequencies provide very low ripple, low stored energy, and fast transient response. A unique oscillator design yields efficiency to 70% and protection from arcs and shorts to ground of unlimited duration. Restoration is instantaneous upon removal of the fault.

G2 and focus voltages can be provided to 1.0KV and 3mA, with G1 up to – 200V. These grid voltages are line regulated to 0.05% max but have load regulation typically between 1% and 10%. They are individually protected and can tolerate a short circuit indefinitely. The interaction with anode loading is usually about 1%, made possible by the superior magnetics.

DYNAMIC ELECTROSTATIC FOCUS SUPPLIES

* Nominal static focus voltages from 1 to 7KV at – 30 to + 300μA
* Static focus adjustment from 70% to 100% of nominal
* Regulation and ripple 0.1% p-p max
* + 22 to 27VDC power input

HDF Series

* With amplifier for dynamic focus correction signal (proportional to square of deflection radius)
* Amplified dynamic focus signal added to static focus voltage
* Amplifier bandwidth DC to 25KHz standard (200KHz optional)
* Dynamic focus output 0 to 300V max at voltage gains of 20 to 60.

F600 Series

* Floating static focus voltage requiring external high-level dynamic input
* Ground-referenced input power and dynamic input
* Full regulation of static focus voltage for line and load changes
* Dynamic bandwidth to 300KHz, voltage to 400V

Dynamic focus is a necessity with high-voltage electrostatic focus CRT's if optimum focus is expected over the entire display. The voltage for best focus in these CRT's increases, as the spot is deflected from the center of the screen, by as much as 300 volts. The static focus voltage is set for best focus at the center. The increase in focus voltage required by deflection will be proportional to the square of the deflection radius, so that the greatest correction is required in the corners of the screen.

The required focus-voltage correction may be obtained by deriving a signal proportional to $r^2 = X^2 + Y^2$, where X and Y are the horizontal and vertical deflection components. Such a signal, at a zero to + 10 volt level, may be fed to an HDF series power supply for amplification to zero to + 300 volts and its addition to the static focus voltage. Or if the signal is externally amplified to the required level, referenced to ground, the static focus voltage may be added to it by using a "floating focus" supply of the F600 series.

Only Keltron offers both methods of achieving direct-coupled dynamic focus.

BEAM PENETRATION (PENETRON CRT SUPPLIES)

* For color selection (red, orange, yellow, green) by anode voltage
* Single or double anode types
* 8-17KV (red-green) anode range
* Slewing currents of ± 50mA (9KV change in 270μS with 1,500pF)
* For display of as many as 120 four-color fields per second
* Arc, overload protected
* Digital color selection, each with full 9KV adjustment
* Dynamic focus, G2 and G1 voltages
* High-voltage switch redundancy for improved MTBF
* Efficient Resonant Flyback^{TM} conversion requring no fan cooling
* Repairable, modular construction
* All solid state

HC170182 (Double anode type): First anode 15KV at 100μA; second anode, 8-17KV at 500μA; focus 2.2 - 3.5KV with 300V dynamic focus correction; G2 adjustable 300-700V; G1 fixed – 35V; + 24VDC input; 11.3″ × 5.45″ × 7.2″, 17.8 lb.

Beam penetration CRT technology makes possible multi-color vector graphic displays with resolution and clarity unequalled by any other system. Keltron is proud to offer its solution to the problem of a reliable, high-performance "color switching" power supply at moderate cost. Noteworthy is the redundancy of the high voltage switch sections which allows failure of up to 13% of its stages without disruption of the display.

Keltron Corporation, 225 Crescent Street, Waltham, MA 02154
(617) 894-8700 Telex 948197 Ted Chadurjian - Marketing Manager

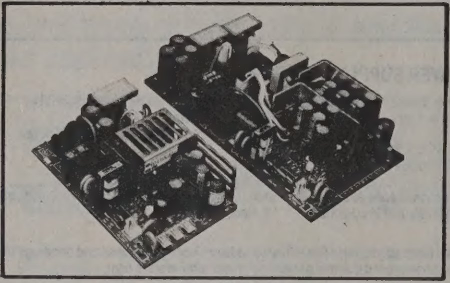
For More Information. Circle No. 333

KEC

PRECISION SWITCHING POWER SUPPLIES SELECTOR GUIDE

It tells you all you'll ever need to know to locate the exact switching power supply for most applications. It's complete with brief specs and prices. If you need to know more, just send for our comprehensive product data sheets.

MULTI-OUTPUT



AC INPUT . . . 115/230 VAC (-20% to +15%)
Efficiency (Typical) . . . 70%

DIM.	KFD 25E	KFD40E	KFD80E
L	5.9	6.3	9
W	3.55	3.9	5
H	1.58	1.9	1.9

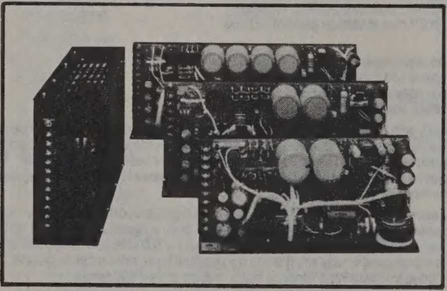
KFD SERIES - MULTI OUTPUT 25, 40, 80 W.

The KFD-25E, 40E and 80E world-class power supplies have been engineered for full time duty at their maximum rated out-puts. They are designed to meet UL, CSA, and VDE safety requirements; and EMI emissions comply with FCC/VDE requirements.

MODEL NUMBER	OUTPUT NO. 1 V(nom)/I(max)	OUTPUT NO. 2 V(nom)/I(max)	OUTPUT NO. 3 V(nom)/I(max)	OUTPUT NO. 4 V(nom)/I(max)	WATT / PRICE*
KFD 25E-01	+5V/3.5A	+12V/1A	▨ −12V/0.5A		25W $55
KFD 25E-02	+5V/3.5A	+15V/1A	▨ −15V/0.5A		
KFD40E-01	+5V/5A	+12V/2.5A	▨ −12V/0.5A		40W $74
KFD40E-02	+5V/5A	+15V/2.5A	▨ −15V/0.5A		
KFD40E-03	+5V/5A	+12V/2.5A	▨ −5V/0.5A		
KFD40E-04	+5V/5A	+12V/2.5A	−48V/0.3A		
KFD80E-01	+5V/7A	+12V/4A	▨ −12V/0.5A	▨ −5V/0.5A	80W $105
KFD80E-02	+5V/7A	+15V/3A	▨ −15V/0.5A	▨ −5V/0.5A	
KFD80E-03	+5V/7A	+12/3A	▨ −12V/0.5A	+24/0.5A	

▨ Shaded area indicates post regulated outputs; no minimum load required.

*1-9 units



AC INPUT...115/230VAC (−20% to +10%)
Efficiency (Typical)...75%

DIM.	KS 100	KS 130	KS 170	KS 200	SCB306
H	2.44	2.44	2.44	2.44	2.50
L	9.06	10.5	10.0	13.0	11.75
W	4.21	4.94	5.63	4.94	7.60

KS SERIES – MULTI OUTPUT (UP TO 6). 100-300 W.

With a range of 100 to 300 watts, these two Series cover the broadest spectrum of applications. They are particularly well suited for use with word processing equipment, computers, as well as a wide range of peripherals. Both overload and overvoltage protection is standard. All models UL recognized.

MODEL NUMBER	Output 1 V(nom)/I(max)	Output 2 V(nom)/I(max)	Output 3 V(nom)/I(max)	Output 4 V(nom)/I(max)	Output 5 V(nom)/I(max)	Output 6 V(nom)/I(max)	WATTS / PRICE**
KS 100-01	+5V/10A	+12V/1.5A	−12V/1.5A	−5V/.5A			100W $188
KS 100-02	+5V/10A	+15V/1.5A	−15V/1.5A	−5V/.5A			
KS 100-03	+5V/10A	+12V/1.5A	−12V/1.5A	▨ +24V/1.5A			
KS 100-04	+5V/10A	+15V/1.5A	−15V/1.5A	▨ +24V/1.5A			
KS 100-03	+5V/10A	+12V/1.5A*	+12V/1.5A*	▨ +24V/1.5A			
KS 100-06	+5V/10A	+12V/1.5A*	−12V/1.5A	▨ +12V/1.5A*			
KS 130-01	+5V/15A	+12V/4A	−12V/3A	−5V/0.5A			130W $205
KS 130-02	+5V/15A	+15V/4A	−15V/3A	−5V/0.5A			
KS 130-03	+5V/15A	+12V/4A	−12V/3A	▨ +24V/2A			
KS 130-04	+5V/15A	+15V/4A	−15V/3A	▨ +24V/2A			
KS 130-05	+5V/15A	+12V/4A*	+12V/3A*	▨ +24V/2A			
KS 130-06	+5V/15A	+12V/4A*	−12V/3A	▨ +12V/2A*			
KS 170-01	+5V/20A	+12V/4A	−12V/4A	▨ +24V/4A			170W $234
KS 170-02	+5V/20A	+15V/4A	−15V/4A	▨ +24V/4A			
KS 170-03	+5V/20A	+12V/4A	−12V/4A	−5V/0.5A			
KS 170-04	+5V/20A	+15V/4A	−15V/4A	−5V/0.5A			
KS 170-05	+5V/20A	+12V/4A*	+12V/4A*	▨ +24V/4A			
KS 170-06	+5V/20A	+12V/4A*	−12V/4A	▨ +12V/4A			
KS 200-01	+5V/25A	+12V/4A	−12V/4A	−5V/0.75A	▨ +24V/4A		200W $257
KS 200-02	+5V/25A	+15V/4A	−15V/4A	−5V/0.75A	▨ +24V/4A		
KS 200-03	+5V/25A	+12V/4A	−12V/4A	−24V/2A	▨ +24V/4A		
SCB306-01	+5V/20A	+12V/4A	−12V/4A	+24V/4A	▨ +15V/4A	▨ −15V/4A	300W $365
SCB306-02	+5V/20A	+12V/4A	−12V/4A	−5V/1A	▨ +24V/4A	▨ −24V/4A	

▨ Shaded outputs have separate returns.

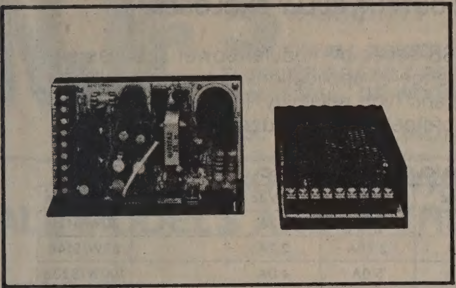
* Can be paralleled for high-current applications

**1-9 units

(Continued on next page)

For More Information. Circle No. 334

(Multi-Output continued)



AC INPUT...115VAC (−20% to +10%)
Efficiency (Typical)...60%

DIM.	KFL 15	KFL 25	KFL 40
L	5.5	6.3	7.1
W	3.9	3.9	3.9
H	1.8	1.9	2.0

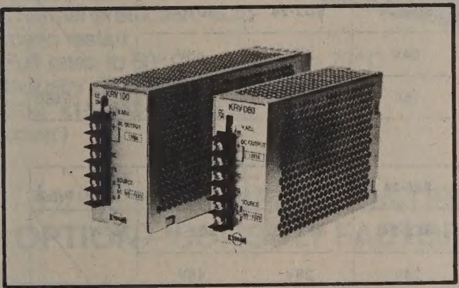
KFL SERIES – 4 OUTPUT. 15, 25, 40 W.

The KFL Series features independently regulated outputs and offers optimum size-to-power ratios. Available in both caged and open versions in 15, 25, and 40-watt models, these units provide ultra-reliable performance in the smallest possible space. Ideal for personal computers. All models UL recognized.

MODEL NUMBER	OUTPUT NO. 1 V(nom)/I(max)	OUTPUT NO. 2 V(nom)/I(max)	OUTPUT NO. 3 V(nom)/I(max)	OUTPUT NO. 4 V(nom)/I(max)	WATT / PRICE*
KFL 15-01U	+5V/2A	−5V/0.5A	+12V/0.5A	−12V/0.5A	15W / $80
KFL 15-02U	+5V/2A	−5V/0.5A	+15V/0.5A	−15V/0.5A	
KFL 25-01U	+5V/3.5A	−5V/0.5A	+12V/1.0A	−12V/0.5A	25W / $95
KFL 25-02U	+5V/3.5A	−5V/0.5A	+15V/1.0A	−15V/0.5A	
KFL 40-01U	+5V/5A	−5V/0.5A	+12V/1.5A	−12V/0.5A	40W / $103
KFL 40-02U	+5V/5A	−5V/0.5A	+15V/1.5A	−15V/0.5A	

*1-9 units

SINGLE OUTPUT



AC INPUT...115 VAC/230 VAC (−25% +15%)
Efficiency (Typical)...75%

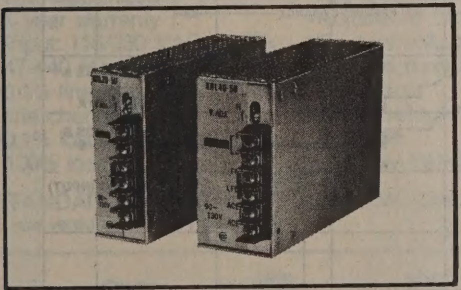
MODEL	H	L	W
KRV 60	3.94	6.65	1.69
KRV 100	3.94	8.74	2.09

KRV SERIES—SINGLE OUTPUT, 60 & 100W.

The KRV Series features **100 kHz** switching speed instead of the usual 20 kHz, resulting in very small efficient packages and providing more wattage per cubic inch. These state-of-the-art power supplies are ideal for any application where space is at a premium.

MODEL NUMBER	Maximum Current Output at 50°C				
	5Vdc	12Vdc	15Vdc	24Vdc	Watt/Price*
KRV 60**	12A	5A	4A	2.5A	60W / $129
KRV 100**	20A	8A	6.5A	4A	100W / $176

**Add voltage to complete model number. Contact factory for non-standard voltages. *1-9 units



AC INPUT...115VAC (−20% to +10%)
Efficiency (Typical)...62%

MODEL	H	L	W
KRL 20	3.9	6.46	1.46
KRL 40	3.9	6.46	1.97

KRL SERIES – SINGLE OUTPUT, 20 & 40 W.

The KRL Series is optimum for those applications requiring totally isolated outputs. A compact size and low price allows maximum flexibility in configuring your own multi-output system—often at a cost less than competitive multi-output units.

MODEL NUMBER	Maximum Current Output at 50°C				
	5Vdc	12Vdc	15Vdc	24Vdc	Watt/Price*
KRL20**	4A	1.7A	1.3A	0.8A	20W / $57
KRL40**	8A	3.3A	2.7A	1.7A	40W / $66

**Add voltage to complete model number. Contact factory for non-standard voltages. *1-9 units

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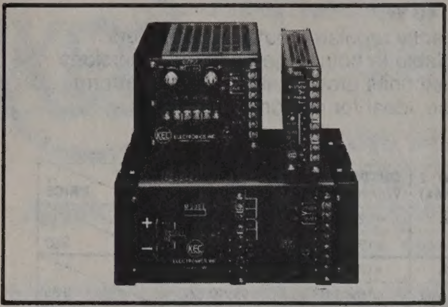
(Single Output continued)



AC INPUT...115/230VAC (−20% to +10%)
Efficiency (Typical)...73%

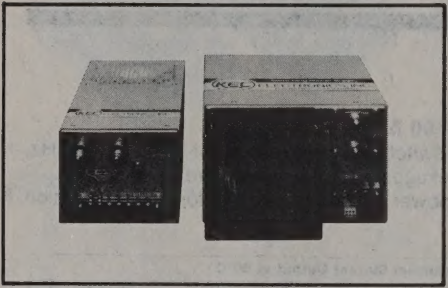
DIM.	SB-30	SB-55	SB-100	SB-150	SB-200	SB-300
W	1.30	1.93	3.44	5.25	5.25	9.45
H	3.94	3.94	3.94	3.94	3.94	3.94
L	7.88	7.88	7.88	7.88	7.88	7.88

SB MODULAR SERIES – SINGLE OUTPUT, FULLY ENCLOSED. 30-300 W.

Compact and cool operating, the SB series of modular power supplies are particularly well suited for a wide range of applications requiring a fully enclosed unit with a single output and high reliability. These rugged units feature overvoltage and overload protection as standard.

MODEL NUMBER	Max. Current Output at 50°C						
	5Vdc	12Vdc	15Vdc	20Vdc	24Vdc	48Vdc	Watt/Price*
SB-30**	6.0A	2.5A	2.0A	1.5A	1.2A		30W/$129
SB-55**	11A	4.5A	3.6A	2.75A	2.2A		55W/$146
SB-100**	20A	8.0A	6.6A	5.0A	4.0A		100W/$203
SB-150**	30A	12A	10A	7.5A	6.0A		150W/$240
SB-200**	40A	16.6A	13.3A	10.0A	8.3A	4.1A	200W/$349
SB-300**	60A	25.0A			12.5A	6.2A	300W/$545

**Add voltage to complete model number. Contact factory for non-standard voltages. *1-9 units



AC INPUT...115 or 230VAC (−15% to +10%)
Efficiency (Typical)...SD Series: 80%, SE Series: 80%

DIM.	SD SERIES	SE SERIES
W	5.00	7.75
H	3.90	4.93
L	12.12	9.70

SD & SE HIGH POWER SERIES – SINGLE OUTPUT, MODULAR 375 & 750 W.

The SD and SE Series combine high power and space saving compactness. The units feature *as standard:* power fail indicator, remote start-up and shut-down, along with remote sensing and overvoltage protection.

SD SERIES

115VAC MODELS	SDI-5	SDI-12	SDI-24	SDI-28	SDI-48	Watt / Price*
230VAC MODELS	SD2-5	SD2-12	SD2-24	SD2-28	SD2-48	375W
NOM. VOLTAGE	5V	12V	24V	28V	48V	
MAX. CURRENT	75A	31A	16A	13A	8A	$580

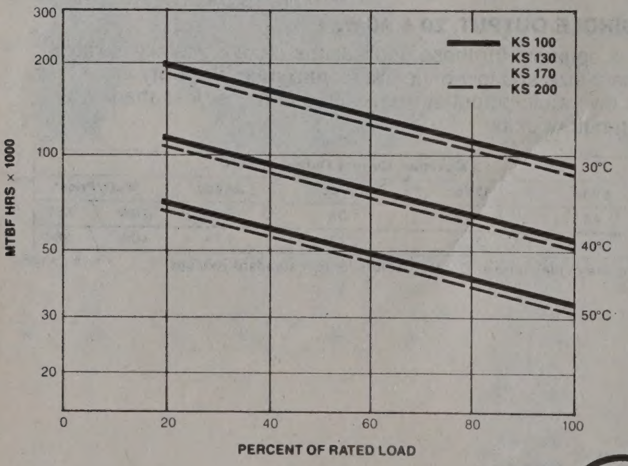
SE SERIES

115VAC MODELS	SEI-5	SEI-12	SEI-24	SEI-28	SEI-48	Watt / Price*
230VAC MODELS	SE2-5	SE2-12	SE2-24	SE2-28	SE2-48	750W
NOM. VOLTAGE	5V	12V	24V	28V	48V	
MAX. CURRENT	150A	64A	31A	27A	16A	$705

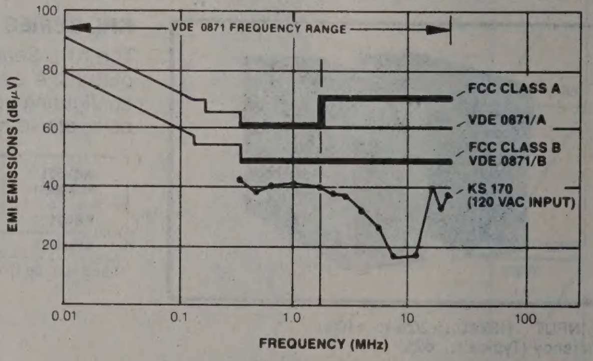
Dimensions are in inches. Model numbers, specifications and prices are subject to change. *1-9 units

KS SERIES, RELIABILITY AND FCC/EMI COMPLIANCE

MEAN TIME BETWEEN FAILURE



EMI SPECIFICATIONS—KS PERFORMANCE WITH OPTION F



OPTION F—Reduces conducted noise to comply with FCC and VDE levels A. Although the figure above indicates that the actual conducted noise is less than FCC level B, an external filter is recommended for compliance with FCC and VDE levels B. The recommended filter is a Stanford Applied Engineering Model CA-3, or equivalent.

KEC

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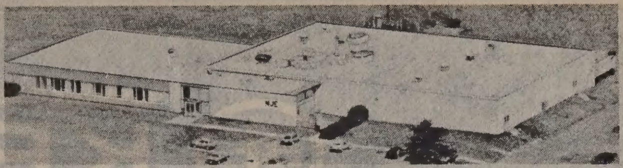
NJE **5** YEAR WARRANTY ON ALL POWER SUPPLIES AGAINST DEFECTS IN MATERIAL OR WORKMANSHIP



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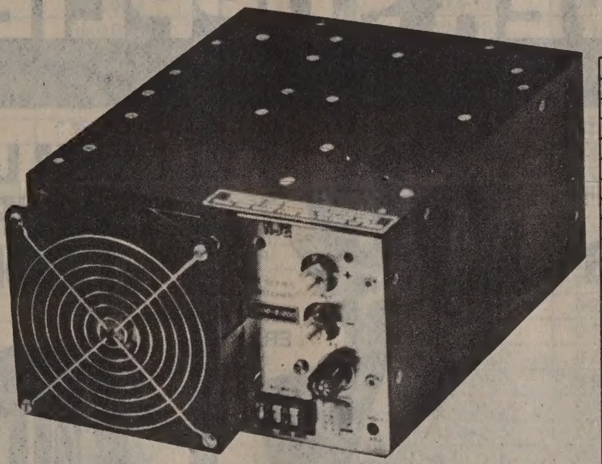
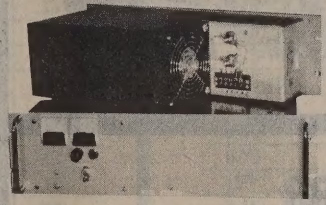
300-1728 WATT SINGLE OUTPUT SWITCHERS
ALL MODELS ARE IN TRUE INDUSTRY STANDARD 5"x8"x11"PACKAGE

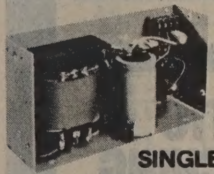
- CSA Certified
- UL recognized
- 5 year warranty
- Expanded AC input range
- Inrush current limiting
- Up to 85% efficiency
- 0.2% line/load regulation
- OVP standard on all models
- Remote inhibit
- Power failure signal
- 20 msec hold-up time
- Reverse voltage and overload protection
- Remote sensing; loss of sense protection
- Thermal protection; automatic restart
- Full rated to 50°C, operation to 70°C
- Industry standard case size, 5"x8"x11" (11¼" with fan cover)



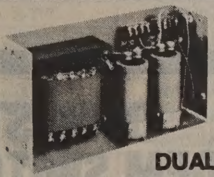
MODEL	VOLTS	AMPS	100 QTY. PRICES
MK750-2-150	2	150	$577.00
MK750-5-150	5	150	577.00
MK750-12-65	12	65	577.00
MK750-15-55	15	55	577.00
MK750-18-46	18	46	577.00
MK750-21-40	21	40	577.00
MK750-24-35	24	35	577.00
MK750-28-30	28	30	577.00
MK750-36-24	36	24	577.00
MK750-48-18	48	18	577.00
MK1000-2-200	2	200	733.00
MK1000-5-200	5	200	733.00
MK1000-12-87	12	87	733.00
MK1000-15-73	15	73	733.00
MK1000-18-61	18	61	733.00
MK1000-21-53	21	53	733.00
MK1000-24-47	24	47	733.00
MK1000-28-40	28	40	733.00
MK1000-36-33	36	33	733.00
MK1000-48-25	48	25	733.00
MK1500-2-300	2	300	920.00
MK1500-5-300	5	300	920.00
MK1500-12-130	12	130	920.00
MK1500-15-110	15	110	920.00
MK1500-18-92	18	92	920.00
MK1500-21-80	21	80	920.00
MK1500-24-70	24	70	920.00
MK1500-28-60	28	60	920.00
MK1500-36-48	36	48	920.00
MK1500-48-36	48	36	920.00



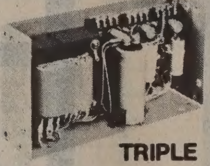
NEW
5¼" X 19" PANEL MOUNTED OPTION—CONSULT FACTORY



SINGLE



DUAL

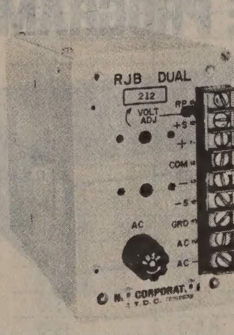


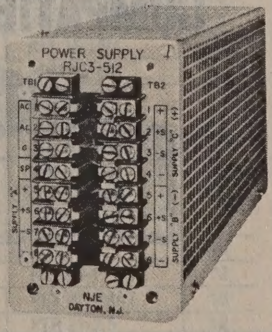
TRIPLE

- CSA Certified
- UL Recognized
- 5 year warranty
- Input: 115/230 VAC ± 10%, 47-440 Hz
- 0.1% line regulation for total line change
- 0.1% load regulation for 100% load change
- Adjustable OVP standard on 5 volt units, optional for others
- Adjustable foldback current limit
- Reverse voltage protection
- Remote sensing; loss of sense protection
- Quad output models also available
- Industry standard case sizes

STANDARD & CUSTOM OPEN FRAME LINEARS

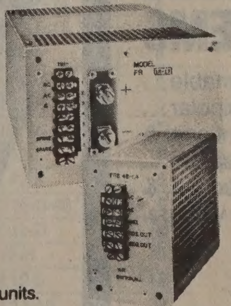
5 year version of industry standards.





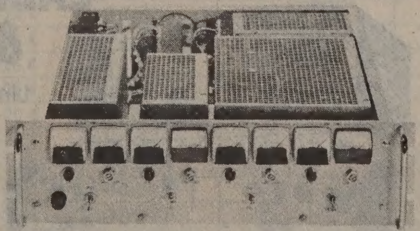
FULLY-ENCLOSED STANDARD & CUSTOM LINEAR

For critical applications requiring excellent regulation (.01% + 1mV), very low ripple and noise (1mV rms). Over 320 single and multiple output models; 2-500V/ .1-175A.



HIGH QUALITY STANDARD & CUSTOM FERRORESONANT

For highest reliability. Efficiency, 65 to 90%; Highest MTBF per Watt. Up to 400V, 2000W units.



RACK MOUNTING ACCESSORIES

for systems using NJE power supplies and custom rack system capability.

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KEPCO®

POWER SUPPLIES

WORLD POWER™ OEM SWITCHING MODULES

Has all approvals needed for world-wide use... single and multi output.

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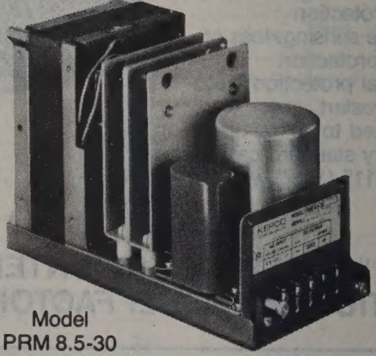
INPUT SELECTOR
85-132V
170-264V

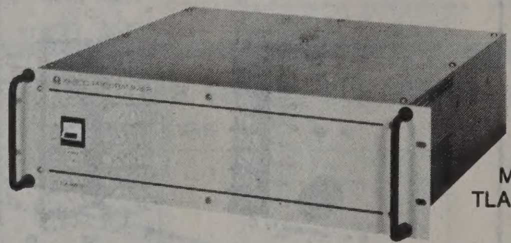
Model
ERX

OEM LINEAR & FERRORESONANT MODULES



Model
PRM 8.5-30

IEEE 488 COMPATIBLE PROGRAMMERS

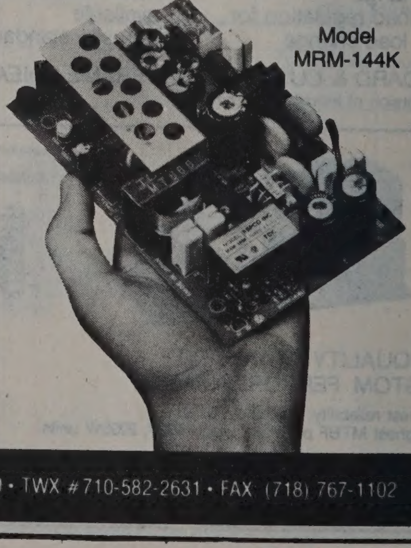


Model
TLA 488-16

DOMESTIC OEM SWITCHING MODULES

Single & multi output...a-c to d-c and d-c to d-c...frameless, open frame, and fully shielded.

Model
MRM-144K



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Linear programmable... unipolar & bipolar... conventional & high speed... low, medium, & high voltage.

Model
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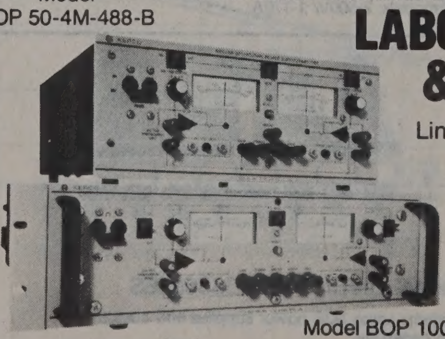

Model BOP 100-4M-488-D

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KEPCO® POWER SUPPLIES

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(1) +50°C current rating (2) Nominal output. Contains taps for two settings higher and two settings lower (3) +40°C current rating

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KEPCO® POWER SUPPLIES

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

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0-75	0-8	JQE 75-8M	15
0-75	0-15	ATE 75-15M	13
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0-100	0-5	ATE 100-5M	13
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(1) +50°C current rating (2) Nominal output. Contains taps for two settings higher and two settings lower (3) +40° current rating

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MULTI OUTPUT POWER SUPPLIES

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+3.5-5.5	0-6	+12	0.4	− 5	0-0.4			RMT 023-SA	9
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+3.5-5.5	0-6	+12	0.4	−9	0-0.4			RMT 025-SA	9
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+4.5-5.5	0-10	+15	0-1	−15	0-1			RDT 002-AA-24	9
+4.5-5.5	0-10	+12	0-1	−12	0-1			RDT 001-AA-48	9
+4.5-5.5	0-10	+15	0-1	−15	0-1			RDT 002-AA-48	9
+4.5-5.5	0-10	+12	0-1	−12	0-1			RMT 001-AA	9
+4.5-5.5	0-10	+15	0-1	−15	0-1			RMT 002-AA	9
+4.5-5.5	0-10	+12	0-1	− 5	0-1			RMT 003-AA	9
+4.5-5.5	0-10	+15	0-1	− 5	0-1			RMT 004-AA	9
+4.5-5.5	0-10	+12	0-1	− 9	0-1			RMT 005-AA	9
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+ 5	1.0-3.0	+12	0.4-2.0	−12	0.0-0.3			EMR 200K	7
+ 5	2.0-6.0	+12	0.2-1.0	−12	0.2-1.0			EMR 300K	7
+ 5	2.0-4.0	+12	0.1-0.5	−12	0.0-0.3	+24	0.2-1.0	EMR 400K	7
+ 5	2.0-5.0	+12	0.4-2.3	−12	0.0-0.3	+24	0.2-1.0	EMR 500K	7
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+ 5	0.45-2.5	+12	0.3-2.0	−12	0.0-0.1			MRM 144KV	6
+ 5	0.45-2.5	+12	0.3-2.0	−12	0.0-0.1			MRM 146K	6
+ 5	0.75-3.0	−12	0.04-0.17	+24	0.0-2.2			MRM 147K/KB	6
+ 5	2.0-5.0	+12	0.5-1.8	+12	0.5-2.0	−12	0.25-0.5	MRM 174K/KF	6
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+ 5	0-6	+15	0-1	−15	0-1	+24	0-0.2	EFX 050T-2	7
+ 5	0-6	+12	0-1	−12	0-1	− 5	0-0.8	EFX 050T-3	7
+ 5	0-6	+15	0-1	−15	0-1	− 5	0-0.8	EFX 050T-4	7
+ 5	0-8	+12	0-2	−12	0-2	+24	0-0.5	EFX 100T-1	7
+ 5	0-8	+15	0-1.6	−15	0-1.6	+24	0-0.5	EFX 100T-2	7
+ 5	0-8	+12	0-2	−12	0-2	− 5	0-1.6	EFX 100T-3	7
+ 5	0-8	+15	0-1.6	−15	0-1.6	− 5	0-1.5	EFX 100T-4	7
+ 5	0-8	+12	0-3.5	−12	0-0.5	+24	0-0.5	EFX 100T-5	7
+ 5	0-8	+12	0-2.8	−12	0-0.5	+12	0-1.8	EFX 100T-6	7
+ 5	0-15	+12	0-2.5	−12	0-2.5	+24	0-1	EFX 150T-1	7
+ 5	0-15	+15	0-2	−15	0-2	+24	0-1	EFX 150T-2	7
+ 5	0-15	+12	0-2.5	−12	0-2.5	− 5	0-2	EFX 150T-3	7
+ 5	0-15	+15	0-2	−15	0-2	− 5	0-2	EFX 150T-4	7
+ 5	0-20	+12	0-4	−12	0-4	+24	0-1	EFX 210T-1	7
+ 5	0-20	+15	0-3	−15	0-3	+24	0-1	EFX 210T-2	7
+ 5	0-20	+12	0-4	−12	0-4	− 5	0-2	EFX 210T-3	7
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+12	0-0.5	− 5	0-0.5					CMP 03-H	9
+12	0-0.5	− 9	0-0.5					CMP 05-H	9
+12	0-12	12	0-12					PRM 2x12-12	12
+15	0-0.4	−15	0-0.4					CMP 02-H	9
+15	0-0.4	− 5	0-0.5					CMP 04-H	9
+15	0-10	15	0-10					PRM 2x15-10	12
+24	0-6	24	0-6					PRM 2x24-6	12
+60	0-2.5	60	0-2.5					PRM 2x60-2.5	12

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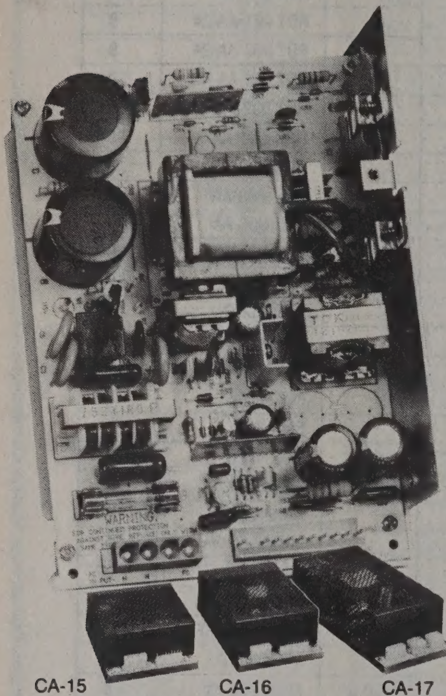
KEPCO/TDK OEM SWITCHING MODULES

High Frequency, High Efficiency Power Supplies with Built-In Overvoltage Protector and Current Limiter

NEW WORLD POWER™ ERX™ SINGLE OUTPUT


CA-15 CA-16 CA-17

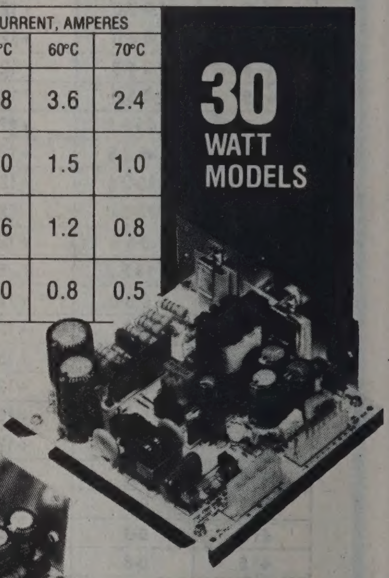
OPTIONAL STEEL ENCLOSURES

This series introduces a whole new generation of cost-effective switchers meeting the highest international safety and EMI standards at remarkably low prices. A built-in filter attenuates conducted EMI below FCC 20780, Class B, and VDE 0871. Optional enclosure reduces radiated EMI below VDE 0875/7.1, level N.

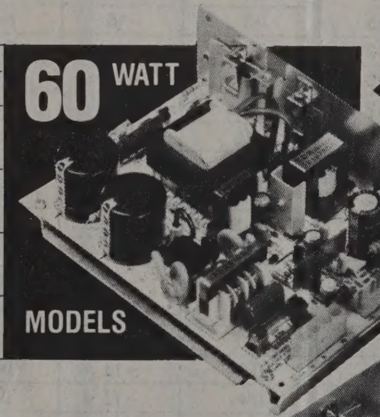
All models are "SELV" per the spacings and hi-pot requirements of VDE 0806 and IEC-380 (certified by TÜV Rheinland), and also meet the requirements of UL478 and CSA C22.2-154. The spacing, even with the larger transformer needed to meet these requirements, has been achieved through the use of two custom hybrid microcircuits. These also reduce the number of parts on the board, resulting in a clean, uncluttered layout, and greatly extended reliability.

The series consist of 12 models: 5V, 12V, 15V, and 24V models in three sizes, 30 Watts, 60 Watts, and 120 Watts. They provide well-stabilized, adjustable d-c outputs, protected by a current limiter and overvoltage protector, with remote error sensing available to compensate for the connecting wire's voltage loss.

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT, AMPERES			
			40°C	50°C	60°C	70°C
ERX 5-6	5	4.5-5.5	6	4.8	3.6	2.4
ERX 12-2.5	12	10.8-13.2	2.5	2.0	1.5	1.0
ERX 15-2	15	13.5-16.5	2.0	1.6	1.2	0.8
ERX 24-1.3	24	21.6-26.4	1.3	1.0	0.8	0.5

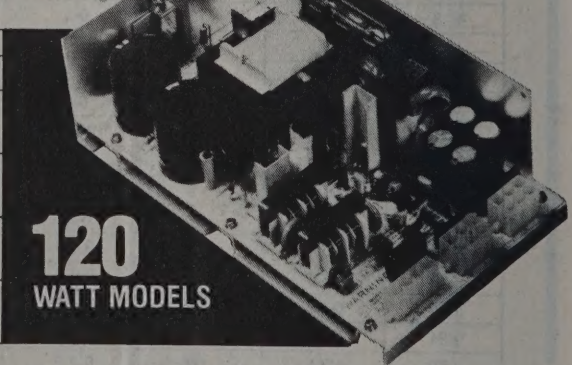


MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT, AMPERES			
			40°C	50°C	60°C	70°C
ERX 5-12	5	4.0-5.5	12	9.6	7.2	4.8
ERX 12-5	12	8.4-13.2	5.0	4.0	3.0	2.0
ERX 15-4	15	10.5-16.5	4.0	3.2	2.4	1.6
ERX 24-2.5	24	16.8-26.4	2.5	2.0	1.5	1.0



This KEPCO product is backed by a firm 1-YEAR WARRANTY

MODEL	OUTPUT VOLTS	ADJUSTMENT RANGE	OUTPUT CURRENT, AMPERES			
			40°C	50°C	60°C	70°C
ERX 5-24	5	4.0-5.5	24.0	19.2	14.4	9.6
ERX 12-10	12	8.4-13.2	10.0	8.0	6.0	4.0
ERX 15-8	15	10.5-16.5	8.0	6.4	4.8	3.2
ERX 24-5	24	16.8-26.4	5.0	4.0	3.0	2.0



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KEPCO. **POWER SUPPLIES**

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

KEPCO/TDK OEM SWITCHING MODULES

High Frequency, High Efficiency Power Supplies with Built-In Overvoltage Protector and Current Limiter

MRM™ TRIPLE AND QUADRUPLE OUTPUT

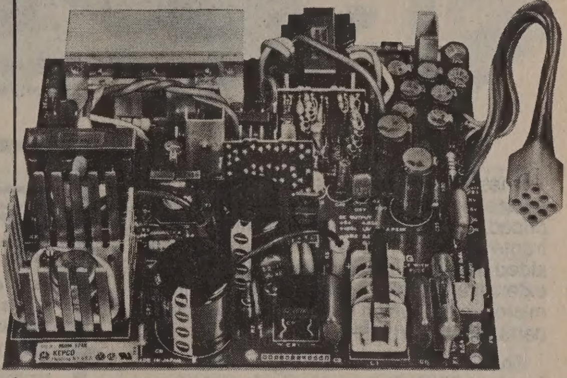
This series of frameless, printed-card style switching power supplies produce multiple outputs to meet, in various combinations, the logic, display, serial output, and disk drive needs of CRT terminals, microcomputers, and video games.

All members of the series have built-in filtering which meets FCC/VDE conducted EMI specs class B (except MRM 147K, Class A). All are UL recognized and CSA certified. The newest member, MRM 250KV, additionally meets the safety requirements of an SELV power supply per VDE 0806 and IEC 380. MRM 144KV also meets these requirements. Both have been so certified by TÜV Rheinland. All models have OVP on their +5V outputs, and all except MRM 146K and MRM 183K have 115/230V selectable inputs.

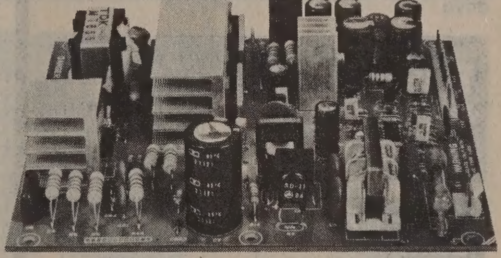
The 60 Watt MRM 250KV, a flyback converter, has four outputs: +5V, +12V, −12V, and −5V. The 40 Watt MRM 144K and −KV and 146K, also flyback converters have three outputs: +5V, +12V, and −12V. MRM 147K (70 Watts), a forward converter, and MRM 183K (43 Watts), a flyback, both produce three outputs. Both have one +5V output; MRM 147K has a −12V, and MRM 183K a −5V, negative reference rail for serial communication outputs. Both have a +24V output: in the MRM 147K it can produce 2.2A; in the MRM 183K it can produce 1.3A. MRM 174K (75 Watts), a forward converter, has four outputs: two separate +12V outputs, one to power a CRT display, the other up to two 5-1/4″ disk drives; a +5V output for TTL logic; and a −12V negative reference rail for serial communications.

A special feature of the MRM 174K is a circuit to minimize transient disturbances on the +12V output being used to power the video display. Such disturbances normally occur when other outputs undergo load change, as when a r/w head starts seeking. Also, the source frequency component of the ripple in the CRT's + 12V output is held below 4mV p-p to minimize interaction with the vertical rate of a CRT display.

MRM 147KB (with barrier strip)



MRM 174KF (with flying lead/connector)



MRM 183K (with pin-header connector)

MRM 144K, 144KV, 146K	40W
Output #1	+ 5V/0.45 to 2.5A (5.0 max)
Output #2	+12V/0.3 to 2.0A (2.5 max)
Output #3	−12V/0.0 to 0.1A (0.5 max)

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MRM 147K	70W
Output #1	+ 5V/0.75 to 3.0A (6.6A peak)
Output #2	−12V/0.04 to 0.17A (0.37A peak)
Output #3	+24V/0.0 to 2.2A (3.3A peak)

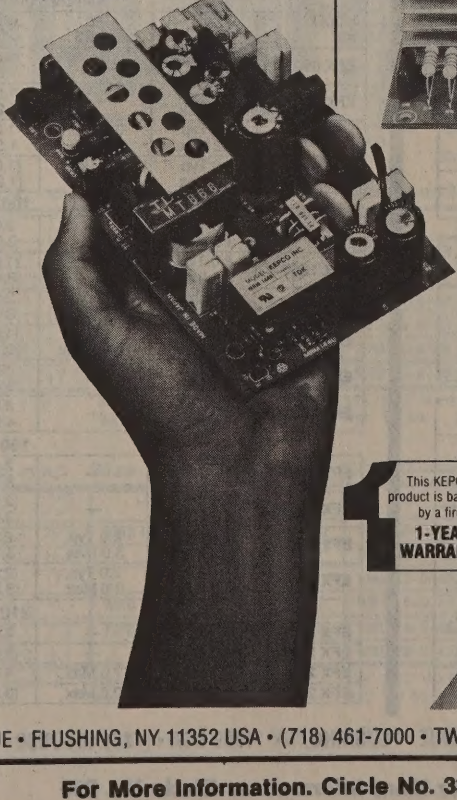
MRM 174K	75W
Output #1	+ 5V/2.0 to 5.0A
Output #2	+12V/0.5 to 1.8A (2.8 peak)
Output #3	+12V/0.5 to 2.0A
Output #4	−12V/0.25 to 0.5A

MRM 183K	43W
Output #1	+ 5V/0.13 to 2.2A
Output #2	− 5V/0.08 to 0.14A
Output #3	+24V/0.0 to 1.3A (1.7A peak)

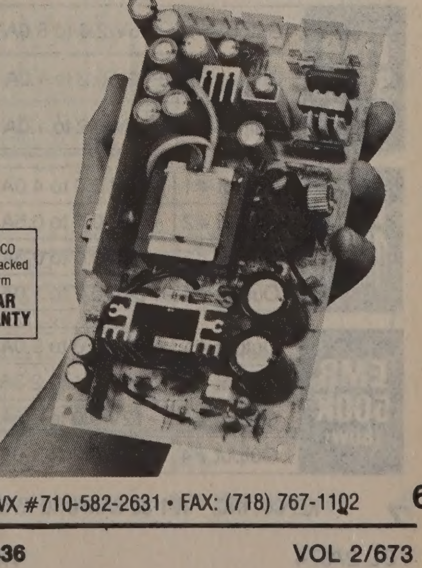
MRM 250KV	60W
Output #1	+5V/2.0 to 6.0A(1)
Output #2	+12V/0.5 to 3.0A(1)
Output #3	−12V/0.0 to 1.0A
Output #4	−5V/0.0 to 0.5A

(1) Max current #1 and #2 is 8.0A

MRM 144K
MRM 144KV



MRM 250KV



1 This KEPCO product is backed by a firm **1-YEAR WARRANTY**

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High Frequency, High Efficiency Power Supplies with Built-In Overvoltage Protector and Current Limiter

EMR™ TRIPLE AND QUADRUPLE OUTPUT

EMR 500K
80 Watts
4 outputs

EMR 400K
53 Watts 4 outputs

EMR 300K
54 Watts
3 outputs

EMR 200K
42 Watts
3 outputs

EMR 100K
22 Watts
3 outputs

UL RECOGNIZED

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These new high-quality multi-output fully enclosed and shielded power supplies are priced well below many competitive open frame designs. This is due to the computer-aided design of these units, and to the extensive use of proprietary TDK hybrid microcircuits, which dramatically reduce the parts population of the boards.

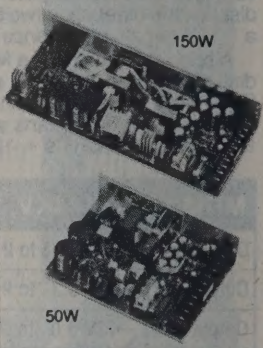
The five EMR models range from a 3-output 22-Watt model for logic circuits, through a 4-output 80-Watt model with sufficient 24V power to run an 8" floppy disk drive.

EMR 100K (22W)	Output #1	+ 5V/1.0 to 3.0A
	Output #2	+12V/0.0 to 0.3A
	Output #3	−12V/0.0 to 0.3A
EMR 200K (42W)	Output #1	+ 5V/1.0 to 3.0A
	Output #2	+12V/0.4 to 2.0A
	Output #3	−12V/0.0 to 0.3A
EMR 300K (54W)	Output #1	+ 5V/2.0 to 6.0A
	Output #2	+12V/0.2 to 1.0A
	Output #3	−12V/0.2 to 1.0A
EMR 400K (53W)	Output #1	+ 5V/2.0 to 4.0A
	Output #2	+12V/0.1 to 0.5A
	Output #3	−12V/0.0 to 0.3A
	Output #4	+24V/0.2 to 1.0A
EMR 500K (80W)	Output #1	+ 5V/2.0 to 5.0A
	Output #2	+12V/0.4 to 2.3A
	Output #3	−12V/0.0 to 0.3A
	Output #4	+24V/0.2 to 1.0A

EFX™ QUADRUPLE OUTPUT

UL RECOGNIZED

CSA CERTIFIED



Four convenient sizes: 50 Watts, 100 Watts, 150 Watts and 210 Watts. Each available in a variety of popular volt-ampere combinations. Custom combinations are also available to your order.

SIZE	DIMENSIONS	NET WGT.	SHIP WGT.
50W	7.25"W x 5.00"D x 2.00"H	1.6 lbs.	3.0 lbs.
100W	9.50"W x 5.00"D x 2.00"H	2.4 lbs.	3.5 lbs.
150W	13.40"W x 5.00"D x 2.52"H	3.5 lbs.	4.5 lbs.
210W	15.00"W x 5.00"D x 2.52"H	4.8 lbs.	6.0 lbs.

	AMPERES OUTPUT CURRENT AT 50°C					
MODEL NO.	+5 VOLTS	−5 VOLTS	+12 (15) VOLTS	+12 VOLTS	−12 (15) VOLTS	+24 VOLTS
50 WATTS						
EFX 050T-1	6.0 Typ. 7.2 Max.	—	1.0 Typ. 1.5 Max.	—	1.0 Typ. 1.5 Max.	0.2 Typ. 0.3 Max.
EFX 050T-2	6.0 Typ. 7.2 Max.	—	(1.0 Typ.) (1.2 Max.)	—	(1.0 Typ.) (1.2 Max.)	0.2 Typ. 0.3 Max.
EFX 050T-3	6.0 Typ. 7.2 Max.	0.8 Typ. 1.2 Max.	1.0 Typ. 1.5 Max.	—	1.0 Typ. 1.5 Max.	—
EFX 050T-4	6.0 Typ. 7.2 Max.	0.8 Typ. 1.2 Max.	(1.0 Typ.) (1.2 Max.)	—	(1.0 Typ.) (1.2 Max.)	—
100 WATTS						
EFX 100T-1	8.0 Typ. 9.6 Max.	—	2.0 Typ. 3.0 Max.	—	2.0 Typ. 3.0 Max.	0.5 Typ. 0.75 Max.
EFX 100T-2	8.0 Typ. 9.6 Max.	—	(1.6 Typ.) (2.4 Max.)	—	(1.6 Typ.) (2.4 Max.)	0.5 Typ. 0.75 Max.
EFX 100T-3	8.0 Typ. 9.6 Max.	1.5 Typ. 2.25 Max.	2.0 Typ. 3.0 Max.	—	2.0 Typ. 3.0 Max.	—
EFX 100T-4	8.0 Typ. 9.6 Max.	1.5 Typ. 2.25 Max.	(1.6 Typ.) (2.4 Max.)	—	(1.6 Typ.) (2.4 Max.)	—
EFX 100T-5	8.0 Typ. 9.6 Max.	—	3.5 Typ. 5.0 Max.	—	0.5 Typ. 0.75 Max.	0.5 Typ. 0.75 Max.
EFX 100T-6	8.0 Typ. 9.6 Max.	—	2.8 Typ. 4.0 Max.	1.8 Typ. 2.7 Max.	0.5 Typ. 0.75 Max.	—
150 WATTS						
EFX 150T-1	15.0 Typ. 18.0 Max.	—	2.5 Typ. 3.75 Max.	—	2.5 Typ. 3.75 Max.	1.0 Typ. 1.5 Max.
EFX 150T-2	15.0 Typ. 18.0 Max.	—	(2.0 Typ.) (3.0 Max.)	—	(2.0 Typ.) (3.0 Max.)	1.0 Typ. 1.5 Max.
EFX 150T-3	15.0 Typ. 18.0 Max.	2.0 Typ. 3.0 Max.	2.5 Typ. 3.75 Max.	—	2.5 Typ. 3.75 Max.	—
EFX 150T-4	15.0 Typ. 18.0 Max.	2.0 Typ. 3.0 Max.	(2.0 Typ.) (3.0 Max.)	—	(2.0 Typ.) (3.0 Max.)	—
210 WATTS						
EFX 210T-1	20.0 Max.	—	4.0 Max.	—	4.0 Max.	1.0 Max.
EFX 210T-2	20.0 Max.	—	(3.0 Max.)	—	(3.0 Max.)	1.0 Max.
EFX 210T-3	20.0 Max.	2.0 Max.	4.0 Max.	—	4.0 Max.	—
EFX 210T-4	20.0 Max.	2.0 Max.	(3.0 Max.)	—	(3.0 Max.)	—

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High Frequency, High Efficiency Power Supplies with Built-In Overvoltage Protector and Current Limiter

SINGLE OUTPUT

RMK™ 30 Watt output 100-130V a-c source power.

RMX™ 50 to 300 Watt output in 5-sizes. 100-130/200-260V a-c source power selectable.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

Size S

MODEL	VOLTS	AMPS at 50°C
RMK 05-S	3.5-5.5	6.0
RMK 09-S	6.3-9.9	3.3
RMK 12-S	8.4-13.2	2.5
RMK 15-S	10.5-16.5	2.0
RMK 24-S	16.8-26.4	1.3

Size: 5.12''H x 1.38''W x 5.75''D
Wgt: 1.4 lbs.

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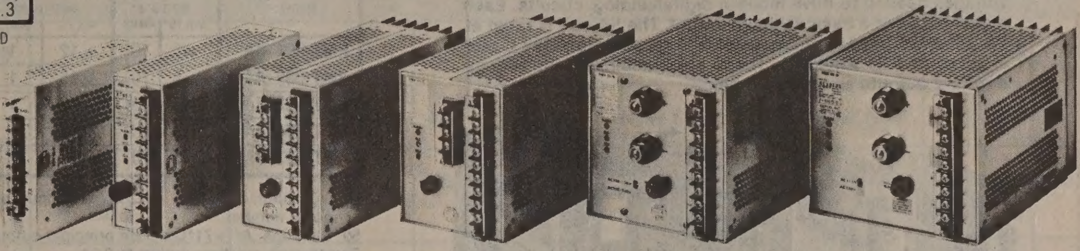

Size A

MODEL	VOLTS	AMPS at 50°C
RMX 05-A	3.5-5.5	10.0
RMX 09-A	6.3-9.9	6.0
RMX 12-A	8.4-13.2	5.0
RMX 15-A	10.5-16.5	4.0
RMX 24-A	16.8-26.4	2.5
RMX 28-A	19.6-30.8	2.15

Size: 5.12''H x 2.17''W x 7.52''D
Wgt: 3.1 lbs.

Size B

MODEL	VOLTS	AMPS at 50°C
RMX 05-B	3.5-5.5	26.0
RMX 09-B	6.3-9.9	15.0
RMX 12-B	8.4-13.2	12.0
RMX 15-B	10.5-16.5	10.2
RMX 24-B	16.8-26.4	7.5
RMX 28-B	19.6-30.8	6.4

Size: 5.12''H x 3.27''W x 8.82''D
Wgt: 4.85 lbs.

Size C

MODEL	VOLTS	AMPS at 50°C
RMX 05-C	3.5-5.5	30.0
RMX 09-C	6.3-9.9	17.2
RMX 12-C	8.4-13.2	14.6
RMX 15-C	10.5-16.5	12.3
RMX 24-C	16.8-26.4	8.0
RMX 28-C	19.6-30.8	6.8

Size: 5.12''H x 4.06''W x 8.82''D
Wgt: 5.25 lbs.

Size N

MODEL	VOLTS	AMPS at 50°C
RMX 05-N	3.5-5.5	45.0
RMX 09-N	6.3-9.9	25.0
RMX 12-N	8.4-13.2	19.0
RMX 15-N	10.5-16.5	15.0
RMX 24-N	16.8-26.4	9.5
RMX 28-N	19.6-30.8	8.0

Size: 5.12''H x 5.24''W x 8.82''D
Wgt: 8.4 lbs.

Size D

MODEL	VOLTS	AMPS at 50°C
RMX 05-D	3.5-5.5	60.0
RMX 09-D	6.3-9.9	32.0
RMX 12-D	8.4-13.2	27.0
RMX 15-D	10.5-16.5	23.0
RMX 24-D	16.8-26.4	16.0
RMX 28-D	19.6-30.8	13.7

Size: 5.12''H x 6.02''W x 8.82''D
Wgt: 9.0 lbs.

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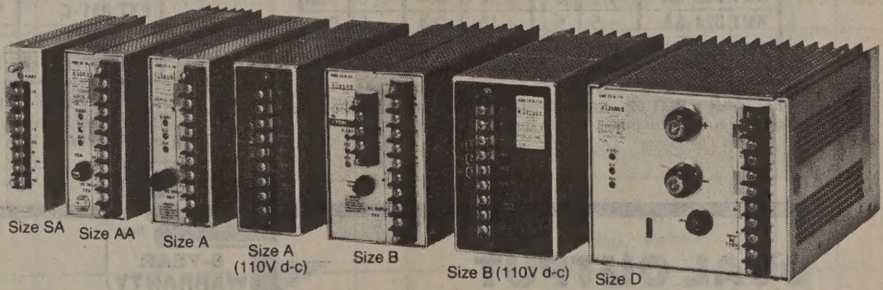
RMD™

d-c to d-c CONVERTERS

The KEPCO/TDK series RMD are d-c input, isolated voltage stabilizers. Standard inputs are 12V, 24V, 48V and 110V d-c. Outputs are 5V, 9V, 12V, 15V, 24V and 28V. For other input and output ratings consult factory.



Size SA—12V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-SA-12	3.5-5.5	6.0
RMD 09-SA-12	6.3-9.9	3.3
RMD 12-SA-12	8.4-13.2	2.5
RMD 15-SA-12	10.5-16.5	2.0
RMD 24-SA-12	16.8-26.4	1.3
RMD 28-SA-12	19.6-30.8	1.1

Size: 5.12''H x 1.38''W x 6.97''D
Wgt: 1.4 lbs.

Size AA—12V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-AA-12	3.5-5.5	10.0
RMD 09-AA-12	6.3-9.9	6.0
RMD 12-AA-12	8.4-13.2	5.0
RMD 15-AA-12	10.5-16.5	4.0
RMD 24-AA-12	16.8-26.4	2.5
RMD 28-AA-12	19.6-30.8	2.15

Size: 5.12''H x 2.17''W x 8.82''D
Wgt: 3.3 lbs.

Size A- 24V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-A-24	3.5-5.5	10.0
RMD 09-A-24	6.3-9.9	6.0
RMD 12-A-24	8.4-13.2	5.0
RMD 15-A-24	10.5-16.5	4.0
RMD 24-A-24	16.8-26.4	2.5
RMD 28-A-24	19.6-30.8	2.1

Size: 5.12''H x 2.17''W x 7.52''D
Wgt: 3.1 lbs.

Size A—48V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-A-48	3.5-5.5	10.0
RMD 09-A-48	6.3-9.9	6.0
RMD 12-A-48	8.4-13.2	5.0
RMD 15-A-48	10.5-16.5	4.0
RMD 24-A-48	16.8-26.4	2.5
RMD 28-A-48	19.6-30.8	2.1

Size: 5.12''H x 2.17''W x 7.52''D
Wgt: 3.1 lbs.

Size A—110V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-A-110	3.5-5.5	10.0
RMD 15-A-110	10.5-16.5	4.0
RMD 24-A-110	16.8-26.4	2.5

Size: 5.12''H x 2.17''W x 7.52''D
Wgt: 3.1 lbs.

Size B—24V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-B-24	3.5-5.5	26.0
RMD 09-B-24	6.3-9.9	15.0
RMD 12-B-24	8.4-13.2	12.0
RMD 15-B-24	10.5-16.5	10.2
RMD 24-B-24	16.8-26.4	7.5
RMD 28-B-24	19.6-30.8	6.4

Size: 5.12''H x 3.27''W x 8.82''D
Wgt: 4.85 lbs.

Size B—48V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-B-48	3.5-5.5	26.0
RMD 09-B-48	6.3-9.9	15.0
RMD 12-B-48	8.4-13.2	12.0
RMD 15-B-48	10.5-16.5	10.2
RMD 24-B-48	16.8-26.4	7.5
RMD 28-B-48	19.6-30.8	6.4

Size: 5.12''H x 3.27''W x 8.82''D
Wgt: 4.85 lbs.

Size B—110V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-B-110	3.5-5.5	26.0
RMD 15-B-110	10.5-16.5	10.2
RMD 24-B-110	16.8-26.4	7.5

Size: 5.12''H x 3.27''W x 8.82''D
Wgt: 4.85 lbs.

Size D—48V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-D-48	3.5-5.5	50.0
RMD 09-D-48	6.3-9.9	28.0
RMD 12-D-48	8.4-13.2	21.0
RMD 15-D-48	10.5-16.5	17.0
RMD 24-D-48	16.8-26.4	10.5
RMD 28-D-48	19.6-30.8	9.0

Size: 5.12''H x 6.02''W x 8.82''D
Wgt: 9.0 lbs.

Size D—110V d-c input

MODEL	VOLTS	AMPS at 50°C
RMD 05-D-110	3.5-5.5	60.0
RMD 15-D-110	10.5-16.5	23.0
RMD 24-D-110	16.8-26.4	16.0

Size: 5.12''H x 6.02''W x 8.82''D
Wgt: 9.0 lbs.

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High Frequency, High Efficiency Power Supplies with Built-In Overvoltage Protector and Current Limiter

RMT™ RDT™ RXT™ TRIPLE OUTPUT

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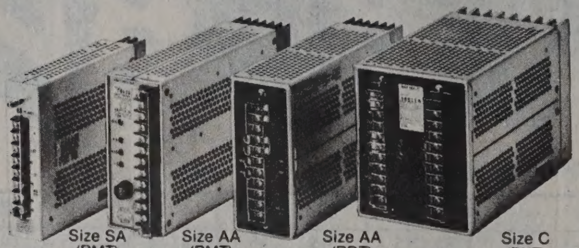
The KEPCO/TDK Series RDT/RMT/RXT provide the instrument designer with a compact, high efficiency source of the multiple voltages needed to drive modern digital-analog circuits. Each model provides a basic 5V logic output. The SA size is rated at 0-6 Amperes; the AA size provides 0-10 Amperes, and the C size is rated at 0-20 Amperes. These are combined with various auxiliary outputs as tabulated below.



SIZE SA

Size: 5.12''H x 2.15''W x 6.97''D **Wgt:** 1.4 lbs.

MODEL	PRINCIPAL OUTPUT#1 VOLTS	PRINCIPAL OUTPUT#1 AMPS	AUXILIARY OUTPUT #2 VOLTS	AUXILIARY OUTPUT #2 AMPS	AUXILIARY OUTPUT #3 VOLTS	AUXILIARY OUTPUT #3 AMPS
RMT 021-SA	+5	6	+12	0.4	−12	0.4
RMT 022-SA	+5	6	+15	0.4	−15	0.4
RMT 023-SA	+5	6	+12	0.4	− 5	0.4
RMT 024-SA	+5	6	+15	0.4	− 5	0.4
RMT 025-SA	+5	6	+12	0.4	− 9	0.4

50°C ratings. At +71°C derate principal output to 2.4A. For Models RMT 021-SA and RMT 022-SA derate each auxiliary output to 0.2A. Input is 115V a-c only.

SIZE AA

Size: 5.12''H x 2.17''W x 8.82''D **Wgt:** 3.3 lbs.

MODEL	PRINCIPAL OUTPUT#1 VOLTS	PRINCIPAL OUTPUT#1 AMPS	AUXILIARY OUTPUT #2 VOLTS	AUXILIARY OUTPUT #2 AMPS	AUXILIARY OUTPUT #3 VOLTS	AUXILIARY OUTPUT #3 AMPS
RMT 001-AA(1)	+5	10	+12	1	−12	1
RMT 002-AA(1)	+5	10	+15	1	−15	1
RMT 003-AA(1)	+5	10	+12	1	− 5	1
RMT 004-AA(1)	+5	10	+15	1	− 5	1
RMT 005-AA(1)	+5	10	+12	1	− 9	1

(1) Std. input: 115V a-c, for 250V a-c input, add suffix "-230" to model number.

50°C ratings. At +71°C derate principal output to 4.0A. Derate each auxiliary output to 0.3A.

RDT 001-AA-24	+5	10	+12	1	−12	1
RDT 002-AA-24	+5	10	+15	1	−15	1
RDT 001-AA-48	+5	10	+12	1	−12	1
RDT 002-AA-48	+5	10	+15	1	−15	1

50°C ratings. At +71°C derate principal output to 4.0A. Derate each auxiliary output to 0.3A. Suffix "-24" input is 20-30V d-c. Suffix "-48" is 42-56V d-c.

SIZE C

Size: 5.12''H x 4.06''W x 8.82''D **Wgt:** 6.4 lbs.

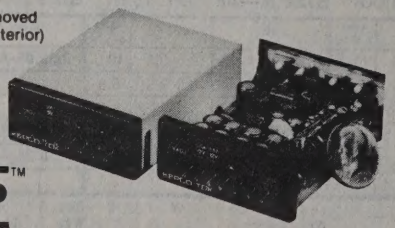
MODEL	PRINCIPAL OUTPUT#1 VOLTS	PRINCIPAL OUTPUT#1 AMPS	AUXILIARY OUTPUT #2 VOLTS	AUXILIARY OUTPUT #2 AMPS	AUXILIARY OUTPUT #3 VOLTS	AUXILIARY OUTPUT #3 AMPS
RXT 051-C	5	20	12	2.0	12	2.0
RXT 052-C	5	20	15	1.6	15	1.6
RXT 053-C	5	20	12	2.0	5	5.0

50°C ratings. At +71°C derate principal output to 8.0A. Derate each auxiliary output currents as follows: 2.0A to 0.8A; 1.6A to 0.6A; 5.0A to 2.0A. Input is selectable 115/230V a-c.

This KEPCO product is backed by a firm 5-YEAR WARRANTY

DUAL OUTPUT

(Cover removed to show interior)



CMP™

SIZE H

MODEL	OUTPUT #1 VOLTS	OUTPUT #1 AMPS(1)	OUTPUT #2 VOLTS	OUTPUT #2 AMPS(1)	CURRENT LIMIT
CMP 01-H	+(10.8-13.2)	0.5A	−(10.8-13.2)	0.5A	0.51A
CMP 02-H	+(13.5-16.5)	0.4A	−(13.5-16.5)	0.4A	0.41A
CMP 03-H	+(10.8-13.2)	0.5A	−(4.5-5.5)	0.5A	0.51A
CMP 04-H	+(13.5-16.5)	0.4A	−(4.5-5.5)	0.5A	0.51A
CMP 05-H	+(10.8-13.2)	0.5A	−(8.1-9.9)	0.5A	0.51A

(1) At +50°C.

Miniature (1.18"H x 2.76"W x 3.75"D) high efficiency sources of stabilized d-c. 10-Watt output, 100-130V a-c source power. Weight: 9 ounces.

SINGLE OUTPUT

MP™

Size H

MODEL	VOLTS	AMPS at 50°C	CURRENT LIMIT
MP 05-H	4.5-5.5V	2.0	2.1A
MP 09-H	8.0-10.0V	1.1	1.2A
MP 12-H	10.5-13.5V	1.0	1.1A
MP 15-H	13.5-16.5V	0.8	0.9A

KEPCO® POWER SUPPLIES

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

GENERAL SPECIFICATIONS AND FEATURES FOR SWITCHING POWER SUPPLIES

MODEL	INPUT Volts a-c	INPUT Volts d-c	EFFICIENCY Typical (%)	HOLDING TIME mSec.	SOFT START	REMOTE CONTROL	REMOTE ERROR SENSING Volts	RECOVERY CHARACTERISTICS mSec.	OVERVOLTAGE PROTECTION	CURRENT LIMIT	ISOLATION Input to Case KV a-c 1 min	ISOLATION Input to Output V d-c	ISOLATION Output to Case MΩ
SINGLE OUTPUT													
ERX	115/230	—	>70	>20	Yes	No	0.35	1	Fixed(1)	Rectangular Fixed	1.25 3.75	500	100
MP	115	—	>73	>7.5	No	No	NA	1	Zener Shunt	Rectangular Fixed	1.5	500	100
RMD	—	12, 24, 48, 110	71-75	—	No	Yes	0.25(2)	1(3)	Adjustable	Rectangular Adj.	1.5	500	100
RMK	115	145	>73	>30	Yes	Yes	0.25	2	Fixed 120%	Rectangular Adj.	1.5	500	100
RMX	115/230	290	68-80	>30	Yes	Yes	0.25(2)	1	Adjustable	Rectangular Adj.	2.5	500	100
MULTI-OUTPUT													
CMP	115	—	>75	>7.5	No	No	NA	1	Zener Shunt	Rectangular Fixed	1.5	500	100
EFX	115/230	—	70-75	>20	Yes	No	NA	5	+5V fixed	Fixed 130%	2.5	500	100
EMR	115/230	—	66-78	>20	Yes	No	NA	2	+5V fixed	Rectangular Fixed(4)	1.5	500	100
MRM	115/230(5)	—	65-70	>16.8(6)	Yes	No	NA	—	+5V fixed	Rectangular Fixed	1.5(7)	500	100
RMT-SA	115	145	>65	>20	Yes	No	NA	5	Fixed 120%(8)	5V: Adj.(9) Aux.: Fixed(10)	1.5	500	20
RMT-AA	115	145	>65	>20	Yes	Yes	0.25(3)	5	Fixed 120%(8)	5V: Adj.(9) Aux.: Fixed(9)	1.5	500	20
RMT-AA 230	230	290	>65	>20	Yes	Yes	0.25(3)	5	Fixed 120%(8)	5V: Adj.(9) Aux.: Fixed(9)	1.5	500	20
RXT	115/230	290	>75	>20	Yes	Yes	0.35	2	Fixed 120%(8)	5V: Adj.(9) Aux.: Fixed(9)	2.5	500	100
RDT	—	24, 48	>74	—	No	Yes	0.25	5	Fixed 120%(8)	5V: Adj.(9) Aux.: Fixed(9)	1.5	500	100

(1) OVP Settings:
5-Volt Models: 5.8V~6.9V; 12-Volt Models: 13.7V~15.7V;
15-Volt Models: 17.0V~19.0V; 24-Volt Models: 27.0V~30.5V.

(2) 0.35V/wire, Size C

(3) For Size A & AA; Size B is 2 mSec

(4) EMR 100K & EMR 200K: foldback

(5) MRM 146K & MRM 183K: 115V a-c only

(6) MRM 146K, 144K, & 144KV: 8.3 mSec

(7) MRM 144KV: 1.25/3.75

(8) For principal output only

(9) Rectangular characteristics

(10) Foldback characteristics

HOLDING TIME: The minimum time, in milliseconds, that the power supply will function, at full load, after loss of source power.

SOFT START: A surge limiting circuit is incorporated to limit the initial turn-on current. A separate logic level on-off circuit is provided in many models for no-surge cycling. (See Remote Control).

REMOTE CONTROL: A TTL compatible logic level signal can be used to turn the power supply on and off. An internal pull-up resistor programs the power supply on in the absence of external signals. This can be used for sequencing and for no-surge cycling.

REMOTE ERROR SENSING: Separate terminals allow a 4-terminal connection between power supply and load. These connections can compensate for voltage drops in the connecting wires.

RECOVERY CHARACTERISTICS: The table lists the time for recovery to within 0.5% (or 0.05V) of the final output value following a step load change of either 50% to 100% or 100% to 50% of maximum (+50 °C) rated load.

OVERVOLTAGE PROTECTION: The tabulated overvoltage protector either shuts down the power supply at the O.V.P. voltage threshold or, in the case of the zener shunt-type, limits the maximum voltage.

CURRENT LIMIT: The rectangular shape of the current limit characteristic means these units may be connected in series or in parallel and may drive capacitive or non-linear loads without special precaution.

KEPCO, INC. • 131-38 SANFORD AVENUE • FLUSHING, NY 11352 USA • (718) 461-7000 • TWX #710-582-2631 • FAX: (718) 767-1102 **10**

For More Information. Circle No. 336

KEPCO. POWER SUPPLIES

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

STATIC SPECIFICATIONS FOR SWITCHING POWER SUPPLIES

MODEL			SOURCE EFFECT % Typical	LOAD EFFECT % (10%–100%)	TEMPERATURE EFFECT % Coefficient per °C	TEMPERATURE EFFECT % Envelope 0–50°C	COMBINED EFFECT % (For rated changes in source voltage, load current, and temperature)	TIME EFFECT (8-hour drift, with constant source voltage, load, and temperature)	RIPPLE AND NOISE			
									OVERALL rms mV	SOURCE COMPONENT p-p mV	SWITCHING COMPONENT p-p mV	SPIKE VOLTAGE to 10 MHz p-p mV
SINGLE OUTPUT												
ERX		Typ	0.6	0.6	—	1.0	2.2	0.1%	—	(1)	(2)	(3)
		Max	1.0	1.0	—	2.0	4.0	0.5%	—	(1)	(2)	(3)
MP		Typ	<0.1	<0.15	—	<1.0	<1.0	<0.02%	<7	<20	<50	—
		Max	0.2	0.3	—	1.5	1.5	0.1%	10	50	100	1% E_o + 50
RMD		Typ	<0.4	<0.4	<0.01	<0.2	<1.0	<0.01%	<3	—	<50	—
		Max	0.8	0.8	0.05	0.6	2.2	0.05%	10	—	100	1% E_o + 50
RMK		Typ	<0.4	<0.4	<0.02	<0.6	<1.4	<0.02%	<7	<20	<30	<70
		Max	0.8	1.0	0.1	1.0	2.8	0.1%	10	50	70	1% E_o + 50
RMX		Typ	<0.3	<0.3	<0.02	<0.4	<1.0	<0.02%	<5	<10	<15	<50
		Max	0.6	0.6	0.1	0.8	2.0	0.1%	10	50	50	1% E_o + 50
MULTI-OUTPUT												
CMP	Outputs #1 and 2	Typ	<0.1	<0.15	—	<1.0	<1.0	<0.02%	<7	<20	<50	—
		Max	0.2	0.3	—	1.5	1.5	0.1%	10	50	100	1% E_0 +50
EFX	Output #1	Typ	<0.5	<0.5	—	<0.5	<1.0	<0.02%	—	<25	<50	—
		Max	1.0	1.0	—	1.0	3.0	0.1%	—	50	100	1% E_0 + 50
	Outputs #2, 3, 4	Typ	<0.5	<5.0	—	<0.5	<6.0	<0.02%	—	<25	<50	—
		Max	1.0	10.0	—	1.0	12.0	0.1%	—	50	100	1% E_0 + 50
EMR	+ 5V	Typ	—	—	—	—	—	—	—	—	<50	—
		Max	1.0-1.5	1.5-6	—	<3.0	< ±3.0	<0.5%	—	—	<100	2% E_0 + 50
	AUX	Typ	—	—	—	—	< ±5.0	—	—	—	<50	—
		Max	1.0-1.5	1.5-6	—	<3.0	< ±7.0	<0.5%	—	—	<200	2% E_0 + 50
MRM	+ 5V	Typ	—	—	—	—	—	—	—	—	—	—
		Max	<1.0	<2.0	—	<2.0	<2 ~ 5	<10 mV	—	<30	<50 ~ 100	<150
	AUX	Typ	—	—	—	—	—	—	—	—	—	—
		Max	<1.0	<2 ~ 5	—	<2.0	<5 ~ 20	<10~40 mV	—	<4 ~ 150	<50 ~ 100	<500
RDT		Typ	<0.4	<0.4	<0.02	<0.6	<1.4	<0.01%	<7	—	<30	—
		Max	0.8	1.0	0.1	1.0	2.8	0.05%	10	—	100	1% E_0 +50
RMT	Principal AA & SA & AA-Aux	Typ	<0.4	<0.4	<0.02	<0.6	<1.4	<0.01%	<7	<20	<30	—
		Max	0.8	1.0	0.1	1.0	2.8	0.05%	10	50	100	1% E_0 + 50
	Auxiliary SA-Size	Typ	<0.1	<0.1	<0.01	<0.4	<0.6	<0.01%	<4	<2	<2	—
		Max	0.2	0.2	0.05	0.6	1.0	0.05%	7	10	10	1% E_0 + 50
RXT		Typ	<0.4	<0.4	<0.02	<0.4	<1.2	<0.02%	<5	<20	<30	—
		Max	0.8	1.0	0.1	0.8	2.6	0.1%	10	50	100	1% E_0 +50

(1) — 5-Volt models: 5 typ, 10 max.
12- and 15-Volt models: 20 typ, 40 max.
24-Volt models: 30 typ, 50 max.

(2) — 5-Volt models: 40 typ, 70 max.
12- and 15-Volt models: 40 typ, 80 max.
24-Volt models: 40 typ, 100 max.

(3) — 5-Volt models: 150
12- and 15-Volt models: 300
24-Volt models: 400

For More Information. Circle No. 336

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

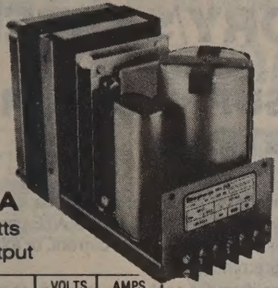
KEPCO® POWER SUPPLIES

OEM MODULES

FERRORESONANT VOLTAGE STABILIZERS

UL RECOGNIZED

This KEPCO product is backed by a firm 5-YEAR WARRANTY



Enclosures available for Sizes A, AA and C

Size A

180 Watts Fixed Output

MODEL	VOLTS	AMPS
PRM 12-15	12.0	0-15
PRM 24-8	24.0	0-8
PRM 28-7	28.0	0-7
PRM 120-1.5	120.0	0-1.5

Size AA

280 Watts Fixed Output

MODEL	VOLTS	AMPS
PRM 8.5-30	8.5	0-30
PRM 12-23	12	0-23
PRM 15-18	15	0-18
PRM 24-12	24	0-12
PRM 28-10	28	0-10
PRM 48-6	48	0-6
PRM 120-2.4	120	0-2.4

Size B

120 Watts Fixed Output

MODEL	VOLTS	AMPS
PRM 12-10	12.0	0-10
PRM 24-5	24.0	0-5
PRM 120-1	120.0	0-1

Size C

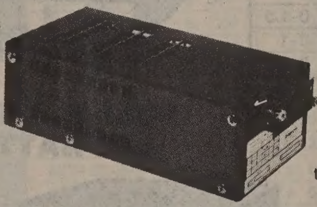
300 Watts Dual Output

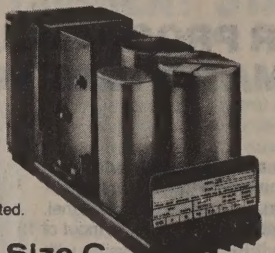
MODEL	VOLTS	AMPS
PRM 2x12-12	12.0	0-12
PRM 2x15-10	15.0	0-10
PRM 2x24-6	24.0	0-6
PRM 2x60-2.5	70.0	0-2.5

Two independent outputs identically rated.

INFLUENCE QUANTITY	OUTPUT EFFECT
SOURCE VOLTAGE: 100-130V a-c	± 1% E_0 max. (1) ± 1.5% E_0 max. (2)
LOAD CHANGE: 100% to 50% 100% to 25%	 < + 10% E_0 max (3) < + 20% E_0 max. (3)
TIME: 8-hour (drift)	< 1% E_0 max.
TEMPERATURE: Per °C	< 0.05% E_0 max.
RIPPLE and NOISE: rms	3 mV to 300 mV(3)

(1) At full load. (2) At no load. (3) Depends on model.





Size C

450 Watts Fixed Output

MODEL	VOLTS	AMPS
PRM 12-35	12.0	0-35
PRM 24-20	24.0	0-20
PRM 28-17	21.0	0-17
PRM 48-10	48.0	0-10

Size D

60 Watts Selectable Output

MODEL	VOLTS	AMPS
PRM 5-10	5.0	0-10.0
PRM 8-7	8.0	0-7.0
PRM 12-5	12.0	0-5.0
PRM 15-4	15.0	0-4.0
PRM 21-2.9	21.0	0-2.9
PRM 26-2.3	26.0	0-2.3
PRM 36-1.7	36.0	0-1.7
PRM 120-0.50	120.0	0-0.50
PRM 240-0.25	240.0	0-0.25

The nominal output is listed. Taps for two settings higher and two settings lower.

Fixed output, heavy duty stabilizers for exceptional longevity under rugged conditions. PRM's offer high efficiency (50-75%) and excellent source isolation. For custom volt-ampere combinations, consult factory.

NOTE: The models listed are for operation on 115V a-c 60 Hz mains only (tolerance ± 3 Hz). For 50 Hz service areas separate models are available. These units have reduced ratings (approximately 20% less than the corresponding 60 Hz models).

DIMENSIONS:

Size A Models: (1) 6¹³⁄₁₆H x 4¾W x 10²⁷⁄₃₂D.
Weight : 24 lbs.
Size AA Models: (1) 6¹³⁄₁₆H x 4¾W x 10²⁹⁄₃₂D.
Weight: 24 lbs.
Size B Models: 3¹³⁄₃₂H x 5W x 13⅞D.
Weight: 17 lbs.
Size C Models: (1) 6¹³⁄₁₆H x 4¾W x 15⅛D.
Weight: 30 lbs (2)
Size D Models: 3¹³⁄₃₂H x 5W x 10⅞D.
Weight: 11 lbs.

(1) Dimension, Models A and C are uncased modules
(2) Dual Output: 38 lbs. 450 Series: 40 lbs.

PRM™

LINEAR PROGRAMMABLE VOLTAGE / CURRENT STABILIZERS

KEPCO
MOD PAT 100-0.2
SER

PAT™

20 WATT PROGRAMMABLE VOLTAGE STABILIZER

These operationally programmable power modules offer a single high-gain control channel for voltage or current stabilization, backed up by an adjustable overcurrent limiter. Programmable from IEEE-488 bus using a Kepco digital interface.

MODEL	VOLTS	AMPS
PAT 7-2	0-7	0-2
PAT 15-1.5	0-15	0-1.5
PAT 21-1	0-21	0-1
PAT 40-0.5	0-40	0-0.5
PAT 72-0.3	0-72	0-0.3
PAT 100-0.2	0-100	0-0.2

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE
SOURCE: 105-125/210-250V a-c		<0.0005%
LOAD: No load — full load		<0.005%
TIME: 8-hours (drift)		<0.01%
TEMPERATURE: Per °C		<0.01%
RIPPLE and NOISE:	rms	<0.1 mV
	p-p	<0.5 mV

DIMENSIONS: 3²²⁄₃₂"H x 6⅜"W x 4⅞"D. **WEIGHT:** 6 lbs.

50 WATT PROGRAMMABLE VOLTAGE/CURRENT STABILIZER

PTR™

Programmable voltage/current stabilizer with automatic crossover and optional overvoltage protection, conventional speed design. Programmable from IEEE-488 bus using a Kepco digital interface.

MODEL	VOLTS	AMPS
PTR 7-5.5	0-7	0-5.5
PTR 15-3.3	0-15	0-3.3
PTR 21-2.5	0-21	0-2.5
PTR 40-1.4	0-40	0-1.4
PTR 72-0.8	0-72	0-0.8
PTR 100-0.6	0-100	0-0.6

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	OUTPUT EFFECTS CURRENT MODE INTERNAL	EXTERNAL(1)
SOURCE: 105-125/210-250V a-c		<0.001%	<0.005%	<0.005%
LOAD: No load — full load		<0.005%	<3.0 mA	<0.01%
TIME: 8-hours (drift)		<0.01%	<0.05%	<0.02%
TEMPERATURE: Per °C		<0.01%	<0.05%	<0.02%
RIPPLE and NOISE:	rms	<0.1 mV	<0.5 mA	<0.5 mA
	p-p	<2.0 mV	<2.0 mA	<2.0 mA

(1) External current sensing and feedback to the voltage amplifier.

DIMENSIONS: 3¹⁷⁄₆₄"H x 5"W x 13²⁷⁄₃₂"D (incl. barrier-strip). **WEIGHT:** 11 lbs.

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

KEPCO® POWER SUPPLIES

POWER MANAGERS™ for LABORATORY/SYSTEMS

ATE™ LINEAR PROGRAMMABLE POWER SUPPLIES FOR AUTOMATIC TEST EQUIPMENT SYSTEMS.

FEATURING:

- Full external control over both voltage and current with automatic crossover; separate voltmeter and ammeter for continuous output monitoring. Local control through 10-turn rheostats on front panel, remote through fixed gain power amplifier scaling from an input of 10 Volts to rated voltage. Digital input via IEEE 488 bus possible with Kepco digital interface programmer.
- User selectable slow or fast mode of operation; slow mode is ideal for delivering constant voltage; in fast mode, the ATE can follow rapidly changing load voltages to deliver constant current, or follow high speed voltage or current programming.
- Two built-in, uncommitted amplifiers for scaling, summing, or other manipulation of programming signals. Both voltage and current control channels have full zeroing and calibration facilities for compatibility with Kepco's digital interfaces.
- Programmable/tracking overvoltage protection.

This KEPCO product is backed by a firm 5-YEAR WARRANTY

QUARTER-RACK

50 WATT

MODEL	VOLTS	AMPS
ATE 6-5M	0-6	0-5
ATE 15-3M	0-15	0-3
ATE 25-2M	0-25	0-2
ATE 36-1.5M	0-36	0-1.5
ATE 55-1M	0-55	0-1
ATE 75-0.7M	0-75	0-0.7
ATE 100-0.5M	0-100	0-0.5
ATE 150-0.3M	0-150	0-0.3

100 WATT

MODEL	VOLTS	AMPS
ATE 6-10M	0-6	0-10
ATE 15-6M	0-15	0-6
ATE 25-4M	0-25	0-4
ATE 36-3M	0-36	0-3
ATE 55-2M	0-55	0-2
ATE 75-1.5M	0-75	0-1.5
ATE 100-1M	0-100	0-1
ATE 150-0.7M	0-150	0-0.7

HALF-RACK 250 WATT

MODEL	VOLTS	AMPS
ATE 6-25M	0-6	0-25
ATE 15-15M	0-15	0-15
ATE 25-10M	0-25	0-10
ATE 36-8M	0-36	0-8
ATE 55-5M	0-55	0-5
ATE 75-3M	0-75	0-3
ATE 100-2.5M	0-100	0-2.5
ATE 150-1.5M	0-150	0-1.5
ATE 325-0.8M	0-325	0-0.8

THREE-QUARTER RACK 500 WATT

MODEL	VOLTS	AMPS
ATE 6-50M	0-6	0-50
ATE 15-25M	0-15	0-25
ATE 25-20M	0-25	0-20
ATE 36-15M	0-36	0-15
ATE 55-10M	0-55	0-10
ATE 75-8M	0-75	0-8
ATE 100-5M	0-100	0-5
ATE 150-3.5M	0-150	0-3.5

FULL-RACK 1000 WATT

MODEL	VOLTS	AMPS
ATE 6-100M	0-6	0-100
ATE 15-50M	0-15	0-50
ATE 25-40M	0-25	0-40
ATE 36-30M	0-36	0-30
ATE 55-20M	0-55	0-20
ATE 75-15M	0-75	0-15
ATE 100-10M	0-100	0-10
ATE 150-7M	0-150	0-7

STATIC STABILIZATION TABLE

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE Typ.	Max	OUTPUT EFFECTS CURRENT MODE Typ.	Max.	OFFSETS[3] ΔE_{io}	ΔI_{io}
SOURCE VOLTAGE (min.-max.):[1]		$<0.0005\%$ E_0 max.	0.001% E_0 max.	$<0.002\%$ I_0 max.	0.005% I_0 max.	<1 µV	<1 nA
LOAD (no load-full load):		<0.001% E_0 max.	0.002% E_0 max.	<0.5 mA [2]	1 mA [2]	<1 µV	<1 nA
TIME (8-hour drift):		<0.005% E_0 max.	0.01% E_0 max.	<0.01% I_0 max.	0.02% I_0 max.	<20 µV	<1 nA
TEMPERATURE, per °C:		<0.005% E_0 max.	0.01% E_0 max.	<0.01% I_0 max.	0.02% I_0 max.	<20 µV	<2 nA
RIPPLE and NOISE	rms:	<0.1 mV	0.3 mV	<0.01% I_0 max.	0.03% I_0 max.	—	—
(Slow Mode)	p-p:	<1 mV	3 mV	<0.1% I_0 max.	0.3% I_0 max.	—	—
RIPPLE and NOISE	rms:	<1 mV	3 mV	<0.01% I_0 max.	0.03% I_0 max.	—	—
(Fast Mode)	p-p:	<10 mV	30 mV	<0.1% I_0 max.	0.3% I_0 max.	—	—

(1) 105-125/210-250V a-c.

(2) In slow mode, the leakage current through the output capacitor adds approximately 0-6 mA to the current mode load effects.

(3) Uncommitted amplifier offsets.

DYNAMIC SPECIFICATIONS

OUTPUT VOLTAGE RATING	6V	15V	25V	36V	55V	75V	100V	150V
BANDWIDTH (−3db)[1]	53 KHz	21 KHz	13 KHz	9 KHz	6 KHz	4 KHz	3 KHz	2 KHz
PROGRAMMING TIME CONSTANT (µsec)[1]	3.0	7.5	12.5	18.0	27.5	37.5	50.0	75.0
REMOTE ERROR SENSING	0 to 0.5V/lead, both terminals							
OVP CONTROL	Local: trimmer-adjustable; remote: 0-10V signal (or may be set to track output voltage.							
VOLTAGE RECOVERY	For step load change between 10% and 100% I_o maximum <50 µsec typ., <100 µsec max. to recover within 10 mV							

(1) In fast mode, operating into a resistive load.

DIMENSIONS:

50 Watt (Quarter-Rack):
5 7/32"H x 4 5/32"W x 17 1/8"D(1) Weight: 17 lbs.
100 Watt (Quarter-Rack):
5 7/32"H x 4 5/32"W x 17 1/8"D(1) Weight: 20 lbs.
250 Watt (Half-Rack):
5 7/32"H x 8 11/32"W x 17 9/64"D(1) Weight: 43 lbs.
500 Watt (Three Quarter-Rack):
5 7/32"H x 12 17/32"W x 17 9/64"D(1) Weight: 56 lbs.
1000 Watt (Full-Rack):(2)
6 31/32"H x 16 1/2"W x 20 9/64"D(1) Weight: 103 lbs.

(1) Add 2 1/2" for connector protrusion.

(2) The full rack model is supplied with brackets for direct mounting in a standard 19-inch rack.

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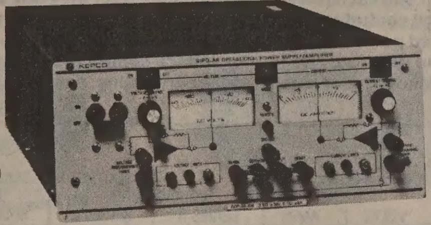
KEPCO® POWER SUPPLIES

POWER MANAGERS™ for LABORATORY/SYSTEMS

4-QUADRANT VOLTAGE/CURRENT STABILIZERS

This KEPCO product is backed by a firm
5-YEAR WARRANTY



BOP™

These low-voltage bipolar power supplies offer full, programmable control over both voltage and current with a mode selector. The power supply is bounded in all four quadrants by four fully adjustable, programmable boundary limits. The wide-band BOP offers two operational pre-amplifiers for scaling, summing and signal processing. Programmable from an IEEE-488 bus using optional interface board. (See page 21).

	MODEL	d-c OUTPUT RANGE E_0 max.	d-c OUTPUT RANGE I_0 max.	CLOSED LOOP GAIN VOLTAGE CHANNEL G_V (V/V)	CLOSED LOOP GAIN CURRENT CHANNEL G_I (A/V)	OUTPUT IMPEDANCE VOLTAGE MODE SERIES R	OUTPUT IMPEDANCE VOLTAGE MODE SERIES L	OUTPUT IMPEDANCE CURRENT MODE SHUNT R	OUTPUT IMPEDANCE CURRENT MODE SHUNT C
100 WATT	BOP 50-2M	± 50V	± 2A	5.0	0.2	0.5 mΩ	100µH	50 kΩ	0.05µF
	BOP 100-1M	±100V	± 1A	10.0	0.1	2.0 mΩ	200µH	100 kΩ	0.05µF

Size: 5 7/32"H x 12 17/32"W x 17 9/64"D **Weight:** 48 lbs.

200 WATT	BOP 20-10M	± 20V	±10A	2.0	1.0	40 µΩ	50µH	20 kΩ	0.1µF
	BOP 36-6M	± 36V	± 6A	3.6	0.6	120 µΩ	50µH	36 kΩ	0.1µF
	BOP 50-4M	± 50V	± 4A	5.0	0.4	0.25 mΩ	100µH	50 kΩ	0.05µF
	BOP 72-3M	± 72V	± 3A	7.2	0.3	0.48 mΩ	200µH	72 kΩ	0.05µF
	BOP 100-2M	±100V	± 2A	10.0	0.2	1.0 mΩ	200µH	100 kΩ	0.05µF

Size: 5 7/32"H x 12 17/32"W x 17 9/64"D **Weight:** 51 lbs.

400 WATT	BOP 20-20M	± 20V	±20A	2.0	2.0	20 µΩ	50µH	20 kΩ	0.2µF
	BOP 36-12M	± 36V	±12A	3.6	1.2	60 µΩ	50µH	36 kΩ	0.2µF
	BOP 50-8M	± 50V	± 8A	5.0	0.8	125 µΩ	100µH	50 kΩ	0.15µF
	BOP 72-6M	± 72V	± 6A	7.2	0.6	240 µΩ	200µH	72 kΩ	0.1µF
	BOP 100-4M	±100V	± 4A	10.0	0.4	500 µΩ	200µH	100 kΩ	0.1µF

Size: 5 7/32"H x 16 15/32"W x 20 5/64"D **Weight:** 90 lbs.

DYNAMIC SPECIFICATIONS

Parameter	Mode	BOP 20-10M	BOP 20-20M	BOP 36-6M	BOP 36-12M	BOP 50-2M	BOP 50-4M	BOP 50-8M	BOP 72-3M	BOP 72-6M	BOP 100-1M	BOP 100-2M	BOP 100-4M
Bandwidth (d-c to f-3 db)	V	3.0 kHz	2.0 kHz	1.8 kHz	2.8 kHz	4.5 kHz	2.8 kHz	3.3 kHz	2.0 kHz	2.0 kHz	4.0 kHz	3.0 kHz	2.0 kHz
	I	3.0 kHz	2.0 kHz	1.8 kHz	1.8 kHz	3.0 kHz	2.8 kHz	1.5 kHz	2.0 kHz	2.0 kHz	3.0 kHz	3.0 kHz	2.0 kHz
Programming Time Constant	V	50 µsec	80 µsec	85 µsec	55 µsec	35 µsec	55 µsec	50 µsec	80 µsec	80 µsec	40 µsec	50 µsec	80 µsec
	I	50 µsec	80 µsec	85 µsec	85 µsec	50 µsec	55 µsec	100 µsec	80 µsec	80 µsec	50 µsec	50 µsec	80 µsec
Large Signal Freq. Response	V	3.3 kHz	2.1 kHz	1.9 kHz	3.0 kHz	5.5 kHz	3.0 kHz	3.3 kHz	2.1 kHz	2.1 kHz	4.7 kHz	3.3 kHz	2.1 kHz
	I	3.1 kHz	2.1 kHz	1.9 kHz	1.9 kHz	3.1 kHz	3.0 kHz	1.5 kHz	2.1 kHz	2.1 kHz	3.5 kHz	3.3 kHz	2.1 kHz
Slewing Rate	V	0.4V/µsec	0.26V/µsec	0.4V/µsec	0.65V/µsec	1.7V/µsec	0.9V/µsec	1V/µsec	0.9V/µsec	0.9V/µsec	3V/µsec	2V/µsec	1.3V/µsec
	I	200 mA/µsec	260 mA/µsec	70 mA/µsec	140 mA/µsec	40 mA/µsec	75 mA/µsec	75 mA/µsec	40 mA/µsec	80 mA/µsec	22 mA/µsec	40 mA/µsec	50 mA/µsec
Recovery Step Load	V	150 µsec	150 µsec	250 µsec	150 µsec	140 µsec	180 µsec	100 µsec	300 µsec	150 µsec	150 µsec	200 µsec	200 µsec
	I	30 µsec	50 µsec	30 µsec	30 µsec	30 µsec	30 µsec	50 µsec	30 µsec	50 µsec	40 µsec	30 µsec	50 µsec

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS(2) VOLTAGE MODE TYP	OUTPUT EFFECTS(2) VOLTAGE MODE MAX	OUTPUT EFFECTS(2) CURRENT MODE TYP	OUTPUT EFFECTS(2) CURRENT MODE MAX	PREAMPLIFIER OFFSETS ΔE_{io}	PREAMPLIFIER OFFSETS ΔI_{io}	REFERENCE ±10V
SOURCE (min-max)(1)		<0.0005%	0.001%	<0.002%	0.005%	<5µV	<1nA	<0.0005%
LOAD (NL-FL):		<0.001%	0.002%	<0.5mA	1mA	—	—	<0.0005%
TIME (8-hour drift):		<0.005%	0.01%	<0.01%	0.02%	<20µV	<1nA	<0.005%
TEMP., per °C:		<0.005%	0.01%	<0.01%	0.02%	<20µV	<1nA	<0.005%
RIPPLE and NOISE:(3)	rms	<1mV	3mV	<0.01%	0.03%	—	—	—
	p-p(4)	<10mV	30mV	<0.1%	0.3%	—	—	—

(1) 105-125/210-250V a-c.
(2) Output effects, expressed as a percentage, are referred to the maximum rated output voltage or current.
(3) Measured with the common terminal grounded so that the common mode current does not flow through the load.
(4) Peak-to-peak ripple is measured over a 20 Hz to 10 MHz bandwidth.

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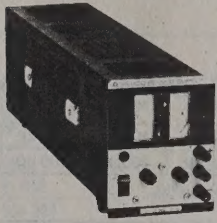
KEPCO® POWER SUPPLIES

POWER MANAGERS™ for LABORATORY/SYSTEMS

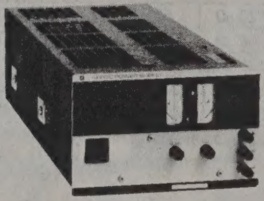
JQE™ GENERAL PURPOSE VOLTAGE STABILIZERS

Systems-type, voltage stabilizers with current limiting, programmable from the IEEE bus using Kepco digital interfaces. JQE's voltage control channel has an I-C front end for maximum stability and minimum offset. The rated power is delivered under the realistic thermal environs of a system's cabinet with no derating. The 10-turn voltage control is standard. For units requiring overvoltage protection and/or high speed programming, see the ATE group.

QUARTER-RACK 100 WATT

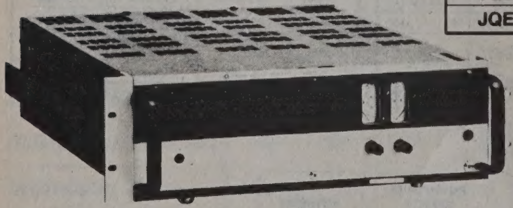


HALF-RACK 250/500 WATT



This KEPCO product is backed by a firm
5-YEAR WARRANTY

FULL-RACK 1000 WATT



MODEL	d-c OUTPUT RANGE		OUTPUT IMPEDANCE				MAX. INPUT AMPS at 125 V a-c
			VOLTAGE MODE		CURRENT MODE(2)		
	VOLTS	AMPS	SERIES R	SERIES L	SHUNT R	SHUNT C	
JQE 6-10M	0-6	0-10	30 μΩ	1 μH	50 kΩ	3 kμF	2.0
JQE 15-6M	0-15	0-6	125 μΩ	1 μH	84 kΩ	1 kμF	2.1
JQE 25-4M	0-25	0-4	300 μΩ	1 μH	125 kΩ	700 μF	2.2
JQE 36-3M	0-36	0-3	600 μΩ	1 μH	165 kΩ	400 μF	2.2
JQE 55-2M	0-55	0-2	1.4 mΩ	1 μH	250 kΩ	220 μF	2.3
JQE 75-1.5M	0-75	0-1.5	2.5 mΩ	1 μH	330 kΩ	160 μF	2.3
JQE 100-1M	0-100	0-1	5 mΩ	2 μH	500 kΩ	110 μF	2.1
JQE 6-22M	0-6	0-22	14 μΩ	0.5 μH	23 kΩ	5.8 kμF	4.2
JQE 6-45M	0-6	0-45	7 μΩ	0.5 μH	11 kΩ	8 kμF	9.0
JQE 15-12M	0-15	0-12	63 μΩ	0.5 μH	42 kΩ	2.7 kμF	4.0
JQE 15-25M	0-15	0-25	30 μΩ	0.5 μH	20 kΩ	4.5 kμF	8.4
JQE 25-10M	0-25	0-10	125 μΩ	0.5 μH	50 kΩ	2.4 kμF	5.3
JQE 25-20M	0-25	0-20	63 μΩ	0.5 μH	25 kΩ	4.3 kμF	10.5
JQE 36-8M	0-36	0-8	225 μΩ	0.5 μH	62.5 kΩ	1.4 kμF	6.0
JQE 36-15M	0-36	0-15	120 μΩ	0.5 μH	33 kΩ	3.6 kμF	9.5
JQE 55-5M	0-55	0-5	550 μΩ	1 μH	100 kΩ	850 μF	5.0
JQE 55-10M	0-55	0-10	275 μΩ	1 μH	50 kΩ	2.1 kμF	9.0
JQE 75-3M	0-75	0-3	1.25 mΩ	1 μH	165 kΩ	850 μF	4.0
JQE 75-8M	0-75	0-8	469 μΩ	1 μH	62.5 kΩ	1.2 kμF	10.0
JQE 100-2.5M	0-100	0-2.5	2 mΩ	1 μH	200 kΩ	600 μF	4.5
JQE 100-5M	0-100	0-5	1.25 mΩ	1 μH	100 kΩ	600 μF	8.4
JQE 150-1.5M	0-150	0-1.5	5 mΩ	2 μH	330 kΩ	440 μF	4.6
JQE 150-3.5M	0-150	0-3.5	2.2 mΩ	2 μH	140 kΩ	440 μF	8.7
JQE 6-90M	0-6	0-90	3.5 μΩ	0.5 μH	3.5 kΩ	17.6 kμF	15.7
JQE 15-50M	0-15	0-50	15 μΩ	0.5 μH	10 kΩ	12 kμF	16.6
JQE 25-40M	0-25	0-40	31 μΩ	0.5 μH	12.5 kΩ	14 kμF	21.0
JQE 36-30M	0-36	0-30	60 μΩ	0.5 μH	16 kΩ	11 kμF	19.0
JQE 55-20M	0-55	0-20	138 μΩ	1 μH	25 kΩ	7.3 kμF	18.0
JQE 75-15M	0-75	0-15	250μΩ	1 μH	33 kΩ	4.2 kμF	18.0
JQE 100-10M	0-100	0-10	0.62 mΩ	1 μH	50 kΩ	2.2 kμF	17.0
JQE 150-7M	0-150	0-7	1.1 mΩ	2 μH	72 kΩ	1 kμF	18.0

DIMENSIONS:

Quarter-Rack Models: $5\frac{7}{32}$"H x $4\frac{5}{32}$"W x $17\frac{3}{16}$D(1); Weight: 19 lbs.
Half-Rack Models: $5\frac{7}{32}$"H x $8\frac{11}{32}$"W x $7\frac{3}{8}$"D(1)
Weight: 250W–42 lbs 500W–56 lbs.
Full-Rack Models: $5\frac{7}{32}$"H x $16\frac{1}{2}$"W(2) x $17\frac{1}{64}$"D(1); Weight: 103 lbs.

(1) behind panel (2) with "ears" standard 19" panel width

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	OUTPUT EFFECTS CURRENT MODE(1)	AMPLIFIER OFFSETS VOLTAGE ΔE_{io}	AMPLIFIER OFFSETS CURRENT ΔI_{io}	REFERENCE 6.2V ± 5%
SOURCE: 105-125/210-250V a-c		<0.0005%	<0.005%	<10 μV	<2 nA	0.0001%
LOAD: No load-full load		<0.005% or 0.2 mV(2)	<0.01%	<200 μV	<5 nA	—
TIME: 8-hours (drift)		<0.01% or 1 mV(2)	<0.02%	<20 μV	<2 nA	0.005%
TEMPERATURE: Per °C		<0.01%(4)	<0.02%(3)	<20 μV	<5 nA	0.005%
RIPPLE and NOISE:(4)	rms	<0.2 mV	<0.02% of I_o max.	—	—	—
	p-p(5)	<1.0 mV	<0.1% of I_o max.	—		—

(1) External current sensing, using the *voltage* amplifier. Effects are measured for a 1-volt current sensing voltage drop.

(2) Whichever is greater.

(3) Typical temperature effect coefficients are: 0.005% per °C voltage mode; 0.01% per °C externally sensed current mode.

(4) One terminal grounded or connected so that the common-mode current does not flow through the load or (in current-mode) through a sensing resistor.

(5) 20 Hz to 10 MHz.

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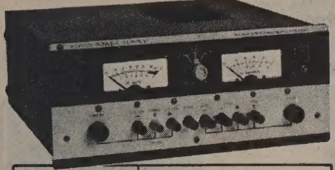
KEPCO. POWER SUPPLIES

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

POWER MANAGERS™ for LABORATORY/SYSTEMS

MPS 620M™

Multiple output voltage stabilizer with adjustable current limits. Model MPS 620M is the ideal bench power supply for the logic experimenter.



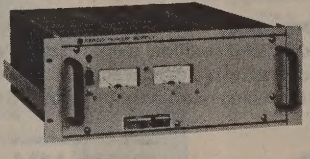
Output #1	0-6V, 0-5A
Output #2	0 to +20V, 0-1A
Output #3	0 to −20V, 0-1A

Outputs 2 and 3 are tracked. Output 1 is protected by an overvoltage crowbar.

DIMENSIONS:
$5\tfrac{7}{32}$" H x $12\tfrac{17}{32}$" W x $12\tfrac{7}{8}$" D.
WEIGHT: 29 lbs.

PRR™

Ferroresonant stabilized 1000W designs producing fixed voltages.

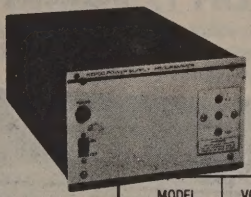


MODEL	VOLTS	AMPS
PRR 12-77M	12.0	0-77
PRR 24-42M	24.0	0-42
PRR 28-36M	28.0	0-36
PRR 48-22M	48.0	0-22

DIMENSIONS:
$6\tfrac{31}{32}$" H x 19" W x $13\tfrac{7}{16}$" D behind panel.
WEIGHT: 63 lbs.

NTC™

Low power shunt stabilized power supplies that can be used on their own as a fast-programmable voltage source, or serve as an interface for higher-powered operational power supplies. The NTC as an interface permits programming with the negative terminal common.



MODEL	VOLTS	AMPS
NTC-200	0-200	0-0.01
NTC 2000	0-2000	0-0.001

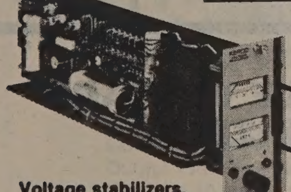
DIMENSIONS:
NTC–200: $5\tfrac{7}{32}$" H x $4\tfrac{5}{32}$" W x $17\tfrac{3}{16}$" D.
NTC–2000: $5\tfrac{7}{32}$" H x $8\tfrac{11}{32}$" W x $12\tfrac{7}{8}$" D.
WEIGHT: NTC–200: 11 lbs., NTC–2000: 21 lbs.

INFLUENCE QUANTITY		MPS OUTPUT EFFECTS 0 to 6V Output	MPS OUTPUT EFFECTS 0 to ±20V Output	PRR OUTPUT EFFECTS Typ.	PRR OUTPUT EFFECTS Max.	NTC(2) VOLTAGE AMPLIFIER OFFSETS ΔE_{io}	NTC(2) VOLTAGE AMPLIFIER OFFSETS ΔI_{io}	NTC(2) REFERENCE ±6.2V
SOURCE: 105-125/210-250V a-c		0.01%	0.01%	±0.5%	±1.0%	<100 μV	<10 nA	0.0005%
LOAD: No load—full load		0.01%	0.05%	(1)		<1 mV	<10 nA	—
TIME: 8-hour drift		0.01%	0.01%	<1%		<20 μV	<5 nA	0.005%
TEMPERATURE: Per °C		0.01%	0.01%	<0.05%		<20 μV	<5 nA	0.005%
RIPPLE and NOISE:	rms	0.1 mV	0.1 mV	—	50 mV	<0.01%	—	—
	p-p	1 mV	1 mV	—	—	<0.05%	—	—

(1) 100%-50% load change—voltage increase 3 ~ 6%; 100%-25% load change—voltage increase 5 ~ 10%

(2) The output effect can be calculated by the relationship: $\Delta E_o = \pm \Delta E_r (R_f/R_i) \pm \Delta E_{io} (1 + R_f/R_i) \pm \Delta I_{io} (R_f)$, where R_f is the built-in feedback resistance, and R_i is the external coupling resistance from the signal source or reference, E_r.

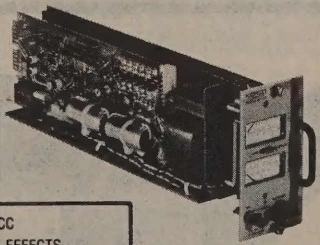
PCX-MAT™ PLUG-IN POWER SUPPLIES CC™



Voltage stabilizers, current limited. Programmable from IEEE-488 bus using Kepco digital interface.

MODEL	VOLTS	AMPS
PCX 7-2MAT	0-7	0-2
PCX 15-1.5MAT	0-15	0-1.5
PCX 21-1MAT	0-21	0-1
PCX 40-0.5MAT	0-40	0-0.5
PCX 72-0.3MAT	0-72	0-0.3
PCX 100-0.2MAT	0-100	0-0.2

MODEL	AMPS	VOLTS
CC 7-2M	0-2	0-7
CC 15-1.5M	0-1.5	0-15
CC 21-1M	0-1	0-21
CC 40-0.5M	0-0.5	0-40
CC 72-0.3M	0-0.3	0-72
CC 100-0.2M	0-0.2	0-100



Current stabilizer. Programmable from IEEE-488 bus using Kepco digital interface.

INFLUENCE QUANTITY		PCX-MAT OUTPUT EFFECTS VOLTAGE MODE	PCX-MAT OUTPUT EFFECTS CURRENT MODE	CC OUTPUT EFFECTS CURRENT MODE
SOURCE: 105-125/210-250V a-c		<0.0005%	<0.005%	<0.0005%
LOAD: No load—full load		<0.005%	<0.01%	<0.005%
TIME: 8-hour (drift)		<0.01%	<0.02%	<0.02%
TEMPERATURE: Per °C		<0.01%	<0.02%	<0.01%
RIPPLE and NOISE:	rms	<0.1 mV	<0.02% of I_o max.	<0.02% of selected scale
	p-p	<3 mV	<0.2% of I_o max.	<0.1% of selected scale

This KEPCO product is backed by a firm
5-YEAR WARRANTY

DIMENSIONS: $5\tfrac{7}{32}$" H x $2\tfrac{25}{32}$" W x $14\tfrac{15}{16}$" D. (behind panel). **WEIGHT:** 8 lbs.

Note: Use optional cases CA-3, CA-4 or CA-5 for bench use, or plug-in style rack adapters RA-22-6A or RA-32. Consult factory for details of the mounting options.

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KEPCO. **POWER SUPPLIES**

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

POWER MANAGERS™ for LABORATORY/SYSTEMS

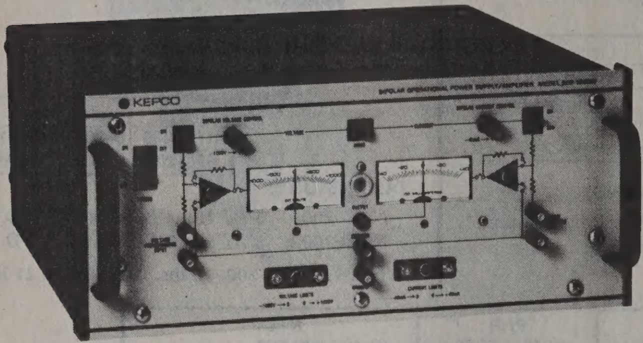
HIGH VOLTAGE MODELS

FOUR-QUADRANT VOLTAGE/CURRENT STABILIZERS

Programmable from IEEE-488 using one of the Kepco stand-alone digital interfaces.

BOP-HV, Bipolar High-voltage Operational Power Supplies, combine the capabilities of fast-programmable power supplies with a bi-directional output stage that can respond in either direction from zero and permits operation either as a sink or as a source. The BOP-HV are programmable from an IEEE-488 bus using one of the stand-alone Kepco digital interfaces.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**



BOP-HV™

MODEL	VOLTS	AMPS
BOP 500M	+500 to −500	+0.08 to −0.08
BOP 1000M	+1000 to −1000	+0.04 to −0.04

DIMENSIONS: $6\frac{31}{32}$"H x $16\frac{1}{2}$"W(1) x 17"D
(1) 19" with flanges.

WEIGHT: 65 lbs.

DYNAMIC SPECIFICATIONS

PARAMETER	MODE SWITCH	BOP 500M	BOP 1000M
BANDWIDTH (d-c to f_{-3dB})	Voltage	2 kHz	1 kHz
	Current	1.3 kHz	0.64 kHz
PROGRAMMING TIME CONSTANT	Voltage	75 μsec	150 μsec
	Current	125 μsec	250 μsec
LARGE SIGNAL FREQUENCY RESPONSE	Voltage	2 kHz	0.5 kHz
	Current	2 kHz	0.5 kHz
SLEWING RATE	Voltage	6V/μsec	3V/μsec
	Current	1 mA/μsec	0.13 mA/μsec
TRANSIENT RECOVERY (Step Load Change)	Voltage	100 μsec	100 μsec
	Current	125 μsec	250 μsec

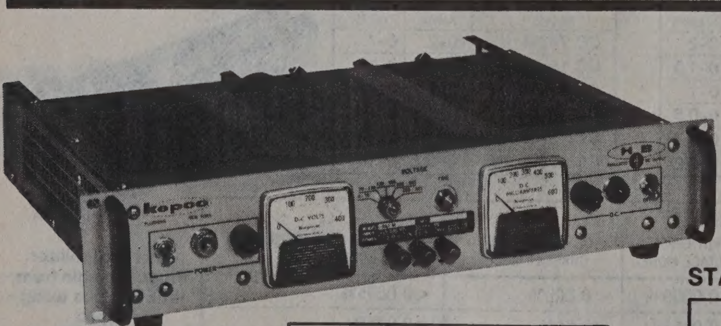
STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS(2) VOLTAGE MODE	CURRENT MODE
SOURCE VOLTAGE (min.-max.):(1)		<0.0005%	<0.0005%
LOAD (No load—full load):		<0.0005%	<0.005%
TIME (8-hour drift):		<0.01%	<0.01%
TEMPERATURE, Per °C:		<0.01%	<0.01%
RIPPLE and NOISE:	rms	<10 mV	<25μA(3)
	p-p	<500 mV	<200μA(3)

(1) 105-125/210-250V a-c.

(2) Specifications are expressed as a *percent-of-setting* for the output range 10% to 100%. Below 10% output, the specification limit is the rated percentage of the 10% output setting.

(3) For frequency components in the bandwidth of the current stabilizer. Beyond cutoff, noise will appear as a voltage component equal to the rated voltage mode noise.



ADJUSTABLE VOLTAGE STABILIZERS

HB™

DIMENSIONS:
$3\frac{19}{32}$"H x 19"W x $14\frac{7}{8}$"D

MODEL	VOLTS(2)	AMPS	SHIP. WGT.
HB 4AM	0-325	0-0.4	35 lbs.
HB 8AM	0-325	0-0.8	41 lbs.
HB 525M	0-525	0-0.5	41 lbs.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

(1) External current sensing, using the *voltage* amplifier. Effects are measured for a 1-volt current sensing voltage drop.

(2) 5 equal voltage steps.

STATIC SPECIFICATIONS

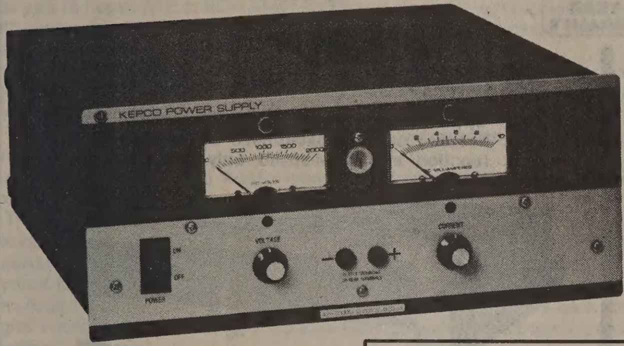
INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	OUTPUT EFFECTS CURRENT MODE (1) (External Sensing)
SOURCE: 105-125/210-250V a-c		<0.01%	<0.01% at rated sample
LOAD: No load—full load		<0.01%	<0.01% at rated sample
TIME: 8 hours (drift)		<0.01%	<0.05%
TEMPERATURE: Per °C		<0.01%	<0.05% at rated sample
RIPPLE and NOISE:	rms	<1 mV	<0.01% of I_o max
	p-p	<5 mV	<0.5% of I

KEPCO® POWER SUPPLIES

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

POWER MANAGERS™ for LABORATORY/SYSTEMS HIGH VOLTAGE MODELS

PROGRAMMABLE (UP TO 1000 VOLTS) FROM IEEE-488 USING ONE OF THE KEPCO STAND-ALONE DIGITAL INTERFACES.



APH™ AUTOMATIC CROSSOVER CONVENTIONALLY FILTERED

High voltage laboratory power supplies offering continuously adjustable/programmable voltage and current in an automatic crossover configuration.

MODEL	VOLTS	AMPS
APH 500M	0–500	0–0.04
APH 1000M	0–1000	0–0.02
APH 2000M	0–2000	0–0.01

DIMENSIONS: $5\frac{7}{32}$"H x $12\frac{17}{32}$"W x $12\frac{7}{8}$"D
WEIGHT: 27 lbs.

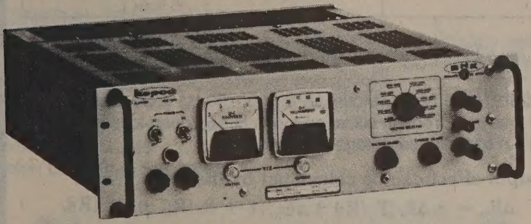
STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE (1)	CURRENT MODE (Internal Sensing)
SOURCE: 105–125V a-c		<0.001%	<0.005%
LOAD (No load—full load):		<0.005%	<0.01% of I_0 max.
TIME: 8-hour (drift)		<0.01%	<0.01% of I_0 max.
TEMPERATURE: Per °C		<0.01%	<0.01% of I_0 max.
RIPPLE and NOISE	rms	<2 mV	<40 μA
	p-p	<10 mV	<200 μA

(1) Specifications are expressed as a *percent-of-setting* for the output range 10% to 100%. Below 10% output, the specification limit is the rated percentage of the 10% output setting.

This KEPCO product is backed by a firm **5-YEAR WARRANTY**

BHK™ 200 WATT AUTOMATIC CROSSOVER CONVENTIONAL AND HIGH SPEED



Programmable (up to 1000V) from an IEEE-488 bus using one of the stand-alone Kepco digital interfaces. Programmable voltage and current stabilizer for high voltage arranged in an automatic crossover configuration. Provision is made for disconnecting the output capacitor for high speed programming.

MODEL	VOLTS	AMPS
BHK 500-0.4M	0-500	0-0.4
BHK 1000-0.2M	0-1000	0-0.2
BHK 2000-0.1M	0-2000	0-0.1

CONTROL/PROGRAMMING:
Output voltage is controlled from the panel by a combination of a 10-position decade switch and a 10-turn vernier control. This arrangement provides 0.005% resolution yet does not inhibit the ability to sweep program a BHK linearly through its entire range. External control can be exercised by a resistance (1000 ohms per volt) or by a control voltage, delivering 0 to +1 milliampere into the summing junction with respect to the plus (+) output/sense terminal. External signals can be substituted for, or summed with, the internal reference for additional control. BHK can be strapped for either conventional speed operation or for fast programming. In fast mode the output can be controlled at 0.5V per microsecond.

DIMENSIONS: $5\frac{7}{32}$"H x 19"W x $15\frac{9}{16}$"D (behind panel)

WEIGHT: 46 lbs.

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		OUTPUT EFFECTS VOLTAGE MODE	CURRENT MODE (Internal Sensing)
SOURCE: 105–125/210–250V a-c		<0.005%	<100 μA
LOAD: No load—full load		<0.01%	<100 μA
TIME: 8 hours (drift)		<0.01%	<0.01%
TEMPERATURE: Per °C		<0.01%	<0.05% of I_0 max
RIPPLE and NOISE: (Slow Speed)	rms	<1 mV	<100 μA
	p-p	<10 mV	<1 mA
RIPPLE and NOISE: (High Speed)	rms	<50 mV	<500 μA
	p-p	<500 mV	<5 mA

KEPCO® POWER SUPPLIES

RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

POWER MANAGERS™ for LABORATORY/SYSTEMS HIGH VOLTAGE MODELS

This KEPCO product is backed by a firm 5-YEAR WARRANTY

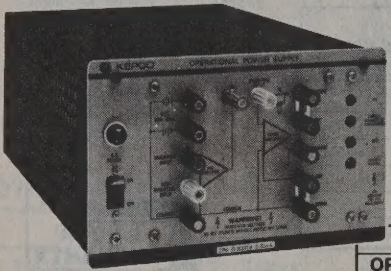
OPS™

group IX B

HIGH SPEED OPERATIONAL POWER SUPPLIES

PROGRAMMABLE (UP TO 1000 VOLTS) FROM IEEE-488 USING ONE OF THE KEPCO STAND-ALONE DIGITAL INTERFACES.

20 watt, high voltage stabilizer, equipped with an operational patch panel and featuring a capacitorless output for fast programming applications. Restricted to non-capacitive loads.



DIMENSIONS:
$5^{7}/_{32}$"H x $8^{11}/_{32}$"W
x $12^{7}/_{8}$"D

WEIGHT: 19 lbs.

MODEL	VOLTS	AMPS
OPS 500B	**0-500**	**0.04**
OPS 1000B	**0-1000**	**0.02**
OPS 2000B	**0-2000**	**0.01**

STATIC SPECIFICATIONS

INFLUENCE QUANTITY (min.-max.)(1)		UNCOMMITTED CONTROL CHANNEL OFFSET VOLTAGE ΔE_{io}	UNCOMMITTED CONTROL CHANNEL OFFSET CURRENT ΔI_{io}
SOURCE: 105-125V a-c		<10 μV	<1 nA
LOAD (No load—full load):		<10 μV (3)	<1 nA
TIME: 8-hour (drift)		<20 μV	<1 nA
TEMPERATURE: Per °C		<20 μV	<0.5 nA
RIPPLE and NOISE	rms	<0.01% of E_0	
	p-p	<0.1% of E_0	

(1) 105-125/210-250V a-c.

The output effect can be calculated by the relationship:

$$\Delta E_o = \pm \Delta E_r (R_f/R_i) \pm \Delta E_{io} (1 + R_f/R_i) \pm \Delta I_{io} (R_f),$$

where R_f is the feedback resistor and R_i is the input resistor from the reference, E_r

DYNAMIC SPECIFICATIONS

PARAMETER	STABILIZATION MODE	OPS 500B	OPS 1000B	OPS 2000B
BANDWIDTH (d-c to f_{-3dB})	Voltage	800 Hz	400 Hz	200 Hz
	Current	320 Hz	160 Hz	80 Hz
PROGRAMMING TIME CONSTANT	Voltage (1)	200 μsec	400 μsec	800 μsec
	Current (2)	500 μsec	1 msec	2 msec
LARGE SIGNAL FREQUENCY RESPONSE	Voltage	320 Hz	160 Hz	80 Hz
SLEWING RATE	Voltage	>1V/μsec	>1V/μsec	>1V/μsec
TRANSIENT RECOVERY (Step Load Change)	Voltage	<100 μsec	<100 μsec	<100 μsec
	Current	500 μsec	1 msec	2 msec

(1) Calculated for a feedback resistance of 1000 ohms per volt of output and a feedback capacitance of 400 pF. The range of capacitance available internally is 400 pF to 3900 pF.

(2) Calculated for a load resistance equal to E_0max/I_0max and the tabulated value for equivalent output capacitance.

OPS™

group X

HIGH SPEED OPERATIONAL POWER SUPPLIES

A high speed, high voltage fast-programmable voltage source: Because of its capacitorless output design, OPS models function at design-speed only when used with resistive loads.

KEPCO POWER SUPPLY

MODEL	VOLTS	AMPS
OPS 3500	**0-3500**	**0-0.01**
OPS 5000	**0-5000**	**0-0.005**

DIMENSIONS:
$5^{7}/_{32}$"H x 19"W
x $16^{31}/_{32}$"D

WEIGHT: 45 lbs.

STATIC SPECIFICATIONS

INFLUENCE QUANTITY		UNCOMMITTED CONTROL CHANNEL OFFSET VOLTAGE ΔE_{io}	UNCOMMITTED CONTROL CHANNEL OFFSET CURRENT ΔI_{io}	CURRENT CONTROL CHANNEL OUTPUT EFFECTS	REFERENCE ±6.2V ±5% NOMINAL
SOURCE VOLTAGE (min.-max.):(1)		< 10 μV	< 1 nA	< 10 μA	< 0.0005%
LOAD (No load—full load):		< 10 μV(2)	< 1 nA	< 10 μA	–
TIME (8-hour drift):		< 20 μV	< 1 nA	< 0.01% of $I_{o\ max}$	< 0.005%
TEMPERATURE, Per °C:		< 20 μV	< 0.5 nA	< 0.01% of $I_{o\ max}$	< 0.005%
RIPPLE and NOISE:	rms	< 0.01% of E_0		< 50 μA	–
	p-p	< 0.1% of E_0		< 500 μA	–

(1) 105-125/210-250V a-c. Model OPS 5000: 60 Hz ± 3% only.

(2) E_{io} for load in current stabilization mode is ΔE_o/open-loop gain. ΔE_o is the compliance voltage change.

The output effect can be calculated by the relationship:

$$\Delta E_o = \pm \Delta E_r (R_f/R_i) \pm \Delta E_{io} (1 + R_f/R_i) \pm \Delta I_{io} (R_f),$$

where R_f is the feedback resistor and R_i is the input resistor from the reference, E_r.

DYNAMIC SPECIFICATIONS

	STABILIZATION MODE	OPS 3500	OPS 5000
BANDWIDTH (d-c to f_{-3dB})	Voltage Current	230 Hz 130 Hz	160 Hz 100 Hz
PROGRAMMING TIME CONSTANT	Voltage(1) Current(2)	700 μsec 1.2 msec	1 msec 1.6 msec
LARGE SIGNAL FREQUENCY RESPONSE	Voltage	135 Hz	100 Hz
SLEWING RATE	Voltage	>3V/μsec	>3V/μsec
TRANSIENT RECOVERY (Step Load Change)	Voltage Current	<100 μsec 1.2 msec	<100 μsec 1.6 msec

(1) Calculated for a feedback resistance of 1000 ohms per volt of output and a feedback capacitance of 200 pF. The range of capacitance available internally is 200 pF to 1900 pF.

(2) Calculated for a load resistance equal to E_{omax}/I_{omax} and the tabulated value for equivalent output capacitance.

For More Information. Circle No. 336

KEPCO.® DIGITAL PROGRAMMING INTERFACES

RETURN IMMEDIATE ACTION
CARD, VOL. 4, OR PHONE

NEW TLA 488-16 INTERACTIVE PROGRAMMER

FOR CONTROLLING UP TO 16 POWER SUPPLIES, USING CIIL COMMANDS

This new Kepco interface not only enables your computer or bus controller to give commands in the Control Interface Intermediate Language (CIIL) over the IEEE 488 bus to as many as 16 Kepco ATE or BOP power supplies; it also enables the power supplies to respond with appropriate flags if they are unable to carry out those commands (hence TLA: Talker-Listener-Adapter).

The commands you can give are voltage setting with current limit, or current setting with voltage limit. The TLA 488-16 automatically translates the desired voltage or current settings into percentages of full scale.

The responses you receive inform you whether your commands have been carried out, and if not why not.

A discrete fault (or status) monitor reports catastrophic failure either in the unit itself, or in the power supplies.

The TLA 488-16 consists of one single-board micro-computer which uses the 8088 CPU microprocessor, and as many as four plug-in boards. The "A" boards are for Kepco ATE power supplies: TL 488-1A controls one power supply, TL 488-2A controls two, and TA 488-4A controls four. TL 488-4B controls up to four Kepco bipolar BOP power supplies. All control circuits of the plug-in boards are optically isolated, to 500 Volts, from each other and from the digital interface circuit. The microcomputer board and all plug-in boards are standard Multibus⁽¹⁾ size.

TLA 488-16 recognizes these CIIL commands:

Function	Reset
Close	Confidence Test
Set	Internal Self Test
Open	Status

It recognizes this noun:
Direct Current Source

It recognizes these noun modifiers:

Voltage	Voltage Limit
Current	Current Limit

(the only allowable combinations of noun modifiers are "Voltage with Current Limit" and "Current with Voltage Limit")

It can receive from the power supplies under its control, and transmit to the host computer, these error messages:

- Voltage Comparison Error
- Current Comparison Error
- Invalid Command
- Voltage Out of Range
- Relay Not Open⁽²⁾
- Relay Not Closed⁽²⁾
- Set Modifier Error
- Current Out of Range
- Device Not Present
- Device Not Selected
- Device Disconnected
- Crowbarred
- Overload

TLA 488-16 implements these interface functions on the IEEE 488 bus:

Source Handshake	Talker
Acceptor Handshake	Listener
Service Request	Device clear

⁽¹⁾Multibus™ is a trademark of the Intel Corporation

⁽²⁾Refers to optional relay placed between the power supply and the load driven by a separate port of the TLA 488/16

GENERAL SPECIFICATIONS

Ambient operating temperature range: 0 to +55°C Storage range: −20 to +75°C
Mounting: 19" rack (Provisions for Jonathan 130-QD series slides)
A-C input: Selectable 115/230V a-c; 50~60 Hz
Input current: @ 115V a-c: 5A; @ 230V a-c: 2.5A
Aux. d.c. output: +5V at 10A
Dimensions: 5-7/32" x 19" x 16-3/16" Weight: 8 lbs.
Color: Gray, Fed. Std. 26440

This KEPCO product is backed by a firm 5-YEAR WARRANTY

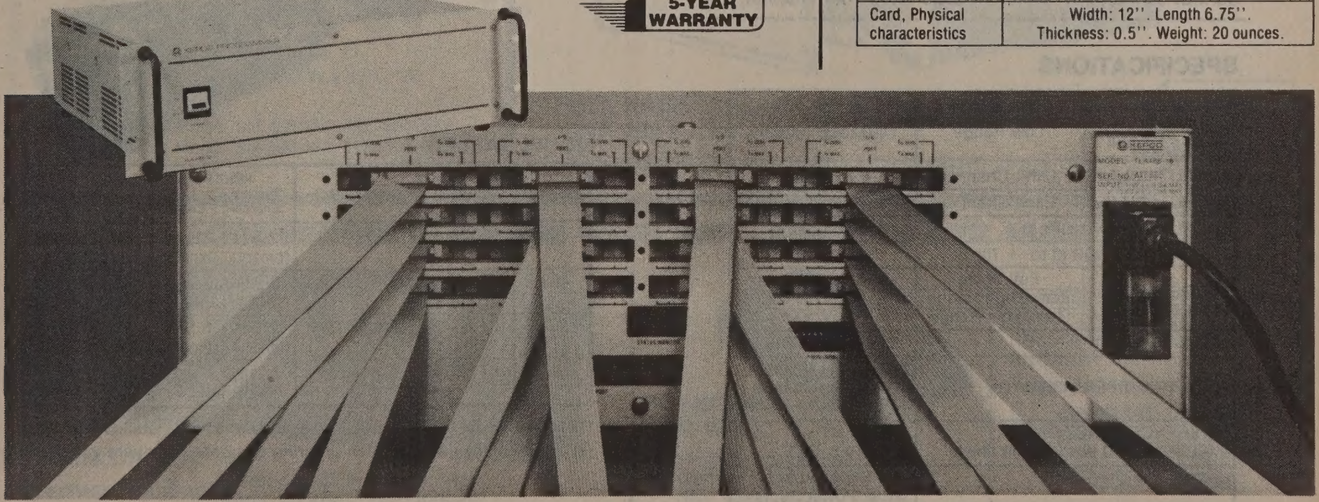
PLUG-IN PROGRAM CARDS

(Standard Multibus Size)

The TLA 488-16 has provision for up to four plug-in cards, which can control the voltage and current function of up to four Kepco unipolar ATE or bipolar BOP power supplies.

SPECIFICATIONS

MODEL	For ATE Models: TL 488-1A -2A -4A	For BOP Models: TL 488-4B
Number of isolated input/output ports	1 2 4	4
Analog outputs/port	Two (2) channels.	
Analog output channels mode of Operation	Voltage and Current Limit or Current and Voltage Limit. Determined by noun modifiers within set command.	
Analog output voltage level	0 to + 10V for Volt. or Volt. limit channel 0 to + 1V for Curr. or Curr. limit channel.	0 to ± 10V for main or Curr. channel. 0 to + 10V for complementary Curr. or Volt. limit channel.
Analog output current level	0 to + 2mA per channel.	0 to ± 2mA for main channel. 0 to + 2mA for limit channel.
Output impedance	< 0.05 ohms.	
Output resolution	12 bit.	
Linearity error (0 to + 70°C)	< ± ½ LSB.	
Adjustments (both channels)	Full scale calibration. Zero adjustment.	
Temp. coefficient (per degree C)	± 0.002% at full scale. ± 20μV at zero.	
Isolation between ports	500V d-c.	
Power supply ident. codes	Set with DIP switch for each port.	
Input signals accepted from the power supply	Supply absent flag. Voltage/current mode flag. Crowbar flag. Volt. out of limit (0.1% of full scale). Curr. out of limit (1.0% of full scale).	
Input digital commands	Via Multibus from TLA 488-16. All signals TTL compatible.	
Power requirements	+ 5V at 2A, via Multibus from TLA 488-16.	
Card, Physical characteristics	Width: 12''. Length 6.75''. Thickness: 0.5''. Weight: 20 ounces.	



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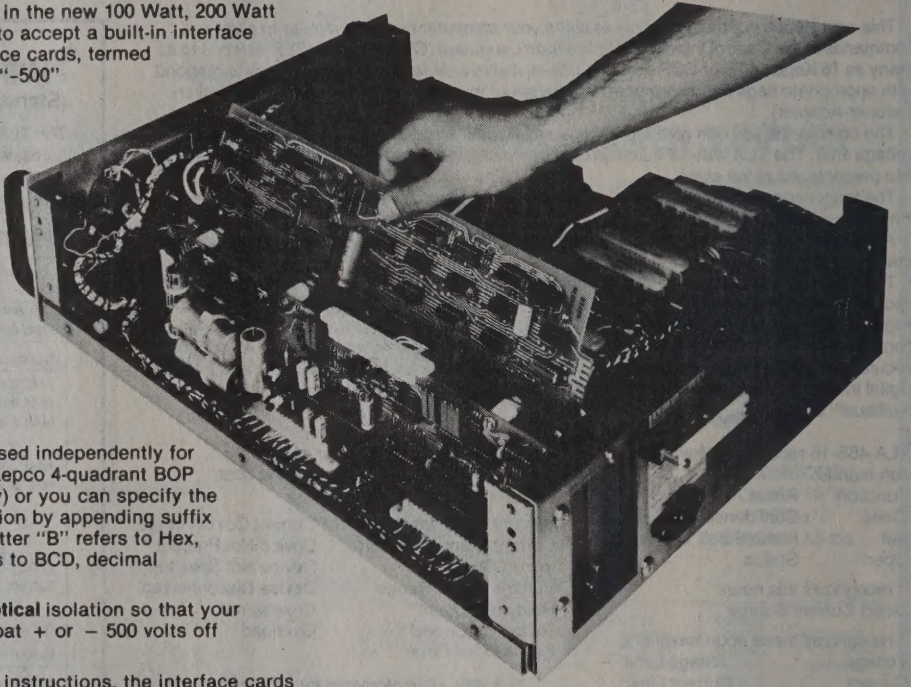
RETURN IMMEDIATE ACTION
CARD, VOL. 4, OR PHONE

INTERNAL DIGITAL PROGRAMMING INTERFACES FOR THE BIPOLAR POWER SUPPLIES



Digital interface card mounts inside your BOP and provides either parallel data or IEEE-488 control.

The Kepco Bipolar power supplies in the new 100 Watt, 200 Watt and 400 Watt series are designed to accept a built-in interface card for digital control. The interface cards, termed "BIT", are available in two styles: "-500" for parallel data buses and "-488" for the popular instrumentation bus based on IEEE-488. In either style, the cards are available with either hexadecimal (12 bit) or decimal (3-BCD) format.

Each card is configured to control either the host BOP's voltage control channel or its current control channel as the user may select. There is an additional "limit channel" which can be addressed to control either voltage or current limits with 8 bit or 2-BCD resolution.

The interface cards can be purchased independently for field installation into an existing Kepco 4-quadrant BOP (100W, 200W, or 400W models only) or you can specify the interface as a factory-provided option by appending suffix -500B (or D) or -488 B (or D). The letter "B" refers to Hex, binary control; the letter "D" refers to BCD, decimal control.

The interface cards incorporate **optical** isolation so that your power supply can be allowed to float + or − 500 volts off digital ground.

In addition to the setting and limit instructions, the interface cards accept polarity (plus or minus) and range (10:1) instructions. The BIT-488 cards (IEEE-488) also implement the GPIB's remote enable and device clear interface functions.

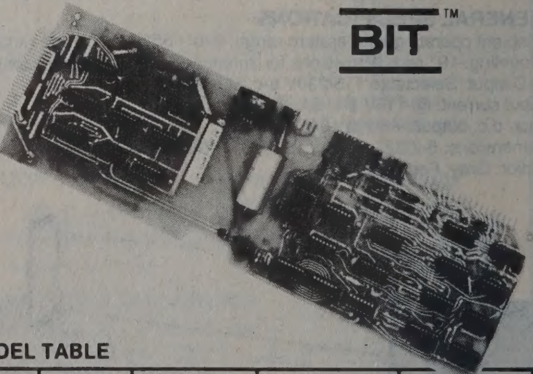
An interconnecting cable is provided for field installation of the series BIT interface card into the host power supply. The interconnect cable from a BIT-488 interface to a GPIB is included when the digital interface is ordered. Model SNQ 488-2 (2 meters long).

The BIT-500 parallel data interfaces require only a digital input connector model PC-12 which is supplied with the interface card.

Data Form (For IEEE-488 interfaces)
The digital interface looks for an instruction of the form CMMMLL (six ASCII encoded characters) where "C" is a 1-byte control character that specifies range and polarity while "MMM" are the 3 characters that specify the setting of the main control channel (voltage or current) in terms of percent of full scale. "LL" are the two control characters for the corresponding limit channel.

SPECIFICATIONS

OUTPUT VOLTAGE (Main Channel)	High Range	0 to ± 10V	
	Low Range	0 to ± 1.0V	
OUTPUT VOLTAGE (Limit Channel)		0 to + 10V	
OUTPUT CURRENT (Each Channel)		± 2.0 mA max	
OUTPUT IMPEDANCE		<0.05 ohms	
LINEARITY ERROR (0 to + 70°C)		± 1/2 LSB	
TEMPERATURE COEFFICIENT	Full Scale	± 35 PPM/°C max	
	Zero, High Range	± 20 μV/°C max	
	Zero, Low Range	± 10 μV/°C max	
LOGIC INPUT		TTL COMPATIBLE	
DATA TRANSFER FORMAT		Byte serial, BIT-parallel (for BIT 488)	BIT parallel (for BIT 500)
INTERFACE FUNCTIONS IMPLEMENTED (for BIT 488 only)		AH1, L1 RL2, DC2	
SOURCE POWER		Supplied by Host Power Supply	



BIT™

MODEL TABLE

SUFFIX [1]	MODEL [2]	DATA FORMAT	RESOLUTION Principal Channel	RESOLUTION Limit Channel	INPUT
−488-B	BIT 488-B	ASCII/Hex	12 Bits (binary)	8 Bits (binary)	For IEEE-488 (GPIB) bus
−488-D	BIT 488-D	ASCII/Decimal	3-Digit (BCD)	2-Digit (BCD)	For IEEE-488 (GPIB) bus
−500-B	BIT 500-B	Hexadecimal	12 Bits (binary)	8 Bits (binary)	For parallel data transfer bus
−500-D	BIT 500-D	Decimal	3-Digit (BCD)	2-Digit (BCD)	For parallel data transfer bus

(1) Add to model No. of the BOP to specify a factory-installed interface.
(2) Use this designation when ordering separately for field installation.

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RETURN IMMEDIATE ACTION CARD, VOL. 4, OR PHONE

KEPCO®

STAND ALONE DIGITAL INTERFACES FOR SINGLE OR MULTIPLE CHANNEL OPERATION

These digital programmers are designed for use with all Kepco operationally-programmable power supplies (high speed and conventionally filtered) and/or voltage-controlled instruments. They enable you to interface your d-c power supplies with the logic bus of a computer-controlled system.

The interface output is an isolated ±10 volt analog signal that makes a simple 2-wire connection to the programming terminals of Kepco ATE, BOP and other programmable power supplies.
Use the 2-channel version to control both voltage and current.

The two channels provided on each Model SN 488-B or SN 488-D plug-in card in the 4-card or 8-card housings are not isolated. Use them to control both voltage and current of the same power supply.

MODEL		SINGLE AND DUAL-CHANNEL PROGRAMMERS, ¼-RACK SIZE								PLUG-IN BOARDS FOR 4 CARD & 8-CARD HOUSINGS	
		SN488-				SN500-				SN 488-B	SN 488-D
		121	122	031	032	121	122	031	032		
NUMBER OF CHANNELS		1	2	1	2	1	2	1	2	2	2
INPUT DATA CODING FORMAT		Hex		Decimal		Hex		Decimal		Hex	Decimal
RESOLUTION		12 Bit		3 Digit		12 Bit		3 Digit		12 Bit	3 Digit
LINEARITY ERROR		± 1/2 LSB									
OUTPUT CURRENT		2 mA max.									
OUTPUT IMPEDANCE		<0.05 ohms									
OUTPUT VOLTAGE	High Range	± 10V									
	Low Range	± 1V									
LOGIC INPUT		TTL COMPATIBLE									
DIGITAL INPUT DATA TRANSFER FORMAT		Byte Serial, Bit Parallel				Bit Parallel				Byte Serial, Bit Parallel	
A-C INPUT	Voltage	105-125V/210-250V (selectable by switch)									
	Frequency	50-440 Hz									
	Power	≈12 VA								≈7 VA	
ISOLATION		1000V max. between digital input and analog input									

QUARTER-RACK STYLE PROGRAMMERS

Are available in either bit-parallel format or byte-serial format that is compatible with any IEEE-488 controller. You can buy single channel models or programmers with two independent, isolated channels.

SN 488

A 2-meter long GPIB Cable to SN 488 is included.

Optional connectors:
SNQ 488-1 (Cable, 1 meter)
SNQ 488-2 (Cable, 2 meters)
PC-488 Plug printed circuit edge to IEEE-488

KEPCO PROGRAMMER
ON
OFF
POWER

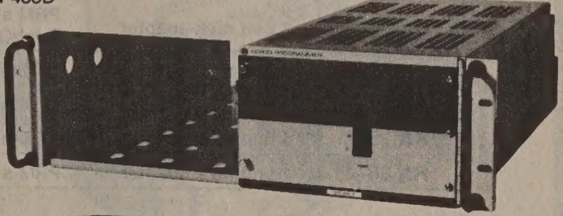
DIMENSIONS: 5⁷⁄₃₂"H x 4⁵⁄₃₂"W x 17³⁄₁₆"D.
WEIGHT: 10 lbs.
Applicable to Model SN 488-121,-122,-031,-032 and to Model SN 500-121,-122,-031,-032

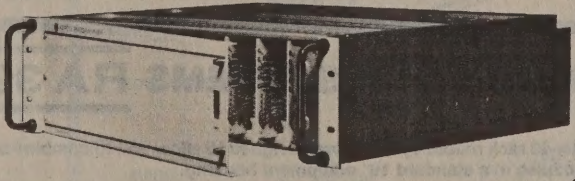
CARD-CAGE STYLE PROGRAMMERS FOR MULTIPLE UNIT SYSTEMS

HALF RACK SNR 488-4

Housing for 4 Dual-Channel Cards
SN 488B or SN 488D

DIMENSIONS:
5⁷⁄₃₂"H x 19"W
x 17¹³⁄₁₆"D
WEIGHT: 17 lbs.





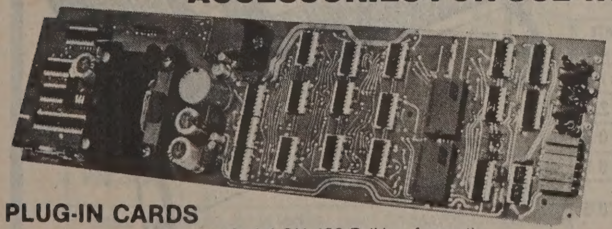
FULL RACK SNR 488-8

Housing for 8 Dual-Channel Cards
SN 488B or SN 488D

DIMENSIONS: 5⁷⁄₃₂"H x 19"W x 18"D **WEIGHT:** 23 lbs.

This KEPCO product is backed by a firm
5-YEAR WARRANTY

ACCESSORIES FOR USE WITH SNR 488-4 AND SNR 488-8



PLUG-IN CARDS FOR EITHER HOUSING
Model SN 488-B (Hex format)
Model SN 488-D (BCD format)

KEYBOARD SN 488-K
Hexadecimal keyboard for manually driving SNR 488-4 or SNR 488-8 *Weight:* 0.8 lbs.

CABLES (IEEE-488 INTERFACE)

SNC 488-1	(1 meter)
SNC 488-2	(2 meter
SNC 488-4	(4 meter)

KEYBOARD CABLES

SNP 488-1	(1 meter)
SNP 488-2	(2 meter)
SNP 488-4	(4 meter)

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KEPCO. HARDWARE

for laboratory-type power supplies and digital programmers

RACK ADAPTER PANELS

These models adapt Kepco (linear and ferroresonant modules) power supplies to the standard 19" wide equipment rack or cabinet.
Panel mounting holes are pre-drilled (standard E.I.A. pattern).
Finish: Light gray, color 26440, Fed. Std. 595.

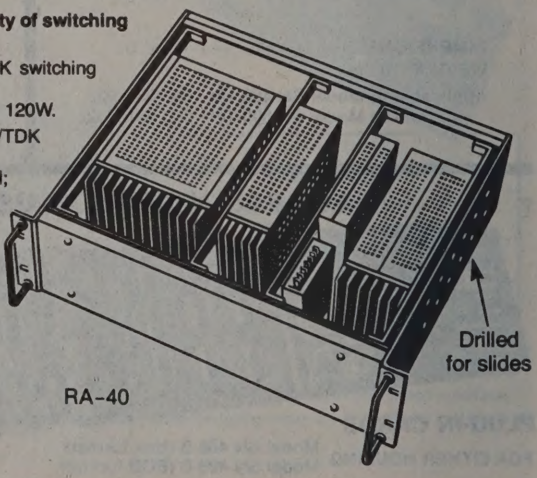
MODEL	DESCRIPTION	USED FOR	DIMENSIONS HEIGHT inches	HEIGHT mm	WIDTH inches	WIDTH mm
RA 8-2	2 unit rack adapter	PRM size A and AA series or size C: Dual Output, Extra-Filtered and -450 series	5 7/32	132.6	19	482.6
RA 9-3	3 unit rack adapter	PRM size A and AA series or size C: Dual Output, Extra-Filtered and -450 series	6 31/32	177.0	19	482.6
RA 10-1	1 unit rack adapter	PRM size A and AA series	5 7/32	132.6	19	482.6
RA 14-3	3 unit rack adapter	PRM size B-120 series or size D-60 series	3 15/32	88.1	19	482.6
RA 15-1	1 unit rack adapter	PRM size B-120 series	3 15/32	88.1	19	482.6
RA 16-4	4 unit rack adapter	PRM size B-120 series or size D-60 series	5 7/32	132.6	19	482.6
RA 17-5	5 unit rack adapter	PRM size B-120 series or size D-60 series	5 7/32	132.6	19	482.6
RA 18-1	1 unit rack adapter	PRM size C-180F series Extra-Filtered	5 7/32	132.6	19	482.6
RA 26-1	1 unit rack adapter	PAT model	3 15/32	88.1	19	482.6
RA 27-2	2 unit rack adapter	PAT models	3 15/32	88.1	19	482.6
RA 28-4	4 unit rack adapter	PAT models	6 31/32	177.0	19	482.6
RA 30-1	1 unit rack adapter	PRM size D-60 series	3 15/32	88.1	19	482.6
RA 31-1	1 unit rack adapter	PRM size C-300 series Dual Output	5 7/32	132.6	19	482.6
RA 33-3	3 unit rack adapter	PTR models	3 1/82	132.6	19	482.6
RA 34-4	4 unit rack adapter	PTR models	5 1/4	133.4	19	482.6
RA 35-1	1 unit rack adapter	PTR model	3 1/2	88.9	19	482.6
RA 38-1	1 unit rack adapter	PRM size C-450 series	5 7/32	132.6	19	482.6

RACK MOUNTING SYSTEMS RA 39™ RA 40™ for switchers

The RA-39 and RA-40 rack mount systems are designed to allow you to combine a variety of switching Power Supply modules in a standard 19" equipment housing.

THE RA-39 SYSTEM: This system is designed for installation of the following KEPCO/TDK switching power units:
RMK-S; RMX-A,-B; RMD-SA,-AA,-A,-B; RMT-SA,-AA; RDT-AA; MP-H; CMP-H; ERX-30W, 60W, 120W.

THE RA-40 SYSTEM: This system is designed for installation of the following KEPCO/TDK switching power units:
RMK-S; RMX-A,-B,-C,-N,-D; RMD-SA,-AA,-A,-B,-D; RMT-SA,-AA; RXT-C; RDT-AA; MP-H; CMP-H; ERX-30W, 60W, 120W.

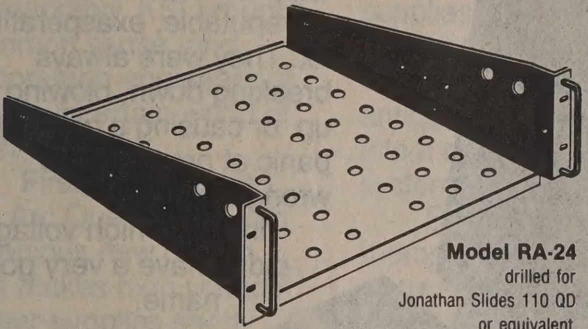


MODEL	DESCRIPTION	HEIGHT inches	HEIGHT mm	WIDTH inches	WIDTH mm	DEPTH inches	DEPTH mm	SHIP WGT LBS	SHIP WGT KG
RA-39	rack adapter	3 15/32	88.1	19	482.6	14 29/32	378.6	4	1.9
RA-40	rack adapter	5 7/32	132.6	19	482.6	14 29/32	378.6	5	2.3
RAB 39-40	for R-series	3/4	19.1	3/4	19.1	12 63/64	329.8	1	0.5
RAB 39-40X	for ERX	1	25.4	3/4	19.1	12 63/64	329.8	1	0.5
ADP-40H	use with RAB 39-40 to mount CMP & MP	3 15/32	88.1	2 49/64	70.2	1/16	1.6	1	0.5

KEPCO® RACK MOUNTING SYSTEMS

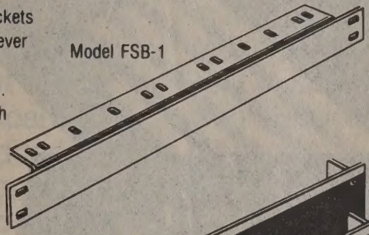
RA 24™ RA 37™

Model RA 24 mounts ATE, APH, BOP, JQE, MPS, OPS IXB, SN 488 and SN 500.
Model RA 37 mounts only ATE, SN 488, SN 500 and BOP ¾ Rack.

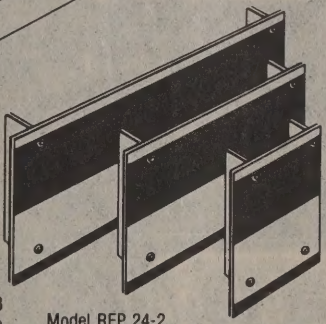


Model RA-24
drilled for
Jonathan Slides 110 QD
or equivalent.

Model FSB
The filler support brackets should be used whenever the total load in an RA-24 exceeds 75 lbs. Mount directly beneath the lower front edge of the housing and fasten to the rack edge.



BLANK FILLER PANELS
are finished with a matching stripe on one side and solid gray on the other. Color 26440 per Fed. Std. 595.



Model RFP 24-3
Model RFP 37-3

Model RFP 24-2
Model RFP 37-2

Model RFP 24-1
Model RFP 37-1

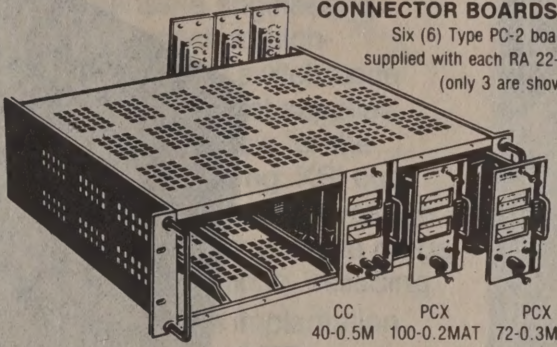
MODEL	DESCRIPTION	DIMENSIONS(1) H	DIMENSIONS(1) W
RA-24	Rack mount for (2) ½ or (4) ¼ rack models, 17⅞'' deep	5 7/32 132.6	19'' 482.6
RA 24B	Blank bottom for custom drilling	5 7/32 132.6	19'' 482.6
RA-37	Reinforced rack mount system, 20'' deep	5 7/32 132.6	19'' 482.6
RFP 24-1 **RFP 37-1**	¼ filler panel for RA 24 ¼ filler panel for RA 37	5 7/32 132.6	4 5/32 105.6
RFP 24-2 **RFP 37-2**	½ filler panel for RA 24 ½ filler panel for RA 37	5 7/32 132.6	8 11/32 211.9
RFP 24-3 **RFP 37-3**	¾ filler panel for RA 24 ¾ filler panel for RA 37	5 7/32 132.6	12 17/32 318.3
FSB-1	Filler support bracket	1 23/32 43.6	19'' 482.6
FSB-3	Filler support bracket	3 15/32 88.1	19'' 482.6
FSB-5	Filler support bracket	5 7/32 132.6	19'' 482.6

(1) Upper dimensions are in inches; lower dimensions in millimeters.

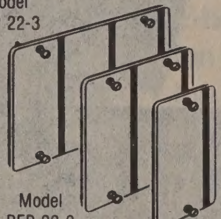
RA 22-6A™ RA 32™

The model RA-22-6A mounts Kepco Laboratory-type power supplies CC and PCX-MAT
The model RA-32 mounts, CC, PCX-MAT and any one ½ Rack or two ¼ rack size models.

PLUG-IN CONNECTOR BOARDS
Six (6) Type PC-2 boards supplied with each RA 22-6A (only 3 are shown)

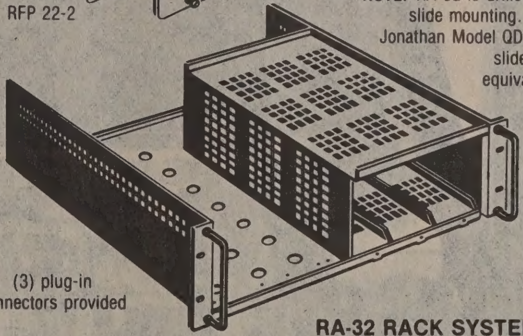


6-SLOT RACK HOUSING—MODEL RA 22-6A



FILLER PANELS
supplied without slide assembly and handle, may be used to fill unused slots in RA 22-6A, RA-32, CA-4 and CA-5.

NOTE: RA-32 is drilled for slide mounting. Use Jonathan Model QD-110 slides or equivalent



RA-32 RACK SYSTEM
combines three plug-in slots of the RA 22-6A with a half-rack space from RA-24 to provide a convenient way of mixing models.

MODEL	DESCRIPTION	DIMENSIONS(2) H	DIMENSIONS(2) W	DIMENSIONS(2) D
RA 22-6A	Six-slot rack housing including (6) PC-2 connectors.	5 7/32 132.6	19 482.6	16¼ 412.8
RFP 22-1	Single filler panel	5 7/32 132.6	2 25/32 70.6	—
RFP 22-2	Double filler panel	5 7/32 132.6	5 9/16 141.2	—
RFP 22-3	Triple filler panel	5 7/32 132.6	8⅜ 212.7	—
RA-32	Rack adapter for (1) half-rack or (2) ¼-rack plus (3) ⅛-rack slots	5 7/32 132.6	19 482.6	19 482.6
PC-2	Edge-connector to barrier-strip interface	5 7/32 132.6	2 21/32 67.5	—
PC-8	Edge-connector to cable interface for CC and PCX–MAT	—	—	—

(2) Upper dimensions are in inches; lower dimensions in millimeters.

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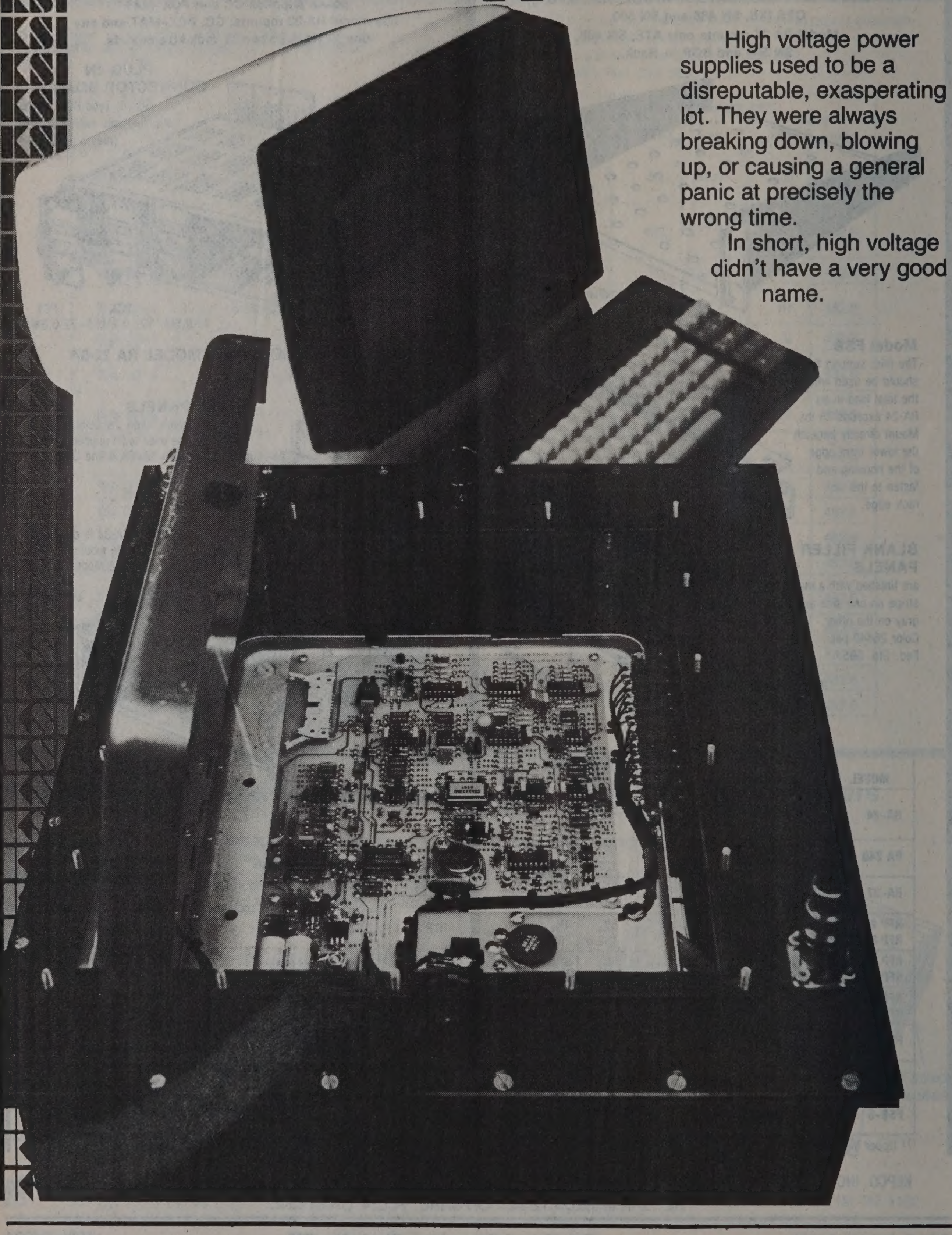
24

High Voltage Power Supplies: The

High voltage power supplies used to be a disreputable, exasperating lot. They were always breaking down, blowing up, or causing a general panic at precisely the wrong time.

In short, high voltage didn't have a very good name.



For More Information. Circle No. 337

Inside Story.

Then along came a company called KSI. Remarkably, KSI brought common sense (and uncommon engineering) to the uncertain world of high voltage.

First, KSI invented the Arc Quencher™—an ingenious new design that makes high voltage power supplies short-circuit proof. And unlike other "fail-safe" systems, the Arc Quencher doesn't preserve itself at the expense of the load.

KSI then added double shielding, RFI filtering, isolated control power, and many other protective features.

Finally!!! High voltage power supplies were becoming reliable, upstanding citizens!

But KSI didn't stop here. High voltage power supplies were still notoriously behind the times. Who wanted to put an antique bucket of bolts into a highly advanced system?

So KSI went to work. It employed the latest vacuum-tube and control-circuit technology. It housed the components in compact tanks and modern control modules. And it used plug-in PCBs with LED indicators and test points.

To make matters even better, KSI taught its power supplies to speak ASCII with computers. Through fiber optics, computers precisely control each critical aspect of power-supply operation.

What's more, KSI is applying the same sensible engineering approach to high-frequency switchmode and resonant supplies.

And now for the happy ending: KSI custom designs high voltage *systems* for a whole range of applications, including:

- Ion implantation
- X-ray systems
- Lasers
- E-beam systems
- Ion deposition
- Ion milling.

To find out the latest developments in this exciting and continuing story, call or write: Kaiser Systems, Inc., 33 Cherry Hill Drive, Danvers, MA 01923. Phone (617) 777-5102. TWX: 887159. FAX: (617) 777-3340.

Typical Specifications

Description	Output Voltage	Reg.	Max. Current	Technology	Application
Multiple Output	Quad 0 to 10kV	.05%	4x 4mA	High-freq.	Beam optics
	0 to 10V 0 to 1.5kV 0 to 10kV	1% 1% 1%	300A 2.2A 40mA	High-freq. resonant	Deposition systems
D.C. Adjustable	+5 to +100kV	.01%	40mA	Output tube regulation	Ion implanters
Pulsed	+40 to +130kV	.1%	800mA		X-ray
Bipolar	−75, +75kV	.01%	200mA	High-freq. resonant	
Fixed voltage	25kV	1%	100mA		Lasers

We've given
high voltage
power supplies
a good name...

KSI Kaiser Systems, Inc.

33 Cherry Hill Drive, Danvers, MA 01923 · Phone: 617-777-5102

For More Information. Circle No. 337

KSI

High Voltage Power Supply Selection Guide

Selecting the right high voltage power supply for a specific application requires careful consideration of many parameters. The following table, which compares the performance characteristics of several types of high voltage supplies, will provide guidance in making the appropriate choice for your application.

Type	Unregulated	Input Regulated			Output Regulated
Technology	—	linear	switch mode	resonant converter	linear
Frequency	50 Hz to 400 Hz	50 Hz to 400 Hz	10 kHz to 50 kHz	10 kHz to 50 kHz	50 Hz to 400 Hz
Output Voltage (Max.)	to > 1 MV	to > 1 MV	to 500 kV	to 500 kV	to 150 kV
Power Level	any	any	to 3 kW	to 50 kW	200 W to 200 kW
Regulation Method	N/A	var. transf. SCR	pulse width modulation	freq., phase modulation	series pass element
Stored Energy*	high	high	low	low	lowest
Output Current Limit Δt	≥ 10 ms	≈ 10 ms	≈ .1 ms	≈ .5 ms	< 1 µs
Transient Response	N/A	slow	medium	medium	very fast
EMI	very low	medium	high	medium	very low
Efficiency	≈ 95%	≈ 90%	≈ 85%	≈ 85%	75 to 90%
Parts Count	lowest	low	high	high	low
Size per Watt	large	large	small	small	large
Cost per Watt	low	medium–high	medium	medium	high
Insulation Medium	air, oil, SF6		air, oil, SF6, encapsulation		air, oil, SF6

*Stored energy at output due to output filter. Low filter requirements (higher ripple) reduce stored energy.

Choose your supplier as carefully as you choose your supplies. Ask yourself the following: are his designs modern, efficient, and reliable? Does he care as much about quality as you do? Will he deliver on time and to specifications?

Then call KSI.

We've given high voltage power supplies a good name...

KSI **Kaiser Systems, Inc.**

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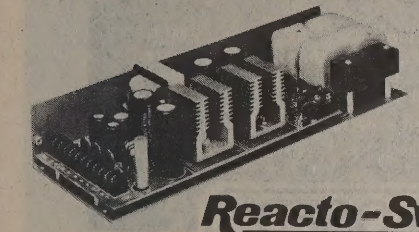
POWER SUPPLIES



- 200 Watt Multi-Output Switching Supply
- New Unique Design Concept
- Reserve Battery Back-up Built-in
- Over 100,000 Hrs MTBF — MIL-HDBK-217D
- Extremely Low Inrush Current
- Designed to Meet UL/CSA/VDE

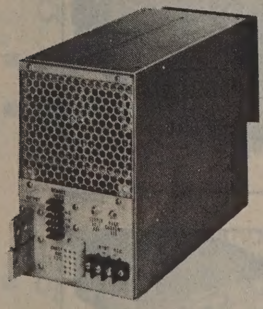
Reacto-Switcher™

ELECTRICAL CHARACTERISTICS

Parameter	Conditions	Limits
Overall Regulation	+5V output —60% ±40% max. rated load change −5V output —60% ±40% max. rated load change ±12V outputs —60% ±40% max. rated load change	±1% max. ±10% max. ±8% max.
Adjustability	+5V Output	4.8V to 5.5V
Input Line Regulation	All outputs — 95 VAC ≤ Vin ≤ 130 VAC 190 VAC ≤ Vin ≤ 260 VAC	±0.15% typ. ±0.15% typ.
Noise and Ripple	Any output — Peak to Peak RMS	2% max. 0.5% max.
Input Voltage	At all rated load conditions	95 VAC to 130 VAC 190 VAC to 260 VAC User Selectable
Input Surge Current	Hot or cold start peak current	34A max.
Input Frequency Range	At all rated load and line conditions	47 Hz to 63 Hz
Efficiency	At maximum continuous output power, nominal line input	75% typ.
Hold up Time	Nominal input voltage, max. output power	16 mS min.
Overvoltage Protection Threshold	+5V output	6.25 ±0.75V
Mechanical Specification	3.00 x 5.25 x 15.0	

OUTPUT VOLTAGES AND MAXIMUM LOADS Note 10

Model Number	Output #1 Vnom Imax.	Output #2 Vnom Imax.	Output #3 Vnom Imax	Output #4 Vnom Imax.	Continuous Output Power Range
Px 3351	+5V @ 20A	−5V @ 3A	+12V @ 4A	−12V @ 4A	0-200W



1500 WATT, 100 KHz OFF-LINE SWITCHMODE POWER SUPPLY — MODEL SP-1500-XX

2.0 to 48.0 Volt Outputs (5.0 Volt, 300 Amperes, Specifications Typical)*

The SP-1500X series achieves 3.75 watts per cubic inch with standard forced air cooling. Reliability is in excess of 100,000 hours — MTBF in the commercial version.

This series is suitable for applications in high reliability main frame systems, telephone switchgear systems, and other systems requiring low to medium voltages. The basic converter topology used is also being applied in custom high voltage applications, such as S and K band TWT amplifiers and jammers.

ELECTRICAL CHARACTERISTICS

Output Voltage Range: 4.5V to 5.5V
Output Current: 300A
Output Overcurrent adj. range: 50A to 325A
Output Ripple, Max. rated Load current: 35 mv P-P Max.
Output Voltage Regulation: ±0.2 Max.
Holdup Time — Standard: ≥10 Msec
Float Battery Option Available
Overvoltage Protection
  (Automatic reset or latch avail.): 6.0 ±25V
Short Circuit Current
  (Automatic reset or latch avail): 0 Amps
Logic Inhibit (≤0.5V inhibits, ≥2.4V enables): TTL Compatible
Remote Sense (both output and return): 0.5V Max.
Polarity (Isolation: ±200 VDC to chassis): Floating Output
Overtemperature Flag (normally open): Sinks 5 ma Max.
Throughput Efficiency (full load): ≥ 80% (5V, 300A)
Soft Start: Linear Ramp.

INPUT

30, 208-240 VAC, Standard: 167-265 VAC
230 VAC, Single Phase, Optional: 167-265 VAC
280 VDC, Optional: 210-325 VDC
Frequency Range: 47-500 Hz
Inrush Current: 30A Max.
Turn-on time with application of Primary Power: 1 sec
Turn-on time with Logic Enable: 200 msec
Size: 5″W x 8″H x 10″L
Weight: 14 pounds
UL, CSA recognized, designed to meet VDE
  MTBE Commercial Version — ≥ 100,000 Hrs. Available in Military Version
*Any output voltage from 2.0 to 48.0 volts available. Voltages below 5.0 volts limited to 350 Amperes output current.
XX Specifies output voltage (i.e., 5V-05/28V-28)

SWITCHING POWER SUPPLIES

L·COM has gained a reputation by selling high quality switching power supplies to users who value product reliability and consistency of delivery performance.

Our design and manufacturing expertise has been focused on the varied requirements of our OEM clientele which resulted in the development of the eight families of standard switching power supplies as shown below. This is only a brief outline of product availability and capabilities but it does represent the culmination of an intensive design and development program including quality and reliability testing.

Some of the built-in features found in L·COM switchers include: Continuous use ratings: Dual AC inputs: EMI-RFI Filters; Soft start and brown out features; Replaceable fuses; Conforming to UL·478; Post regulators as required; Adequate hold-up time after loss of AC power; Adequate load and line regulation; etc. Burn-in is provided to assure years of predictable trouble-free service and all switchers are fully warranteed for one year.

Our customer service people stand ready to discuss your specific needs. If your requirements fall in the 15 to 150 watt category, there's a good chance that L·COM could help you.

L·com

OPEN FRAME

1•3•4 OUTPUTS

SERIES G

30 WATT

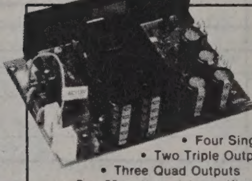
- **Seven stock models fill many applications.**

SIZE: 3 x 2 x 6″ SINGLE
4 x 2 x 7″ MULTIPLE

- Four Single Outputs
- One Triple Output
- Two Quad Outputs

Call or send for complete listings & specifications.

Note: Customer modifications considered.



1•3•4 OUTPUTS

SERIES G

50 WATT

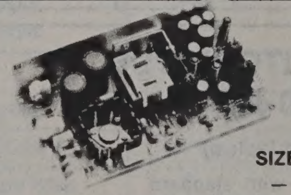
- **Ten stock models fill many applications.**

- Four Single Outputs
- Two Triple Outputs
- Three Quad Outputs
- One 50 watt model specifically for Disk Drive

SIZE: 4 x 2 x 6″ SINGLE
4 x 2 x 6.5″ MULTIPLE

Call or send for complete listings & specifications.

Note: Customer modifications considered.



QUAD OUTPUT

SERIES SP

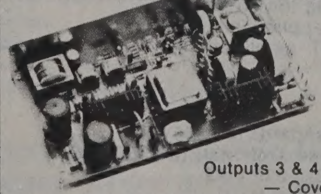
70 WATT

- **Four stock models fill many applications.**

SIZE: 4.25 x 2.5 x 8.25″

— Covers Available —

Other output ratings possible to meet custom needs.



QUAD OUTPUT

SERIES SP

150 WATT

- **Four stock models fill many applications.**

SIZE: 5 x 2.5 x 10.5″

Outputs 3 & 4 have Series regulator.

— Covers Available —

Other output ratings possible to meet custom needs.

ENCLOSED

SINGLE OUTPUT

A SERIES

15 WATT

- **Four stock models fill many applications.**

MODEL	OUTPUT
A-0503	5V-3A
A-121R3	12V-1.3A
A-1501	15V-1A
A-24R7	24V-0.7A

SIZE: 4 x 1.5 x 4.6″

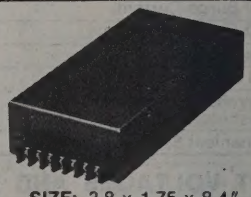
1•2 OUTPUTS

B SERIES

25 & 50 WATT

- **Four stock models fill many applications.**

MODEL	OUTPUT
B-0505	5V-5A
B-0510	5V-10A
B-1204	12V-4A
B-1503	15V-3A



SIZE: 3.8 x 1.75 x 8.4″

QUAD OUTPUT

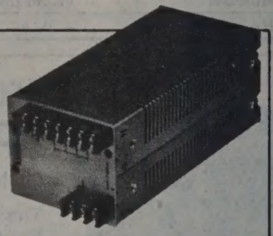
D SERIES

75 WATT

- **Five popular output voltage types for many applications.**

SIZE: 3.14 x 3.75 x 8.5″

All Outputs Regulated



TRIPLE OUTPUT

PS SERIES

42 WATT

- **Ten stock models fill many applications.**

MODEL	OUTPUT #	OUTPUT #2	OUTPUT #3
PS-1	5V-6A	+ 12V-.5A	– 12V-.5A
PS-2	5V-6A	+ 15V-.4A	– 15V-.4A
PS-3	5V-6A	+ 12V-.5A	– 5V-1A
PS-4	5V-3A	+ 24V-.6A	– 24V-.6A

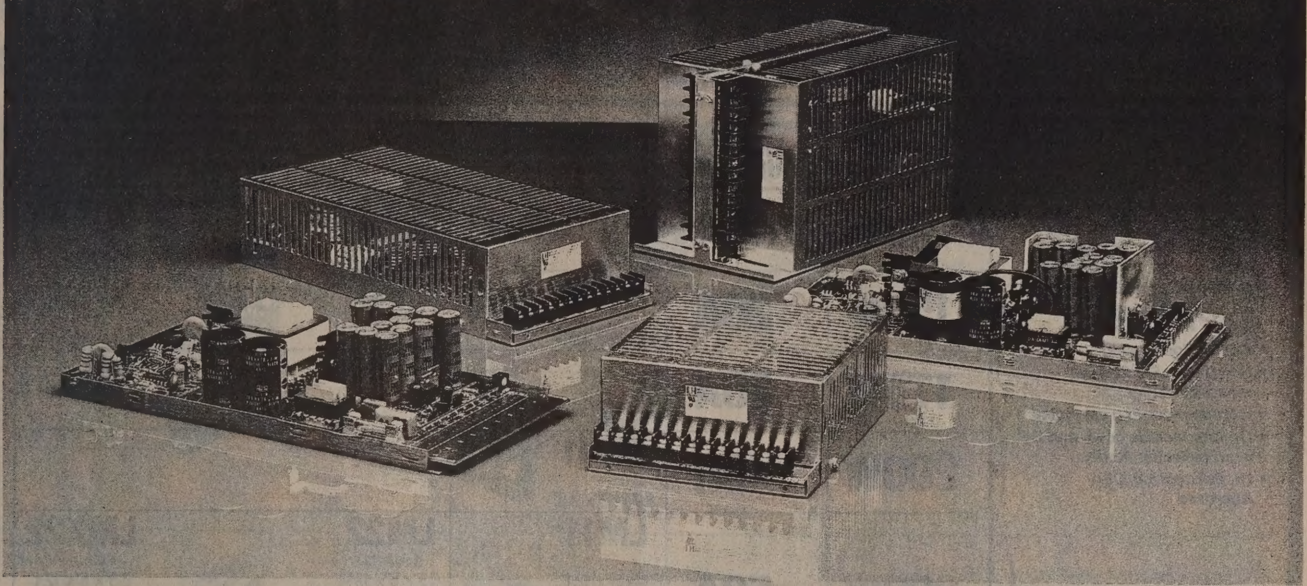
Choice of line cord or screw termination

SIZE: 4 x 2.25 x 8″

L·com POWER PRODUCTS
1755 Osgood Street No. Andover, MA 01845

Call TOLL FREE 800-343-1455
MA.RES.617-682-6936

The World's Largest Manufacturer of Switching Regulated Power Supplies.



NEW! 50-240W Multi-Output Switchers that Meet All Safety & Emissions Specs, and Are Price-Competitive with Linears.

At last! A broad line of low power switchers that is priced competitively with linear power supplies.

Introducing the new International-MITE Series switchers. They offer you a broad selection of high performance power at low, low prices.

Available in three basic configurations, the new IM series is designed to meet or exceed the most stringent federal and international safety and emissions specifications. And every supply is made by LH Research; your best assurance of quality and reliability.

- State-of-the-Art MOSFET Circuitry.
- 130 Basic Models.
- Four Basic Terminations:
  - Barrier Strip
  - AMP/Molex
  - Edge Card Compatible
- Up to 8 Outputs Available.
- Three Basic Configurations:
  - Enclosed
  - Base Mounted
  - PC Board
- Designed to Meet UL, CSA, VDE and IEC Safety Specifications.
- 115V or 230V, User-Selectable.
- Designed to Meet VDE and FCC Emissions Specifications.
- Automatic Shutdown and Restart on AC Power Surge — Self-Protecting.
- Regulated & Semi-Regulated Versions.
- Off-the-Shelf Delivery.

Call 714/730-0162

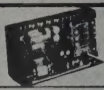
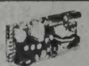
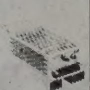
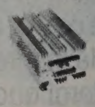
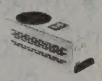
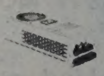
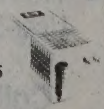
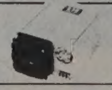
Full Range of Modifications to Standards. High Volume Customs.

LH RESEARCH

The Power Supplier.

LH Research, Inc., 14402 Franklin Avenue, Tustin, California 92680

LH Research Switcher

	TOTAL OUTPUT POWER	MAIN FRAME CURRENT	SINGLE 2-28VDC*	DUAL 2-28VDC*
Teeny Tiny-**MITE**™ • *Convection Cooled* • *Full Line and Load Regulation* • *Brownout Protection to 85 VAC* • *Extended 20 msec Hold Up Time* • *Designed to meet UL and CSA*	100W	12A		**TTM22** 1.5A aux. 4.9"x 9"x 2.8"  **TTM32** 3A aux. 4.9"x 9"x 3.2"
Tiny-**MITE** • *Convection Cooled* • *Unique Pin Fin Chassis—runs 23% cooler* • *Flexible mounting capability* • *Options include cover and DC input (selected Models)* • *UL Recognized/CSA Approved*	150W	20A	**TM11**[1] — 4.0"x 9.5"x 2.5" 	**TM22** 8A aux. 5.2"x 12"x 2.8"
	175W	20A		
	200W	40A	**TM41** — 5.2"x 12"x 2.5" 	
Little-**MITE**[6] Dyna-**MITE** • *Convection Cooled* • *AC and DC versions mechanically interchangeable* • *Single motherboard for greater reliability* • *Black anodized heatsinks for improved cooling* • *UL Recognized/CSA Approved*	300W	50A	**LM11**[2] — 4"x 5"x 12.1" **DM11**[2] — 4"x 5"x 12.1" 	**LM22** 5A aux. 6.5"x 5"x 12.1" **DM22** 5A aux. 6.5"x 5"x 12.1" **LMX22** 9A aux. 6.5"x 5"x 12.1" **DMX22** 9A aux. 6.5"x 5"x 12.1"
	350W	50A		**LM32** 10A aux. 4.1"x 7.5"x 15.9" **DM32** 10A aux. 4.1"x 7.5"x 15.9"
	600W	100A	**LM41**[3] — 4.2"x 7.5"x 15.9" **DM41**[3] — 4.2"x 7.5"x 15.9" 	**LM52** 10A aux. 6"x 7.5"x 15.9" **DM52** 10A aux. 6"x 7.5"x 15.9"  **LMX52** 16A aux. 6"x 7.5"x 15.9" **DMX52** 16A aux. 6"x 7.5"x 15.9"
Mighty-**MITE** • *Fan Cooled* • *Up to 2.5 Watts per Cubic Inch* • *Extended 20 msec Hold-up Time* • *Cool running, 70% efficiency typical* • *UL Recognized/CSA Approved*	375W	75A	**MM11** — 3.9"x 5"x 12.1" 	**MM22** 12A aux. 3.9"x 5"x 15.1"  **MMX22** 18A aux. 3.9"x 5"x 15.1" **MMX72** 20A aux. 3"x 9.5"x 13.1"
	600W	75A		**MM52**[4] — 5"x 6.5"x 13.4"
	750W	150A	**MM31** — 5"x 5"x 12.6" **SM71**[5] — 5"x 8"x 11" 	**MM42** 12A aux. 5"x 7"x 12.6" **MMX42** 20A aux. 5"x 7"x 12.6"
Super-**MITE**™ • *Fan Cooled* • *Brownout Protection to 85 VAC* • *Exceptional 35 msec Hold-up Time* • *Remote High and Low Margining* • *UL Recognized/CSA Certified*	1000W	150A		**SM22** 18A aux. 6"x 8"x 11"
		200A	**SM11** — 5"x 8"x 11" 	
	1500W	300A	**SM81** — 5"x 8"x 15" 	

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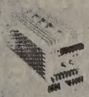
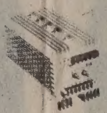
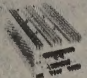
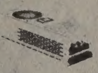
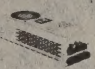
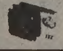
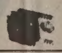
For More Information. Circle No. 339

Selection Guide

LH RESEARCH

The Power Supplier.

TRIPLE 2-28VDC*	QUAD 2-28VDC*	5-7 2-28VDC*
TTM23 1.5A aux. 4.9"x 9"x 2.8" **TTM33** 3A aux. 4.9"x 9"x 3.2"	**TTM24** 1.5A aux. 4.9"x 8"x 2.8" **TTM34** 3A aux. 4.9"x 9"x 3.2"	**TTM25** 2A aux. 4.1"x 9"x 2.8" **TTM35** 3A aux. 4.1"x 9"x 3.2"
TM23 5A aux. 5.2"x 12"x 2.8" 		
TM33 8A aux. 6.2"x 13"x 2.8" 	**TM34** 5A aux. 6.2"x 13"x 2.8" 	
LM23 5A aux. 6.5"x 5"x 12.1" **DM23** 5A aux. 6.5"x 5"x 12.1"  **LMX23** 9A aux. 6.5"x 5"x 12.1" **DMX23** 9A aux. 6.5"x 5"x 12.1"	**LM24** 5A aux. 6.5"x 5"x 12.1" **DM24** 5A aux. 6.5"x 5"x 12.1" 	**For FREE 52 page Switcher Catalog or additional information, call your local sales representative or LH RESEARCH, INC., 14402 Franklin Avenue, Tustin, CA 92680 Phone 714/730-0162**
LM33 10A aux. 4.1"x 7.5"x 15.9" **DM33** 10A aux. 4.1"x 7.5"x 15.9" **DMX33** 10A aux. 4.1"x 7.5"x 15.9" **LMX33** 10A aux. 4.1"x 7.5"x 15.9"	**LM34** 10A aux. 4.1"x 7.5"x 15.9" **DM34** 10A aux. 4.1"x 7.5"x 14.9" 	**DMA33**[7] 10A aux. 4.1"x 7.5"x 15.9" **DMA34**[7] 10A aux. 4.1"x 7.5"x 15.9"
LM53 10A aux. 6"x 7.5"x 15.9" **DM53** 10A aux. 6"x 7.5"x 15.9"  **LMX53** 16A aux. 6"x 7.5"x 15.9" **DMX53** 16A aux. 6"x 7.5"x 15.9"	**LM54** 10A aux. 6"x 7.5"x 15.9" **DM54** 10A aux. 6"x 7.5"x 15.9" 	
MM23 10A aux. 3.9"x 5"x 15.1"  **MM73** 12A aux. 3"x 9.5"x 13.1"	**MM24** 12A aux. 3.9"x 5"x 15.1" 	**MM25** 5A aux. 3.9"x 5"x 15.1" 
MM63[4] 12A aux. 5"x 8.5"x 13.4" **MMX63**[4] 20A aux. 5"x 8.5"x 13.4"	**MM64**[4] 12A aux. 5"x 8.5"x 13.4" 	**MML45** 12A aux. 4.9"x 8.4"x 13.4" **MM65**[4] 12A aux. 5"x 8.5"x 13.4" **MML46** 12A aux. 4.9"x 8.4"x 13.4" **MML47** 12A aux. 4.9"x 8.4"x 13.4"
MM43 12A aux. 5"x 7"x 12.6" 	**MM44** 12A aux. 5"x 7"x 12.6" 	
SM23 10A aux. 6"x 8"x 11"  **SMX23** 18A aux. 6"x 8"x 11"	**SM24** 10A aux. 6"x 8"x 11" 	

FOOTNOTES:

*Except TTM models (5-24 VDC only).

1 Maximum output 100 watts.
2 Maximum output 250 watts.
3 Maximum output 500 watts.
4 Contains two 375W mains (750W total). Total loading of each main plus all associated auxiliaries combined not to exceed 375W.
5 See SM11 for typical photo.
6 Little-Mite: 115 or 230 VAC, Dyna-Mite: 48 VDC input.
7 DMA33 and DMA34 have maximum of 4 outputs.

GENERAL NOTE:
Actual maximum auxiliary currents will vary depending on voltage levels.

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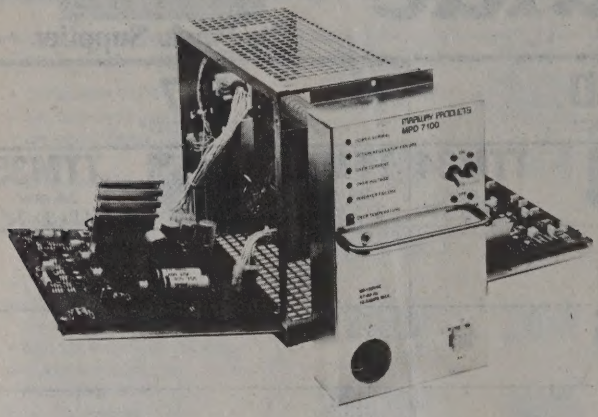

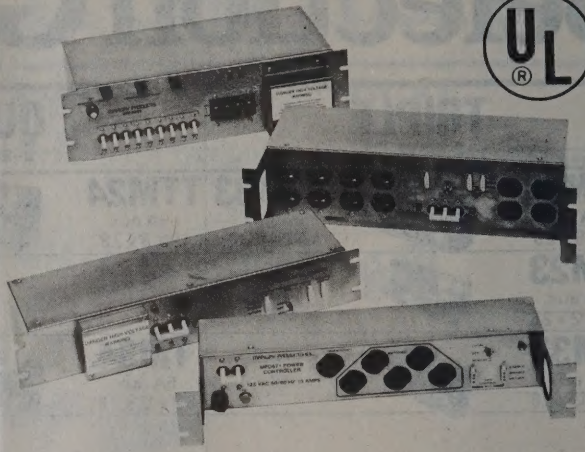

DC Power Supplies for DEC Computers From The Industries Leading Manufacturer of DEC® Compatible Power Products

MPS 7100 (VAX) SWITCHING POWER SUPPLY

- High Reliability Via All Solid State Circuitry With Reduced Component Count
- Low Common And Differential Mode Output Noise
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- Pulse Width Modulation With Constant Operating Frequency To Eliminate Audible Noise
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- Over Temperature Shutdown
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DEC Compatible AC Power Controllers For All Types Of DEC Computer Installations

MPD 861

- Three Models
  - -**MPD 861 C** For 120 V AC @ 24 Amps
  - -**MPD 861 B** For 240 V AC @ 16 Amps
  - -**MPD 861 A** For 240 V AC / 120 V AC
- 12 Receptacles

MPD 869

- Two Models
  - -**MPD 869D** For 208 V AC @ 72 Amps
  - -**MPD 869E** For 416 V AC @ 36 Amps
- 18 Receptacles

MPD 871

- Two Models
  - -**MPD 871 A** For 120 V AC @ 12 Amps
  - -**MPD 871 B** For 416 V AC @ 12 Amps
- Six Receptacles

MPD 872

- Three Models
  - -**MPD 872D** For 120 V AC @ 24 Amps
  - -**MPD 872C** For 240 V AC @ 16 Amps
  - -**MPD 872E** For 240 V AC / 120 V AC @ 24 Amps
- 10 Receptacles

MPD 874

- Three Models
  - -**MPD 874A** For 120 V AC @ 12 Amps
  - -**MPD 874D** For 120 V AC @ 24 Amps
  - -**MPD 874B** For 240 V AC @ 16 Amps

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POWER PRODUCTS FOR COMPUTERS

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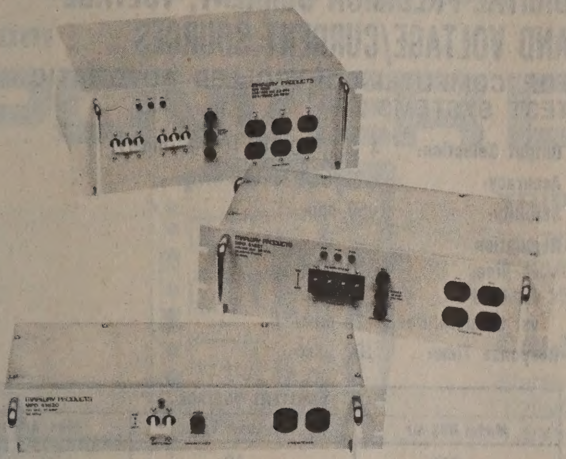

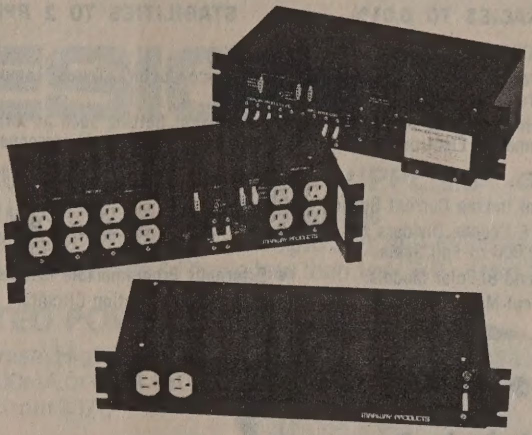

Front Panel Mount AC Power Distributor Units For Instrumentation, Test Equipment, Etc.

Featuring:

- Optional Remote Control/Shutdown Panel
- Sturdy Rack Panel Construction With Handles And Painted Front Panel
- Standard 3½", 5¼", 7" & 8⅞" Panel Heights
- Single And Multiple Phase Electrical Configurations With Up To 150 Amp Capacity
- Optional Remote Control Via Safe Low Voltage Switch Closure
- High Performance T Section EMI Filter For Noise Free Operation
- Fast, Accurate Magnetic Circuit Breakers For Overload Protection
- High Energy Transient Suppression To Protect Valuable Equipment
- **Custom Configurations Available**

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P. D. U.

(Power Distribution Units)

Distribution Of Popular Line Voltages

120 V AC

- **MPD 117A**
  -15 Amp Service
  -8 Outlets
- **MPD 110**
  -15 Amp Service
  -10 Outlets
  -Rack Mount
- **MPD 115**
  -30 Amp Service
  -12 Outlets
  -Rack Mount

240 V AC

- **MPD 220**
  -15 Amp Service
  -8 Outlets
- **MPD 230**
  -20 Amp Service
  -12 Outlets

240 / 120 V AC 4 WIRE

- **MPD 2010**
  -30 Amp Service
  -8 Outlets
- **MPD 872E**
  -30 Amp Service
  -10 Outlets
- **MPD 861A**
  -30 Amp Service
  -12 Outlets

208 / 120 V AC 5 WIRE

- **MPD 208A**
  -90 Amp Service
  -18 Outlets

416 / 240 V AC 5 WIRE

- **MPD 416A**
  -60 Amp Service
  -18 Outlets

Marway Power Distribution Units Include Features Such As:

- High Performance EMI Filtering
- Transient Supression
- Remote Control
- Overvoltage Protection
- **Custom Configurations Available**

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POWER PRODUCTS FOR COMPUTERS

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For More Information. Circle No. 340

PRECISION CURRENT & VOLTAGE SOURCES

PRECISION CURRENT SOURCES

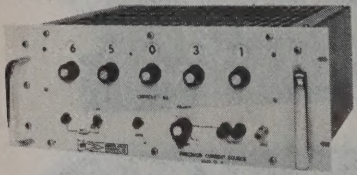
ACCURACIES TO 0.01% **STABILITIES TO 2 PPM**

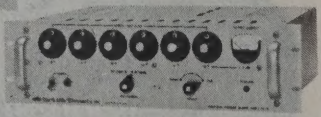
APPLICATIONS:

- Laboratory and Production Testing of Semiconductors, Gyros, Lamps, Meters, Thermistors, etc.
- Systems requiring a Precision Constant Current Setting such as X-ray Equipments, Electron Beam Welders, and Electron Beam Microscopes.

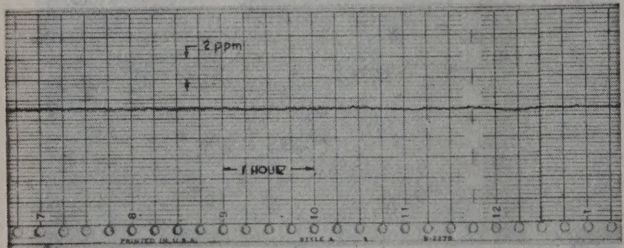
FEATURES:

- Digital In-Line Current Setting and Readout.
- 5 or 6 Decade Dividers for Setting to 1 Part in 100,000 or 1 Part in 1,000,000 of Full Scale.
- Uni- and Bi-Polar Models.
- External Modulation Capability.
- Externally Programmable Models.
- Automatic Protection Circuits.


CS-11


CS-31

Model	Current Range (mA)	Compliance Range (V)	Accuracy (%)	Stability (ppm)
CS-11	0 - 100	100	0.015	10
CS-12	0 - 1000	12.5	0.015	10
CS-13	0-5000	25	0.03	10
CS-14	0 - 10,000	12.5	0.03	10
CS-31	0 - 2000	60	0.01	5
CS-32	0- 2000	100	0.01	5
CS-111	0 - 500	250	0.1	30
CS-120	0 - 10	2000	2.0	1000
CS-151	0 - ±10	± 10	0.01	2
CS-152	0 - ±150	± 25	0.01	2
CS-153	0 - ±150	±100	0.01	2



DIGITAL PRECISION CURRENT, VOLTAGE AND VOLTAGE/CURRENT SOURCES

FOR COMPUTER-CONTROLLED AUTOMATIC TEST SYSTEMS

Output Selection: 4 digit BCD or 16 bit binary

Accuracy: 0.02% + ½ LSB

Stability: 50 ppm

Regulation

vs. line: 10 ppm

vs. load: 10 ppm

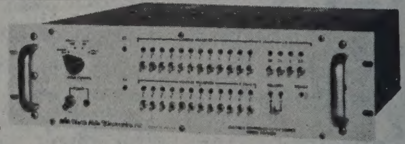
vs. temperature: 25 ppm/°C

Response Time: 100 μsec

CONSTANT VOLTAGE		
Model DVS-40	**Full-Scale Volts**	**Max. Amps.**
−010	10	2
−015	15	1.5
−020	20	1
−050	50	0.5
−075	75	0.3
−110	100	0.2

CONSTANT CURRENT		
Model	**Full-Scale Amps.**	**Max. Volts**
DCS-28—135	0.35	800
DCS-30—110	0.1	100
DCS-30—150	0.5	40
DCS-30—210	1	40
DCS-30—220	2	40
DCS-30—250	5	20
DCS-30—310	10	10

CONSTANT VOLTAGE/CURRENT		
Model	**Full-Scale Volts**	**Full-Scale Amps.**
DCVS-220	±100	±0.33
DCVS-222	±20	±2.0
DCVS-224	±40	±1.0


DCVS-220

PRECISION VOLTAGE/CURRENT SOURCES

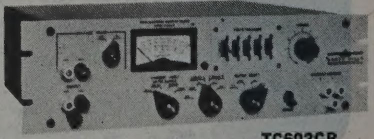
These highly stable and accurate precision sources can be operated in either constant voltage or constant current modes.

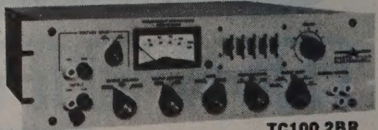
All models include such features as manual and remote programming, and output voltage regulation by either local or remote sensing.

Voltage and current outputs are selected on decade switches whose markings form an in-line digital readout.

Automatic protection limits output voltage and current to safe levels. No voltage or current overshoot occurs during turn-on or turn-off. A warning indicator alerts the operator if the actual output should differ from the dialed setting beyond the specified limits. Models TG-100.2BR and TC-602CR include a panel meter to monitor output current.

Model	Constant Voltage (V)	Constant Current (mA)	Accuracy (%)	Stability (ppm)	Decades
CVS-264	0 to ±100 @ 100 mA max.	0 to ±100 @ 100 V max.	0.1	25	5
TC-100.2 BR	0 to 100 @ 200 mA max.	0 to 100 @ 100 V max.	0.01	5	5 + vernier
TC-602 CR	0 to 60 @ 2 A max.	0 to 2000 @ 60 V max.	0.01	5	5 + vernier


TC602CR


TC100.2BR

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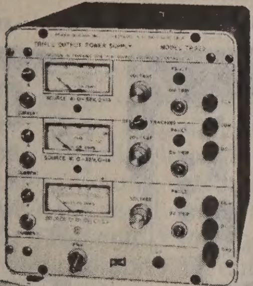
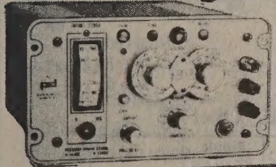
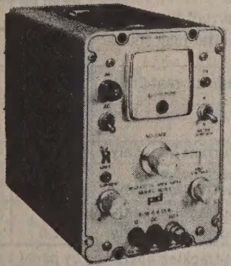
POWER SUPPLIES from POWER DESIGNS



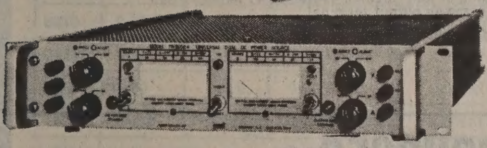
TP-325



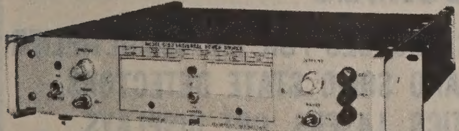
2005A



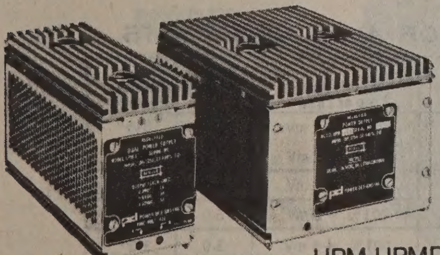
5015T



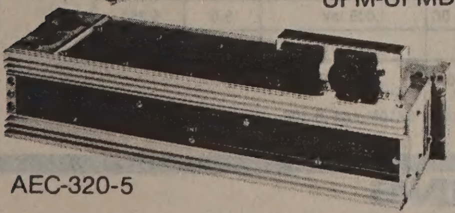
Dual 6050A



6150



UPM-UPMD



AEC-320-5

TRIPLE OUTPUT LAB POWER SUPPLIES

For T^2L, COS/MOS Digital & Analog Applications 0-32VDC, 0-1A ■ 0-32VDC, 0-1A Tracking to 0.1% ■ 0-6VDC, 0-5A or 0-15VDC, 0-2.5A ■ Noise & Ripple less than 1mV P-P... from $420

CALIBRATED POWER SOURCES

Stable, Low Noise, High Resolution for Precision Lab Applications 0-20VDC, 0-500mA or 0-2A ■ 0-40VDC, 0-1A ■ 0-100VDC, 0-400mA ... from $370

HIGH VOLTAGE POWER SOURCES

Calibrated, Low Noise, High Stability for Photomultiplier, Proportional & Solid State Detectors, Electron Optics, Lasers, CRT Displays, Electron Guns, Ion Probes, Scanning Electron Microscopes, Mass Spectrometer Applications. 1kV to 30kV, 1mA to 200mA... from $370

LAB and MODULAR POWER SUPPLIES

Features "Predictable Reliability" pre-testing, guarantees 5-year minimum operation to published specifications. 0-120VDC, 0-15A in 15 models... from $165

REDULE® UNIVERSAL MODULAR POWER SUPPLIES

Single & Dual units with choice of several output levels in one package. 0-100VDC, up to 10A, fixed & adjustable voltage models ... from $147.50

UNIPLY®

The general purpose power source that replaces four conventional power supplies. Available in bench and rack models. Single unit provides 0-7VDC @ 5A, 0-15VDC @ 3A, 0-25VDC @ 2A, 0-60VDC @ 1A... from $249

MODULAR HIGH VOLTAGE PRECISION POWER SOURCES (UPM-UPMD)

High stability, low noise modules, 10-2000VDC, 0-30mA ■ 10-3000VDC, 0-10mA ■ 10-5000VDC, 0-5mA... from $385

NIM POWER SOURCES ("AEC" Series)

Nuclear Instrument Module Bin Power Supplies per TID-20893 ±12VDC @ 2A ■ ±12VDC @ 1A ■ ±6VDC @ 10A ■ ±24VDC @ 1.5A... from $300

POWER DESIGNS INC

1700 Shames Drive
Westbury, N.Y. 11590
516-333-6200
TWX 510-222-6561

3381 Miranda Avenue
Palo Alto, CA 94304
415-493-6111
TWX 910-373-1251

**POWER IS OUR FIRST NAME...
and our Quality and Reliability are Legion.**

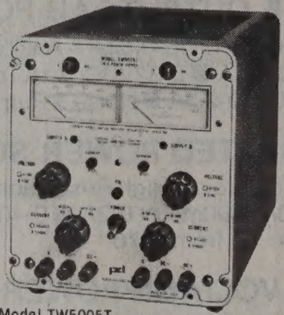
For More Information. Circle No. 342

LABORATORY POWER SUPPLIES

SINGLE OUTPUT

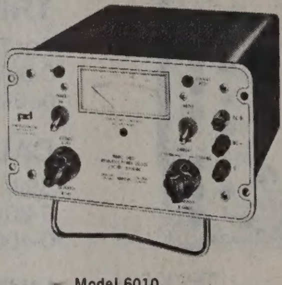
Model 5015T
5¾″ w x 8⅝″ h x 10⅞″ d
Case B

DUAL OUTPUT



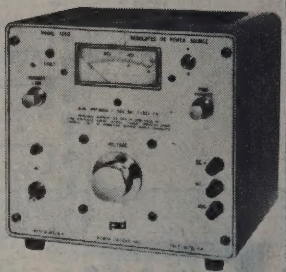
Model TW5005T
7¾″ w x 8⅝″ h x 13½″ d
Case C

SINGLE OUTPUT



Model 6010
Case A 8⅜″ w x 4¾″ h x 9″ d
Case A1 : 12″ d

SINGLE OUTPUT



Model 5030
8½″ w x 7¾″ h x 10½″ d
Case D

• Laboratory workhorse power supplies with over 15 years of field history • Continuously adjustable voltage, current or current limiting controls with limiter or current mode indicating lamps • No RFI generating SCR or switching circuits • Modular package construction suitable for bench or rack mounting • Processed under a "Predictable Reliability" Program for 5-year minimum operation to published specifications. This program features: Avalanche-controlled rectifiers, 100% stress testing of transistors, pre-aged zener references with maximum I/F noise specifications, computer grade capacitors, low T.C. 1% tin oxide film resistors in critical circuits, etc. • Supplies are burned in under full load for a minimum of 50 hours prior to test.

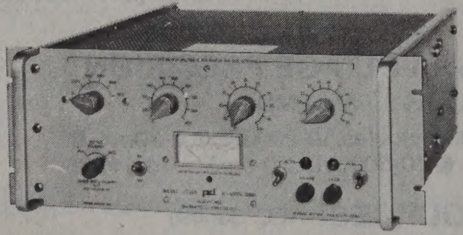
PARTIAL LIST OF AVAILABLE UNITS

Model	Voltage	Current Amps	Voltage Regulation	Current Regulation	Ripple Pk to Pk mV	Case
6010△	0-20/ 50/60	1.5/1.0/ 0.5	0.005% +1 mV	better than 500μA	1.0	A
5030	0-33/50	3/2	0.01% + 1 mV/A	adj. current limit	3	D
6050C△	0-6/15/ 30/60	5.0/3.0/ 2.0/1.0	0.005% +1 mV	better than 1.0 mA	1.0	A1
5015T	0-50	0-1.5	+0.01% or 3 mV†	current limit only	1.0	B
TW5005W	0-50, 0-0.5A each output		each output 0.005% +1 mV	each output better than 500μA	1.0	C
4050	*0-40	0-5.0	0.01% +3 mV	current limit only	3.0	C
1120S	0-120	0-1.0	0.01% +3 mV	current limit only	1.0	C

† Whichever is greater
* Built-in adj. overvoltage crowbar
** Tracking or non-tracking operation by panel switch with common output terminal
△ Uniply® Technique. Model 6050C uses digital display.

HIGH VOLTAGE POWER SOURCES

CALIBRATED POWER SOURCES FOR PHOTOMULTIPLIER PROPORTIONAL AND SOLID STATE DETECTORS, ELECTRON OPTICS, LASERS, CRT DISPLAYS



MODEL 1556B

Calibrated high voltage power sources supplying tightly regulated DC for critical applications where stability, low noise and reliability are of prime consideration. • .25% calibration accuracy • 10 MV resolution • Sealed transformers and rectifiers • Self-restoring overload and short circuit protection • All solid state except for "Series" Pass Tube • Voltage and current metering.

PARTIAL LIST OF AVAILABLE UNITS

Model	Voltage	Current mA	Regulation Line or Load	Ripple Pk to Pk mV	△Size Panel Ht.
2K20	1-2012	0-20	0.001% +2 mV	1.0	3½″
1570	1-3012	*0-40	0.001% +2 mV	1.0	5¼″
1556B	10-6021	0-20	0.001% +2 mV	1.0	7″
1543A	10-10021	0-10	0.001% +2 mV	5.0	10½″
**3K10B	10-3000	0-10	.001% +3 mV	3.0	3.0″
2K100P	500-2012 DC	0-100 DC	.005 mV	5.0	5.25″
3K75P	10-3000	0-75	.005 mV	5.0	5.25″

*Panel adj. current limiting, 5-40 mA
**All solid state. Size: 3″ x 8½″ x 11½″
△Units are std. 19″ rack mtg. except 2K10M and 3K10B

POWER DESIGNS

POWER DESIGNS INC.
1700 SHAMES DRIVE ■ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ■ TWX 510-222-6561

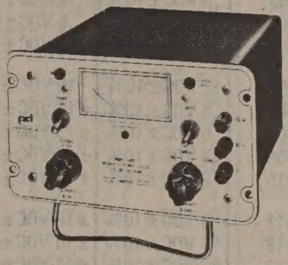
TECHNICAL DATA

LABORATORY BENCH POWER SUPPLIES

• Laboratory workhorse power supplies with over 15 years of field history • Continuously adjustable voltage, current or current limiting controls with limiter or current mode indicating lamps • No RFI generating SCR or switching circuits • Modular package construction suitable for bench or rack mounting • Processed under a "Predictable Reliability" Program for 5-year minimum operation to published specifications. This program features: Avalanche-controlled rectifiers 100% stress testing of transistors, pre-aged zener references with maximum I/F noise specifications, computer grade capacitors, low T.C. 1% tin oxide resistors in critical circuits, etc. • Supplies are burned in under full load for a minimum of 50 hours prior to test.

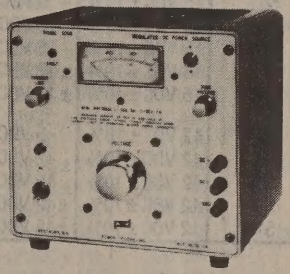
MODEL 6010

0-20V • 1.5A
0-50V • 1.0A
0-60V • 0.5A



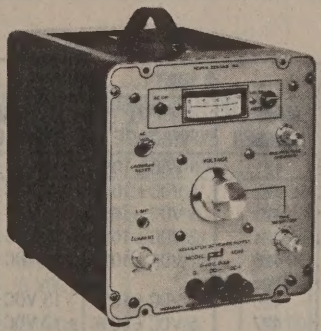
MODEL 5030

0-33 VDC
0-3A
0-50 VDC
0-2A



MODEL 4050

0-40 VDC
0-5A

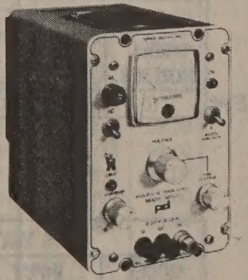


Model	Voltage	Current Amps	Voltage Regulation	Current Regulation	Ripple Pk to Pk mV
6010△	0-20/ 50/60	1.5/ 1.0/ 0.5	0.005% +1 mV	better than 500μA	1.0
5030	0-33/50	3/2	0.01% +1 mV/A	adj. current limit	3
5015T	0-50	0-1.5	+0.01% or 3 mV†	current limit only	1.0
4050	*0-40	0-5.0	0.01% +3 mV	current limit only	3.0
1120S	0-120	0-1.0	0.01% +3 mV	current limit only	1.0

† Whichever is greater * Built-in adj. overvoltage crowbar
△ Uniply® Technqiue. Model 6050C uses digital display.

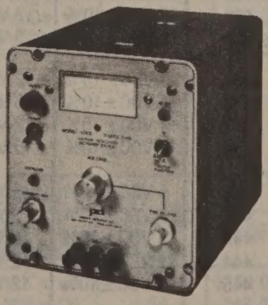
MODEL 5015T

0-50 VDC
0-1.5A



MODEL 1120S

0-120 VDC
0-1.0A



POWER DESIGNS

POWER DESIGNS INC.

1700 SHAMES DRIVE ▪ WESTBURY, N.Y. 11590
Tel: 516-333-6200 ▪ TWX 510-222-6561

QUICK SELECTION: DC-DC CONVERTERS

1 WATT SINGLE & DUAL OUTPUT

MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
401	5 VDC ± 10%	5 VDC ± 5%	100 mA	$34.00
402	5 VDC ± 10%	12 VDC ± 5%	80 mA	34.00
403	5 VDC ± 10%	15 VDC ± 5%	65 mA	34.00
404	12 VDC ± 10%	5 VDC ± 5%	100 mA	34.00
405	12 VDC ± 10%	12 VDC ± 5%	80 mA	34.00
406	12 VDC ± 10%	15 VDC ± 5%	65 mA	34.00
407	5 VDC ± 10%	± 12 VDC ± 5%	± 40 mA	38.00
408	5 VDC ± 10%	± 15 VDC ± 5%	± 33 mA	38.00
409	12 VDC ± 10%	± 12 VDC ± 5%	± 40 mA	38.00
410	12 VDC ± 10%	± 15 VDC ± 5%	± 33 mA	38.00
411	5 VDC ± 10%	± 12 VDC ± 5%	± 40 mA	38.00
412	5 VDC ± 10%	± 15 VDC ± 5%	± 33 mA	38.00
413	12 VDC ± 10%	± 12 VDC ± 5%	± 40 mA	38.00
414	12 VDC ± 10%	± 15 VDC ± 5%	± 33 mA	38.00
501	5 VDC ± 10%	5 VDC ± 5%	100 mA	39.00
502	5 VDC ± 10%	12 VDC ± 5%	80 mA	39.00
503	5 VDC ± 10%	15 VDC ± 5%	65 mA	39.00
504	5 VDC ± 10%	± 12 VDC ± 5%	80 mA	46.00
505	5 VDC ± 10%	± 15 VDC ± 5%	65 mA	46.00
506	12 VDC ± 10%	5 VDC ± 5%	100 mA	39.00
507	12 VDC ± 10%	12 VDC ± 5%	80 mA	39.00
508	12 VDC ± 10%	15 VDC ± 5%	65 mA	39.00
509	12 VDC ± 10%	± 12 VDC ± 5%	80 mA	46.00
510	12 VDC ± 10%	± 15 VDC ± 5%	65 mA	46.00

2 WATT SINGLE & DUAL OUTPUT

MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
421	5 VDC ± 10%	5 VDC ± 5%	250 mA	$42.00
422	5 VDC ± 10%	12 VDC ± 5%	160 mA	42.00
423	5 VDC ± 10%	15 VDC ± 5%	130 mA	42.00
424	12 VDC ± 10%	5 VDC ± 5%	250 mA	42.00
425	12 VDC ± 10%	12 VDC ± 5%	160 mA	42.00
426	12 VDC ± 10%	15 VDC ± 5%	130 mA	42.00
427	5 VDC ± 10%	± 12 VDC ± 5%	± 80 mA	46.50
428	5 VDC ± 10%	± 15 VDC ± 5%	± 65 mA	46.50
429	12 VDC ± 10%	± 12 VDC ± 5%	± 80 mA	46.50
430	12 VDC ± 10%	± 15 VDC ± 5%	± 65 mA	46.50
431	5 VDC ± 10%	± 12 VDC ± 5%	± 80 mA	46.50
432	5 VDC ± 10%	± 15 VDC ± 5%	± 65 mA	46.50
433	12 VDC ± 10%	± 12 VDC ± 5%	± 80 mA	46.50
434	12 VDC ± 10%	± 15 VDC ± 5%	± 65 mA	46.50
441	5 VDC ± 10%	5 VDC ± 5%	250 mA	$44.00
442	5 VDC ± 10%	12 VDC ± 5%	160 mA	44.00
443	5 VDC ± 10%	15 VDC ± 5%	130 mA	44.00
444	12 VDC ± 10%	5 VDC ± 5%	250 mA	44.00
445	12 VDC ± 10%	12 VDC ± 5%	160 mA	44.00
446	12 VDC ± 10%	15 VDC ± 5%	130 mA	44.00
447	5 VDC ± 10%	± 12 VDC ± 5%	± 80 mA	48.50
448	5 VDC ± 10%	± 15 VDC ± 5%	± 65 mA	48.50
449	12 VDC ± 10%	± 12 VDC ± 5%	± 80 mA	48.50
450	12 VDC ± 10%	± 15 VDC ± 5%	± 65 mA	48.50

2 WATT SINGLE & DUAL OUTPUT

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
NEW	461	5 VDC ± 10%	5 VDC ± 4%	250 mA	$52.00
NEW	462	5 VDC ± 10%	8 VDC ± 4%	250 mA	52.00
NEW	463	5 VDC ± 10%	12 VDC ± 4%	160 mA	52.00
NEW	464	5 VDC ± 10%	15 VDC ± 4%	130 mA	52.00
NEW	465	5 VDC ± 10%	21 VDC ± 4%	95 mA	52.00
NEW	466	12 VDC ± 16%	5 VDC ± 4%	250 mA	52.00
NEW	467	12 VDC ± 16%	8 VDC ± 4%	250 mA	52.00
NEW	468	12 VDC ± 16%	12 VDC ± 4%	160 mA	52.00
NEW	469	12 VDC ± 16%	15 VDC ± 4%	130 mA	52.00
NEW	470	12 VDC ± 16%	21 VDC ± 4%	95 mA	52.00
NEW	471	24 VDC ± 16%	5 VDC ± 4%	250 mA	52.00
NEW	472	24 VDC ± 16%	8 VDC ± 4%	250 mA	52.00
NEW	473	24 VDC ± 16%	12 VDC ± 4%	160 mA	52.00
NEW	474	24 VDC ± 16%	15 VDC ± 4%	130 mA	52.00
NEW	475	24 VDC ± 16%	21 VDC ± 4%	95 mA	52.00
NEW	476	28 VDC ± 14%	5 VDC ± 4%	250 mA	52.00
NEW	477	28 VDC ± 14%	8 VDC ± 4%	250 mA	52.00
NEW	478	28 VDC ± 14%	12 VDC ± 4%	160 mA	52.00
NEW	479	28 VDC ± 14%	15 VDC ± 4%	130 mA	52.00
NEW	480	28 VDC ± 14%	21 VDC ± 4%	95 mA	52.00
NEW	481	48 VDC − 12/ + 16%	5 VDC ± 4%	250 mA	52.00
NEW	482	48 VDC − 12/ + 16%	8 VDC ± 4%	250 mA	52.00
NEW	483	48 VDC − 12/ + 16%	12 VDC ± 4%	160 mA	52.00
NEW	484	48 VDC − 12/ + 16%	15 VDC ± 4%	130 mA	52.00
NEW	485	48 VDC − 12/ + 16%	21 VDC ± 4%	95 mA	52.00
NEW	486	5 VDC ± 10%	± 12 VDC ± 2%	± 80 mA	56.00
NEW	487	5 VDC ± 10%	± 15 VDC ± 2%	± 65 mA	56.00
NEW	488	12 VDC ± 16%	± 12 VDC ± 2%	± 80 mA	56.00
NEW	489	12 VDC ± 16%	± 15 VDC ± 2%	± 65 mA	56.00
NEW	490	24 VDC ± 16%	± 12 VDC ± 2%	± 80 mA	56.00
NEW	491	24 VDC ± 16%	± 15 VDC ± 2%	± 65 mA	56.00
NEW	492	28 VDC ± 14%	± 12 VDC ± 2%	± 80 mA	56.00
NEW	493	28 VDC ± 14%	± 15 VDC ± 2%	± 65 mA	56.00
NEW	494	48 VDC − 12/ + 16%	± 12 VDC ± 2%	± 80 mA	56.00
NEW	495	48 VDC − 12/ + 16%	± 15 VDC ± 2%	± 65 mA	56.00

5 WATT SINGLE OUTPUT

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
NEW	710	7 to 32 VDC	5 VDC ± 2%(adj)	1000 mA	$62.00

6 WATT DUAL OUTPUT

	MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
NEW	623	5 VDC ± 10%	± 12 VDC ± 5%	± 250 mA	$69.00
NEW	624	5 VDC ± 10%	± 15 VDC ± 5%	± 250 mA	69.00
NEW	625	5 VDC ± 10%	± 18 VDC ± 5%	± 165 mA	69.00

POWER GENERAL 152 WILL DRIVE, CANTON, MA 02021 TWX: 710-348-0200 TELEPHONE: (617) 828-6216

5 WATT SINGLE & DUAL OUTPUT

MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
801	5 VDC±10%	5 VDC±1%	1000 mA	$79.00
802	12 VDC±10%	5 VDC±1%	1000 mA	79.00
803	24 VDC±10%	5 VDC±1%	1000 mA	79.00
804	28 VDC±10%	5 VDC±1%	1000 mA	79.00
805	48 VDC±10%	5 VDC±1%	1000 mA	79.00
806	5 VDC±10%	9 VDC±1%	550 mA	79.00
807	12 VDC±10%	9 VDC±1%	550 mA	79.00
808	24 VDC±10%	9 VDC±1%	550 mA	79.00
809	28 VDC±10%	9 VDC±1%	550 mA	79.00
810	48 VDC±10%	9 VDC±1%	550 mA	79.00
811	5 VDC±10%	12 VDC±1%	450 mA	79.00
812	12 VDC±10%	12 VDC±1%	450 mA	79.00
813	24 VDC±10%	12 VDC±1%	450 mA	79.00
814	28 VDC±10%	12 VDC±1%	450 mA	79.00
815	48 VDC±10%	12 VDC±1%	450 mA	79.00
816	5 VDC±10%	15 VDC±1%	350 mA	79.00
817	12 VDC±10%	15 VDC±1%	350 mA	79.00
818	24 VDC±10%	15 VDC±1%	350 mA	79.00
819	28 VDC±10%	15 VDC±1%	350 mA	79.00
820	48 VDC±10%	15 VDC±1%	350 mA	79.00
821	5 VDC±10%	±12 VDC±1%	±230 mA	84.00
822	12 VDC±10%	±12 VDC±1%	±230 mA	84.00
823	24 VDC±10%	±12 VDC±1%	±230 mA	84.00
824	28 VDC±10%	±12 VDC±1%	±230 mA	84.00
825	48 VDC±10%	±12 VDC±1%	±230 mA	84.00
826	5 VDC±10%	±15 VDC±1%	±170 mA	84.00
827	12 VDC±10%	±15 VDC±1%	±170 mA	84.00
828	24 VDC±10%	±15 VDC±1%	±170 mA	84.00
829	28 VDC±10%	±15 VDC±1%	±170 mA	84.00
830	48 VDC±10%	±15 VDC±1%	±170 mA	84.00

10 WATT SINGLE & DUAL OUTPUT

MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
901	5 VDC±10%	5 VDC±1%	2000 mA	$99.00
902	12 VDC±10%	5 VDC±1%	2000 mA	99.00
903	24 VDC±10%	5 VDC±1%	2000 mA	99.00
904	28 VDC±10%	5 VDC±1%	2000 mA	99.00
905	48 VDC±10%	5 VDC±1%	2000 mA	99.00
906	5 VDC±10%	9 VDC±1%	1200 mA	99.00
907	12 VDC±10%	9 VDC±1%	1200 mA	99.00
908	24 VDC±10%	9 VDC±1%	1200 mA	99.00
909	28 VDC±10%	9 VDC±1%	1200 mA	99.00
910	48 VDC±10%	9 VDC±1%	1200 mA	99.00
911	5 VDC±10%	12 VDC±1%	900 mA	99.00
912	12 VDC±10%	12 VDC±1%	900 mA	99.00
913	24 VDC±10%	12 VDC±1%	900 mA	99.00
914	28 VDC±10%	12 VDC±1%	900 mA	99.00
915	48 VDC±10%	12 VDC±1%	900 mA	99.00
916	5 VDC±10%	15 VDC±1%	700 mA	99.00
917	12 VDC±10%	15 VDC±1%	700 mA	99.00
918	24 VDC±10%	15 VDC±1%	700 mA	99.00
919	28 VDC±10%	15 VDC±1%	700 mA	99.00
920	48 VDC±10%	15 VDC±1%	700 mA	99.00
921	5 VDC±10%	±12 VDC±1%	±450 mA	104.00
922	12 VDC±10%	±12 VDC±1%	±450 mA	104.00
923	24 VDC±10%	±12 VDC±1%	±450 mA	104.00
924	28 VDC±10%	±12 VDC±1%	±450 mA	104.00
925	48 VDC±10%	±12 VDC±1%	±450 mA	104.00
926	5 VDC±10%	±15 VDC±1%	±350 mA	104.00
927	12 VDC±10%	±15 VDC±1%	±350 mA	104.00
928	24 VDC±10%	±15 VDC±1%	±350 mA	104.00
929	28 VDC±10%	±15 VDC±1%	±350 mA	104.00
930	48 VDC±10%	±15 VDC±1%	±350 mA	104.00

10 WATT TRIPLE OUTPUT

MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
931	5 VDC±10%	5VDC±1% ±15VDC±1%	1A ±165 mA	$124.00
932	12 VDC±10%	5VDC±1% ±15VDC±1%	1A ±165 mA	124.00
933	24 VDC±10%	5VDC±1% ±15VDC±1%	1A ±165 mA	124.00
934	28 VDC±10%	5VDC±1% ±15VDC±1%	1A ±165 mA	124.00
935	48 VDC±10%	5VDC±1% ±15VDC±1%	1A ±165 mA	124.00
936	5 VDC±10%	5VDC±1% ±12VDC±1%	1A ±200 mA	124.00
937	12 VDC±10%	5VDC±1% ±12VDC±1%	1A ±200 mA	124.00
938	24 VDC±10%	5VDC±1% ±12VDC±1%	1A ±200 mA	124.00
939	28 VDC±10%	5VDC±1% ±12VDC±1%	1A ±200 mA	124.00
940	48 VDC±10%	5VDC±1% ±12VDC±1%	1A ±200 mA	124.00
941	5 VDC±10%	5VDC±1% +12VDC±1% −5VDC±1%	1A 300 mA 100 mA	124.00
942	12 VDC±10%	5VDC±1% +12VDC±1% −5VDC±1%	1A 300 mA 100 mA	124.00
943	24 VDC±10%	5VDC±1% +12VDC±1% −5VDC±1%	1A 300 mA 100 mA	124.00
944	28 VDC±10%	5VDC±1% +12VDC±1% −5VDC±1%	1A 300 mA 100 mA	124.00
945	48 VDC±10%	5VDC±1% +12VDC±1% −5VDC±1%	1A 300 mA 100 mA	124.00

15 WATTS TO 50 WATTS SINGLE OUTPUT

MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
700	9.5 TO 40 VDC	3 VDC±1%	3A	$88.00
701	8 TO 40 VDC	3 VDC±1%	5A	109.00
702	9.5 TO 40 VDC	5 VDC±1%	3A	88.00
703	8 TO 40 VDC	5 VDC±1%	5A	109.00
704	8 TO 40 VDC	6 VDC±1%	4A	109.00
705	14 TO 40 VDC	12 VDC±1%	2A	88.00
706	14 TO 40 VDC	12 VDC±1%	4A	109.00
707	17 TO 40 VDC	15 VDC±1%	1.5A	88.00
708	17 TO 40 VDC	15 VDC±1%	3A	109.00

25 WATTS SINGLE OUTPUT

MODEL NUMBER	INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	PRICE
711	20 to 72 VDC	5 VDC±1%	5A	$149.00
712	20 to 72 VDC	6 VDC±1%	4.5A	149.00
713	20 to 72 VDC	12 VDC±1%	2.5A	149.00
714	20 to 72 VDC	15 VDC±1%	2A	149.00

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QUICK SELECTION CHARTS: SWITCHING POWER SUPPLIES

SINGLE OUTPUT MODELS

MODEL NO.	OUTPUT VOLT/TOL	OUTPUT CURRENT	MAX. OUTPUT POWER	EFFICIENCY	FORM FACTOR	PRICE
125	5 VDC ±2%	5A	25W	80%	MODULE	$104.00
126	9 VDC ±2%	2.8A	25W	80%	MODULE	$104.00
127	12 VDC +2%	2A	25W	80%	MODULE	$104.00
128	14 VDC ±2%	1.7A	25W	80%	MODULE	$104.00
1030-1A	5 VDC ADJ	6A	30W	80%	P.C. BOARD	$94.00
1030-1B	5 VDC ADJ	6A	30W	80%	OPEN FRAME	$104.00
1030-1C	5 VDC ADJ	6A	30W	80%	ENCLOSED	$114.00
1030-2A	12 VDC ADJ	2.5A	30W	80%	P.C. BOARD	$94.00
1030-2B	12 VDC ADJ	2.5A	30W	80%	OPEN FRAME	$104.00
1030-2C	12 VDC ADJ	2.5A	30W	80%	ENCLOSED	$114.00
1030-3A	15 VDC ADJ	2A	30W	80%	P.C. BOARD	$94.00
1030-3B	15 VDC ADJ	2A	30W	80%	OPEN FRAME	$104.00
1030-3C	15 VDC ADJ	2A	30W	80%	ENCLOSED	$114.00
1030-4A	24 VDC ADJ	1.2A	30W	80%	P.C. BOARD	$94.00
1030-4B	24 VDC ADJ	1.2A	30W	80%	OPEN FRAME	$104.00
1030-4C	24 VDC ADJ	1.2A	30W	80%	ENCLOSED	$114.00
1040-1	5 VDC ADJ	8A	40W	80%	P.C. BOARD	$64.00
1040-2	12 VDC ADJ	3A	40W	80%	P.C. BOARD	$64.00
1040-3	15 VDC ADJ	2.5A	40W	80%	P.C. BOARD	$64.00
1040-4	24 VDC ADJ	1.7A	40W	80%	P.C. BOARD	$64.00
1040-5	28 VDC ADJ	1.5A	40W	80%	P.C. BOARD	$64.00
1050-1	5 VDC ADJ	10A	50W	80%	P.C. BOARD	$109.00
1050-2	12 VDC ADJ	4A	50W	80%	P.C. BOARD	$109.00
1050-3	15 VDC ADJ	3.4A	50W	80%	P.C. BOARD	$109.00
1050-4	24 VDC ADJ	2A	50W	80%	P.C. BOARD	$109.00

SINGLE OUTPUT MODELS

MODEL NO.	OUTPUT VOLT/TOL	OUTPUT CURRENT	MAX. OUTPUT POWER	EFFICIENCY	FORM FACTOR	PRICE
1060-1A	5 VDC ADJ	12A	60W	80%	P.C. BOARD	$115.00
1060-1B	5 VDC ADJ	12A	60W	80%	OPEN FRAME	$127.00
1060-1C	5 VDC ADJ	12A	60W	80%	ENCLOSED	$137.00
1060-2A	12 VDC ADJ	5A	60W	80%	P.C. BOARD	$115.00
1060-2B	12 VDC ADJ	5A	60W	80%	OPEN FRAME	$127.00
1060-2C	12 VDC ADJ	5A	60W	80%	ENCLOSED	$137.00
1060-3A	15 VDC ADJ	4A	60W	80%	P.C. BOARD	$115.00
1060-3B	15 VDC ADJ	4A	60W	80%	OPEN FRAME	$127.00
1060-3C	15 VDC ADJ	4A	60W	80%	ENCLOSED	$137.00
1060-4A	24 VDC ADJ	2.5A	60W	80%	P.C. BOARD	$115.00
1060-4B	24 VDC ADJ	2.5A	60W	80%	OPEN FRAME	$127.00
1060-4C	24 VDC ADJ	2.5A	60W	80%	ENCLOSED	$137.00
1100-1	5 VDC ADJ	20A	100W	80%	P.C. BOARD	$169.00
1100-2	12 VDC ADJ	9A	100W	80%	P.C. BOARD	$169.00
1100-3	15 VDC ADJ	8A	100W	80%	P.C. BOARD	$169.00

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DUAL OUTPUT MODELS

MODEL NO.	OUTPUT NO. 1 VOLT/TOL	OUTPUT NO. 1 CURRENT	OUTPUT NO. 2 VOLT/TOL	OUTPUT NO. 2 CURRENT	MAX. OUTPUT POWER	EFFICIENCY	FORM FACTOR	PRICE
225	+5 VDC ±2%	4A	−5 VDC ±5%	1A	25W	80%	MODULE	$109.00
226	+12 VDC ±2%	1.8A	−12 VDC ±5%	1.8A	25W	80%	MODULE	$109.00
227	+15 VDC ±2%	1.8A	−15 VDC ±5%	1.8A	25W	80%	MODULE	$109.00
2050-1	+5 VDC ADJ	8A	−5 VDC (1)	2A	50W	75%	P.C. BOARD	$119.00
2050-2	+12 VDC ADJ	3A	−12 VDC (1)	2A	50W	75%	P.C. BOARD	$119.00
2050-3	+15 VDC ADJ	3A	−15 VDC (1)	2A	50W	75%	P.C. BOARD	$119.00
2040-2A	+5 VDC ADJ	8A	−5 VDC ±3%	4A	60W	80%	P.C. BOARD	$125.00
2040-2B	+5 VDC ADJ	8A	−5 VDC ±3%	4A	60W	80%	OPEN FRAME	$135.00
2040-2C	+5 VDC ADJ	8A	−5 VDC ±3%	4A	60W	80%	ENCLOSED	$147.00
2040-3A	+12 VDC ADJ	3A	−12 VDC ±3%	2A	60W	80%	P.C. BOARD	$125.00
2040-3B	+12 VDC ADJ	3A	−12 VDC ±3%	2A	60W	80%	OPEN FRAME	$135.00
2040-3C	+12 VDC ADJ	3A	−12 VDC ±3%	2A	60W	80%	ENCLOSED	$147.00
2040-4A	+15 VDC ADJ	2A	−15 VDC ±3%	2A	60W	80%	P.C. BOARD	$125.00
2040-4B	+15 VDC ADJ	2A	−15 VDC ±3%	2A	60W	80%	P.C. BOARD	$135.00
2040-4C	+15 VDC ADJ	2A	−15 VDC ±3%	2A	60W	80%	P.C. BOARD	$147.00
2060-1A	+5 VDC ADJ	6A	+24 VDC ±5%	0.5A (2.5A pk)	60W	80%	P.C. BOARD	$125.00
2060-1B	+5 VDC ADJ	6A	+24 VDC ±5%	0.5A (2.5A pk)	60W	80%	OPEN FRAME	$135.00
2060-1C	+5 VDC ADJ	6A	+24 VDC ±5%	0.5A (2.5A pk)	60W	80%	ENCLOSED	$147.00
2060-2A	+5 VDC ADJ	8A	+12 VDC ±5%	1.6A (3.1A pk)	60W	80%	P.C. BOARD	$125.00
2060-2B	+5 VDC ADJ	8A	+12 VDC ±5%	1.6A (3.1A pk)	60W	80%	OPEN FRAME	$135.00
2060-2C	+5 VDC ADJ	8A	+12 VDC ±5%	1.6A (3.1A pk)	60W	80%	ENCLOSED	$147.00
3050-7	+5 VDC ADJ	5A	+24 VDC ±5%	1.7A (2.5A pk)	60W	70%	P.C. BOARD	$119.00
3050-8	+5 VDC ADJ	5A	+12 VDC ±5%	4A (6A pk)	60W	70%	P.C. BOARD	$119.00
3050-9	+5 VDC ADJ	5A	+24 VDC ±5%	2.5A (3.5A pk)	60W	70%	P.C. BOARD	$119.00

TRIPLE OUTPUT MODELS

MODEL NO.	OUTPUT NO. 1 VOLT/TOL	OUTPUT NO. 1 CURRENT	OUTPUT NO. 2 VOLT/TOL	OUTPUT NO. 2 CURRENT	OUTPUT NO. 3 VOLT/TOL	OUTPUT NO. 3 CURRENT	MAX. OUTPUT POWER	EFFICIENCY	FORM FACTOR	PRICE
325	+5 VDC ±2%	4A	+12 VDC ±4%	0.2A	−12 VDC ±4%	0.2A	25W	70%	MODULE	$109.00
326	+5 VDC ±2%	4A	+15 VDC ±4%	0.2A	−15 VDC ±4%	0.2A	25W	70%	MODULE	$109.00
3030-1	+5 VDC ADJ	3A	+12 VDC ±5%	0.5A	−12 VDC ±5%	0.5A	30W	65%	P.C. BOARD	$ 69.00
3030-2	+5 VDC ADJ	3A	+15 VDC ±5%	0.5A	−15 VDC ±5%	0.5A	30W	65%	P.C. BOARD	$ 69.00
3045-1	+5 VDC ADJ	3A	+12 VDC ±5%	2A	−12 VDC ±5%	0.5A	40W	75%	P.C. BOARD	$ 69.00
3045-2	+5 VDC ADJ	3A	+12 VDC ±5%	2A	−12 VDC ±5%	0.5A	40W	75%	P.C. BOARD	$ 79.00
3045-3	+5 VDC ADJ	3A	+12 VDC ±5%	2A	− 5 VDC ±5%	0.5A	40W	75%	P.C. BOARD	$ 69.00
3050-1	+5 VDC ADJ	6A	+12 VDC ±5%	1A	−12 VDC ±5%	1A	50W	70%	P.C. BOARD	$119.00
3050-2	+5 VDC ADJ	6A	+15 VDC ±5%	1A	−15 VDC ±5%	1A	50W	70%	P.C. BOARD	$119.00
3050-3	+5 VDC ADJ	6A	+12 VDC ±5%	2A (3A pk)	−12 VDC ±5%	2A	50W	70%	P.C. BOARD	$119.00
3050-4	+5 VDC ADJ	6A	+15 VDC ±5%	2A (3A pk)	−15 VDC ±5%	2A	50W	70%	P.C. BOARD	$119.00
3050-5	+5 VDC ADJ	6A	− 5 VDC ±5%	0.1A	+12 VDC ±5%	3A (5A pk)	50W	70%	P.C. BOARD	$119.00
3050-6	+5 VDC ADJ	6A	+12 VDC ±5%	3A (5A pk)	−12 VDC ±5%	0.2A	50W	70%	P.C. BOARD	$119.00
3060-1	+5 VDC ADJ	6A	+12 VDC ±5%	3A (5A pk)	−12 VDC ±5%	1A	60W	70%	P.C. BOARD	$135.00
3060-2	+5 VDC ADJ	6A	+15 VDC ±5%	3A (5A pk)	−15 VDC ±5%	1A	60W	70%	P.C. BOARD	$135.00
3065-1	+5 VDC ADJ	8A	+12 VDC ±5%	0.1A	−12 VDC ±5%	0.1A	65W	70%	P.C. BOARD	$179.00
3065-2	+5 VDC ADJ	8A	+15 VDC ±5%	0.1A	−15 VDC ±5%	0.1A	65W	70%	P.C. BOARD	$179.00
3065-3	+5 VDC ADJ	6A	+12 VDC ADJ	0.1A	−12 VDC ±5%	0.1A	65W	70%	P.C. BOARD	$189.00
3075-1	+5 VDC ±5%	6A	+12 VDC ±5%	4A	−12 VDC ±6%	1A	75W	70%	P.C. BOARD	$119.00
3075-2	+5 VDC ±5%	6A	+12 VDC ±5%	4A	− 5 VDC ±6%	1A	75W	70%	P.C. BOARD	$119.00
3075-3	+5 VDC ±5%	6A	+24 VDC ±5%	2A	−12 VDC ±6%	1A	75W	70%	P.C. BOARD	$119.00
3100-1	+5 VDC ADJ	15A	+12 VDC ±5%	1A	−12 VDC ±5%	1A	100W	65%	P.C. BOARD	$199.00
3100-2	+5 VDC ADJ	15A	+15 VDC ±5%	1A	−15 VDC ±5%	1A	100W	65%	P.C. BOARD	$199.00
3100-3	+5 VDC ADJ	10A	+12 VDC ±5%	3A	−12 VDC ±5%	1A	100W	65%	P.C. BOARD	$199.00

For More Information. Circle No. 343

QUAD OUTPUT MODELS

MODEL NO.	OUTPUT NO. 1		OUTPUT NO. 2		OUTPUT NO. 3	
	VOLT/TOL	CURRENT	VOLT/TOL	CURRENT	VOLT/TOL	CURRENT
4027-1	+5 VDC ADJ	4A	−2.5 to −15 VDC	0.1 to 0.5A	+15 VDC ±4%	0.5A
4027-2	+5 VDC ADJ	4A	−2.5 to −15 VDC	0.1 to 0.5A	+12 VDC ±4%	0.5A
4043-1	+5 VDC ADJ	3A	−5 VDC ±1%	0.3A	+12 VDC ±5%	2A
4050-1	+5 VDC ADJ	6A	−5 VDC ±5%	1A	+12 VDC ±5%	2A (3A pk)
4050-2	+5 VDC ADJ	6A	−5 VDC ±5%	1A	+15 VDC ±5%	2A (3A pk)
4070-1	+5 VDC ADJ	6A	−12 VDC ±5%	1A	+12 VDC ±5%	1A
4070-2	+5 VDC ADJ	6A	−15 VDC ±5%	1A	+15 VDC ±5%	1A
4075-1	+5 VDC ±5%	6A	+12 VDC ±5%	2A	−12 VDC ±5%	1A
4075-2	+5 VDC ±5%	6A	+12 VDC ±5%	2A	−12 VDC ±5%	1A
4075-3	+5 VDC ±5%	6A	+12 VDC ±5%	2A	−12 VDC ±5%	1A
4100-1	+5 VDC ADJ	10A	−5 VDC ±3%	10A	+12 VDC ±5%	1.5A
4100-2	+5 VDC ADJ	10A	−5 VDC ±3%	10A	+15 VDC ±5%	1.5A
4100-3	+5 VDC ADJ	10A	−5 VDC ±3%	10A	+12 VDC ±5%	3A
4100-4	+4 VDC ADJ	10A	−5 VDC ±3%	10A	+15 VDC ±5%	3A
4110-1	+5 VDC ADJ	10A	+12 VDC ±5%	3A	−12 VDC ±5%	3A
4110-2	+5 VDC ADJ	10A	+12 VDC ±5%	3A	−12 VDC ±5%	3A
4110-3	+5 VDC ADJ	10A	+12 VDC ±5%	3A	−12 VDC ±5%	3A
4110-4	+5 VDC ADJ	10A	+12 VDC ±5%	3A	−12 VDC ±5%	3A
4110-5	+5 VDC ADJ	10A	12 VDC (iso) ±5%	4A	−12 VDC ±5%	0.5A

FIVE OUTPUT MODELS

MODEL NO.	OUTPUT NO. 1		OUTPUT NO. 2		OUTPUT NO. 3	
	VOLT/TOL	CURRENT	VOLT/TOL	CURRENT	VOLT/TOL	CURRENT
5100-1	+5 VDC ADJ	10A	−5 VDC ±3%	1A	+12 VDC ±5%	1.5A
5100-2	+5 VDC ADJ	10A	−5 VDC ±3%	1A	+15 VDC ±5%	1.5A
5100-3	+5 VDC ADJ	10A	−5 VDC ±3%	1A	+12 VDC ±5%	2A
5100-4	+5 VDC ADJ	10A	−5 VDC ±3%	1A	+15 VDC ±5%	2A
5110-1	+5 VDC ADJ	10A	−5 VDC ±3%	1A	+12 VDC ±5%	1A
5110-2	+5 VDC ADJ	10A	−5 VDC ±3%	1A	+15 VDC ±5%	1A
5110-3	+5 VDC ADJ	10A	−5 VDC ±3%	1A	+12 VDC ±5%	1A

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QUAD OUTPUT MODELS

OUTPUT NO. 4		MAX. OUTPUT POWER	EFFI-CIENCY	FORM FACTOR	PRICE
VOLT/TOL	CURRENT				
−15 VDC ±4%	0.5A	30W	70%	P.C. BOARD	$135.00
−12 VDC ±4%	0.5A	30W	70%	P.C. BOARD	$135.00
−12 VDC ±5%	0.3A	40W	75%	P.C. BOARD	$69.00
−15 VDC ±5%	1A	60W	70%	P.C. BOARD	$139.00
−15 VDC ±5%	1A	60W	70%	P.C. BOARD	$139.00
+24 VDC ±5%	1.5A (3A pk)	70W	70%	P.C. BOARD	$145.00
+24 VDC ±5%	1.5A (3A pk)	70W	70%	P.C. BOARD	$145.00
12 VDC (iso) ±5%	2A	75W	70%	P.C. BOARD	$129.00
5 VDC (iso) ±5%	2A	75W	70%	P.C. BOARD	$129.00
24 VDC (iso) ±5%	2A	75W	70%	P.C. BOARD	$129.00
−12 VDC ±5%	1.5A	100W	70%	P.C. BOARD	$169.00
−15 VDC ±5%	1.5A	100W	70%	P.C. BOARD	$169.00
−12 VDC ±5%	3A	100W	70%	P.C. BOARD	$169.00
−15 VDC ±5%	3A	100W	70%	P.C. BOARD	$169.00
12 VDC (iso) ±5%	3A	100W	70%	P.C. BOARD	$169.00
24 VDC (iso) ±5%	2A	100W	70%	P.C. BOARD	$169.00
15 VDC (iso) ±5%	3A	100W	70%	P.C. BOARD	$169.00
5 VDC (iso) ±5%	3A	100W	70%	P.C. BOARD	$169.00
−5 VDC ±5%	0.25A	100W	70%	P.C. BOARD	$169.00

FIVE OUTPUT MODELS

OUTPUT NO. 4		OUTPUT NO. 5		MAX. OUTPUT POWER	EFFI-CIENCY	FORM FACTOR	PRICE
VOLT/TOL	CURRENT	VOLT/TOL	CURRENT				
−12 VDC ±5%	1.5A	12 to 30 VDC	0.4 to 1A	100W	70%	P.C. Board	$179.00
−15 VDC ±5%	1.5A	12 to 30 VDC	0.4 to 1A	100W	70%	P.C. Board	$179.00
−12 VDC ±5%	2A	12 to 30 VDC	0.4 to 1A	100W	70%	P.C. Board	$179.00
−15 VDC ±5%	2A	12 to 30 VDC	0.4 to 1A	100W	70%	P.C. Board	$179.00
−2.5 to −12 VDC	0.2 to 1A	24 VDC ±5%	2.5A (4A pk)	100W	70%	P.C. Board	$179.00
−2.5 to −15 VDC	0.2 to 1A	24 VDC ±5%	2.5A (4A pk)	100W	70%	P.C. Board	$179.00
−2.0 to −12 VDC	0.2 to 1A	12 VDC ±5%	3A (4A pk)	100W	70%	P.C. Board	$179.00

POWER GENERAL 152 WILL DRIVE, CANTON, MA 02021 TWX: 710-348-0200 TELEPHONE: (617) 828-6216

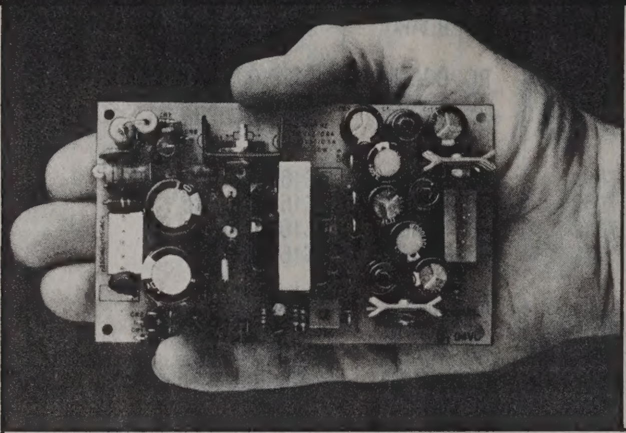
For More Information. Circle No. 343

NEW FROM POWER GENERAL
NEW PRODUCTS — SWITCHING SUPPLIES

POWER
GENERAL
A SUBSIDIARY OF **UNITRODE** CORPORATION

ULTRA MINIATURE
30 WATT SWITCHING POWER SUPPLIES
TRIPLE OUTPUT, LOW NOISE
ALL OUTPUTS FULLY REGULATED

3030 SERIES



FEATURES

- 5, +12, and −12 (or +15 and −15) VDC outputs fully regulated
- Low output noise
- 90-130 VAC or 180-250 VAC input
- Small size — light weight
- Designed to meet VDE, UL, and CSA safety standards

APPLICATIONS

- Analog systems
- Digital systems
- Analog/Digital systems
- Microprocessor based systems
- General-purpose power supply

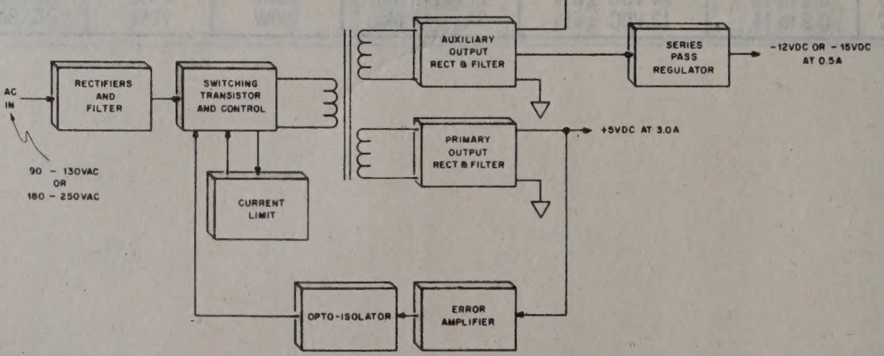
GENERAL DESCRIPTION

This new series of power supplies features triple outputs delivering a total of 30 watts of continuous output power. All outputs are low noise and tightly regulated for use in analog/digital applications where these characteristics are essential.

Low cost, light weight, and high performance make the Model 3030 an ideal choice for OEM applications where space is at a premium. The Model 3030 is designed to meet the safety requirements of UL, CSA, VDE, and IEC.

Advanced circuit design and manufacturing techniques permit a low price, yet high-grade components are used throughout. Each power supply undergoes a rigorous computerized test and burn-in program before delivery.

BLOCK DIAGRAM
MODEL 3030 — 1 & 2


AC IN
90 - 130VAC OR 180 - 250VAC
RECTIFIERS AND FILTER
SWITCHING TRANSISTOR AND CONTROL
CURRENT LIMIT
AUXILIARY OUTPUT RECT & FILTER
PRIMARY OUTPUT RECT & FILTER
SERIES PASS REGULATOR
+12VDC OR +15VDC AT 0.5A
SERIES PASS REGULATOR
-12VDC OR -15VDC AT 0.5A
+5VDC AT 3.0A
OPTO-ISOLATOR
ERROR AMPLIFIER

POWER GENERAL 152 WILL DRIVE, CANTON, MA 02021 TWX: 710-348-0200 TELEPHONE: (617) 828-6216

For More Information. Circle No. 343

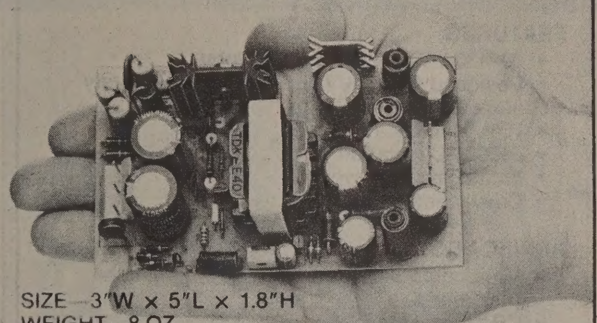
NEW FROM POWER GENERAL
NEW PRODUCTS — SWITCHING SUPPLIES

POWER GENERAL
A SUBSIDIARY OF **UNITRODE** CORPORATION

WORLD'S SMALLEST 40 WATT SWITCHERS SINGLE, TRIPLE & QUAD OUTPUTS

1040, 3045, 4043 SERIES

Model 3045-1
5V @ 3A, +12V @ 2A (5A pk), −12V @ 0.5A



SIZE—3"W x 5"L x 1.8"H
WEIGHT—8 OZ
$27.50 OEM QTY

FEATURES

- Small size, light weight
- Designed to meet UL, CSA, VDE & IEC safety standards
- 75% efficiency
- 90 to 130 VAC or 180 to 250 VAC user selectable input

APPLICATIONS

- CRT terminals
- Disc drive systems
- Microcomputers
- Portable equipment
- General purpose power supply

GENERAL DESCRIPTION

The 1040, 3045 and 4043 series of power supplies, are comprised of a number of single, triple and quad output models capable of delivering 40 watts of continuous output power.

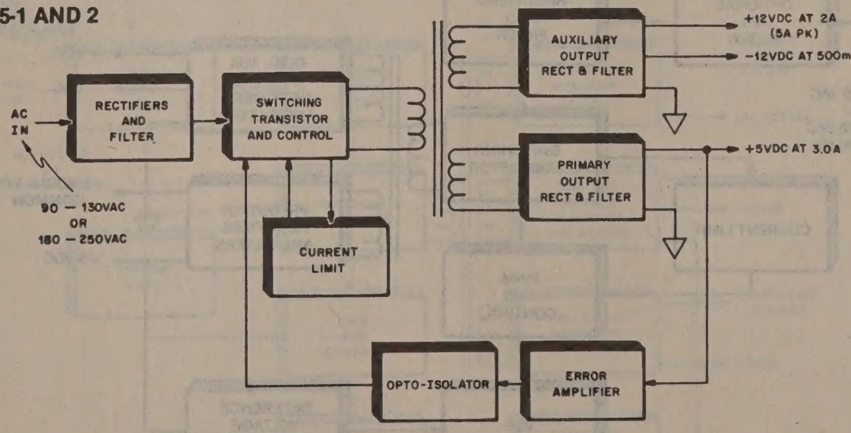
Their low cost, light weight and high performance features offer the OEM user a power supply which can satisfy the majority of today's CRT, disk-drive, microprocessor and mixed analog/logic applications. Their small size and high efficiency makes these power supplies an ideal choice for portable equipment, microcomputers or peripherals where space is a premium.

All models are designed to meet the safety requirements of UL, CSA, VDE and IEC.

The model 3045-2 is a direct replacement of similar units offered by other manufacturers, but the Power General unit offers higher output current capabilities, to facilitate easy and non-costly end user system upgrade.

Although priced low, due to advanced circuit and manufacturing techniques, high grade components are used, and an extensive computerized test and burn-in program accompanies each unit.

BLOCK DIAGRAM
MODEL 3045-1 AND 2


AC IN
90 — 130VAC OR 180 — 250VAC
RECTIFIERS AND FILTER
SWITCHING TRANSISTOR AND CONTROL
CURRENT LIMIT
AUXILIARY OUTPUT RECT & FILTER
+12VDC AT 2A (5A PK)
−12VDC AT 500mA
PRIMARY OUTPUT RECT & FILTER
+5VDC AT 3.0A
OPTO-ISOLATOR
ERROR AMPLIFIER

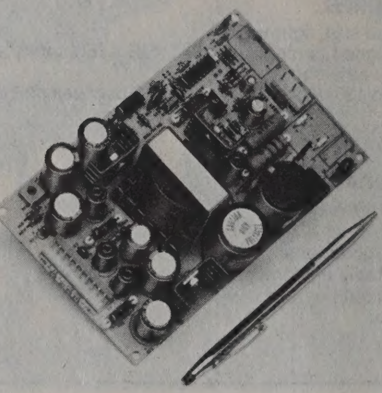
POWER GENERAL 152 WILL DRIVE, CANTON, MA 02021 TWX: 710-348-0200 TELEPHONE: (617) 828-6216

NEW FROM POWER GENERAL
NEW PRODUCTS — SWITCHING SUPPLIES

POWER GENERAL
A SUBSIDIARY OF **UNITRODE** CORPORATION

WORLDS SMALLEST 75 WATT, TRIPLE OUTPUT SWITCHING POWER SUPPLY

3075 SERIES



FEATURES:
- 90–130 VAC or 180–250 VAC Input
- Designed to meet VDE, UL, and CSA safety standards
- 70% efficiency
- 4000 VAC isolation
- Small size, light weight
- Convection cooled

APPLICATIONS:
- Microcomputer systems
- Disk drives
- CRT terminals
- Digital/Analog circuits
- General purpose power supply

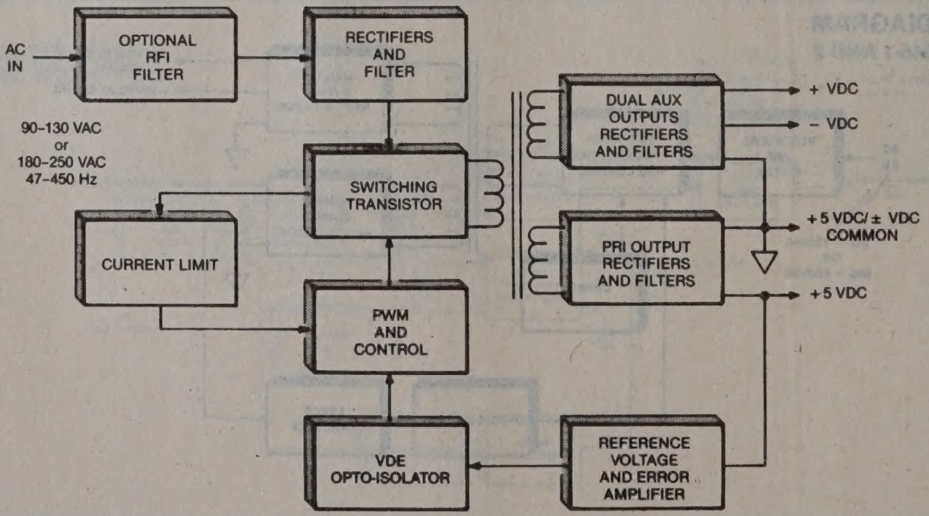
GENERAL DESCRIPTION

Power Generals' 3075 series are compact, triple output, 75-watt switching power supplies. Each model is designed to conform with UL, CSA and VDE safety standards. Input to output isolation is 4000 volts, hold-up time is 32 msec. minimum and efficiency is 70%. Input voltage ranges of 90 to 130 VAC or 180 to 250 VAC are available as a factory wired option. Cooling is by natural convection.

Utilizing state of the art integrated PWM design techniques and high quality components, these supplies offer high performance and reliability in a small, light weight single P.C. board form-factor. Each unit must pass a stringent test and burn-in program prior to shipment.

Their high level of reliable operating performance compact design, and generous OEM discounts, make the 3075 series an excellent choice for a wide variety of applications.

BLOCK DIAGRAM


AC IN
OPTIONAL RFI FILTER
RECTIFIERS AND FILTER
90–130 VAC or 180–250 VAC 47–450 Hz
SWITCHING TRANSISTOR
CURRENT LIMIT
PWM AND CONTROL
VDE OPTO-ISOLATOR
REFERENCE VOLTAGE AND ERROR AMPLIFIER
DUAL AUX OUTPUTS RECTIFIERS AND FILTERS
PRI OUTPUT RECTIFIERS AND FILTERS
+ VDC
– VDC
+5 VDC/± VDC COMMON
+5 VDC

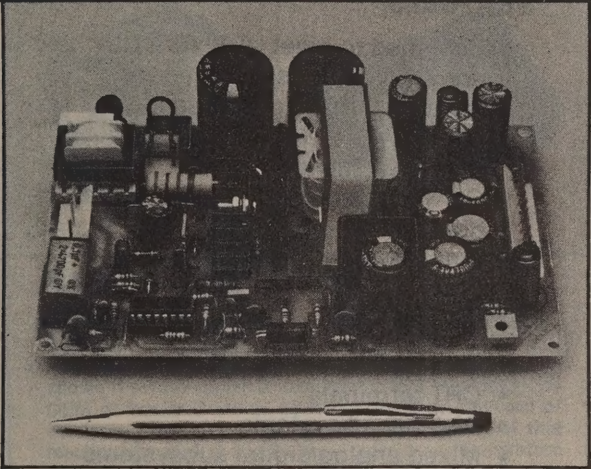
POWER GENERAL 152 WILL DRIVE, CANTON, MA 02021 TWX: 710-348-0200 TELEPHONE: (617) 828-6216

NEW FROM POWER GENERAL
NEW PRODUCTS — SWITCHING SUPPLIES

POWER GENERAL
A SUBSIDIARY OF **UNITRODE** CORPORATION

WORLD'S SMALLEST 75 WATT QUAD OUTPUT SWITCHING POWER SUPPLIES

4075 SERIES



FEATURES

- 5, +12, −12, and 5, 12, or 24VDC isolated outputs
- Designed to meet VDE, US, CSA safety standards
- 70% efficiency
- Small size, light weight
- 90-130 or 180-250 VAC input
- Convection cooled

APPLICATIONS

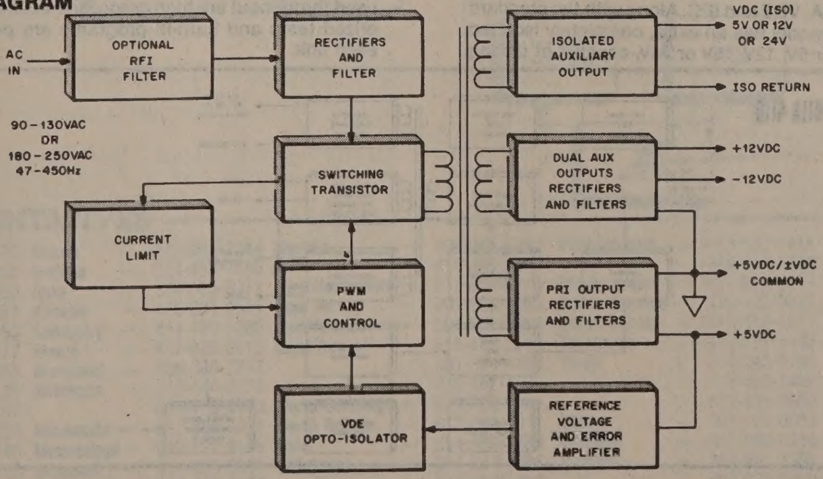
- Microcomputers
- CRT Terminals
- Disk Drives
- Digital/Analog Circuits
- General Purpose Power Supply

GENERAL DESCRIPTIONS

Power General's 4075 series are quad output power supplies capable of providing 75 watts of continuous power within the specified voltages and currents. These power supplies are designed to meet the safety requirements of VDE, UL, and CSA despite their small size and light weight. All models have one of their outputs totally isolated and floating, an ideal characteristic for systems which integrate a disk drive and must eliminate system component interference. These floating outputs will also accept the peak pulsed loads required by most applications.

By using state-of-the-art integrated PWM techniques and high-quality discrete components, these power supplies offer an excellent choice for the quality-minded OEM, since each unit is put through Power General's proven quality control and burn-in programs.

SERIES 4075 BLOCK DIAGRAM


AC IN
OPTIONAL RFI FILTER
RECTIFIERS AND FILTER
90-130VAC OR 180-250VAC 47-450Hz
SWITCHING TRANSISTOR
CURRENT LIMIT
PWM AND CONTROL
VDE OPTO-ISOLATOR
ISOLATED AUXILIARY OUTPUT
VDC (ISO) 5V OR 12V OR 24V
ISO RETURN
DUAL AUX OUTPUTS RECTIFIERS AND FILTERS
+12VDC
−12VDC
+5VDC/±VDC COMMON
PRI OUTPUT RECTIFIERS AND FILTERS
+5VDC
REFERENCE VOLTAGE AND ERROR AMPLIFIER

POWER GENERAL 152 WILL DRIVE, CANTON, MA 02021 TWX: 710-348-0200 TELEPHONE: (617) 828-6216

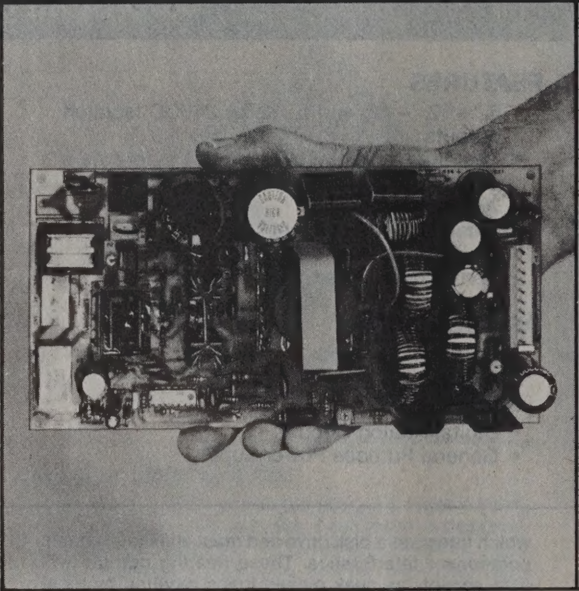
For More Information. Circle No. 343

NEW FROM POWER GENERAL
NEW PRODUCTS — SWITCHING SUPPLIES

POWER
GENERAL
A SUBSIDIARY OF **UNITRODE** CORPORATION

WORLD'S SMALLEST 100 WATT QUAD OUTPUT SWITCHING POWER SUPPLIES

4110 SERIES



FEATURES

- Designed to meet VDE, IEC, UL and CSA safety specifications
- Isolated output for pulsed load
- 90-130VAC or 180-250VAC input user selectable
- Convection cooled — No external heat sinking
- Small size and light weight

APPLICATIONS

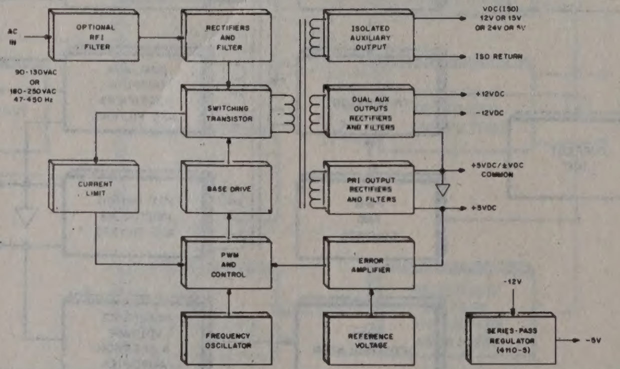
- Microprocessor based systems
- CRT terminals
- Disk based systems
- Mixed analog/digital subsystems
- MS/systems
- General purpose power supply

GENERAL DESCRIPTION

The 4110 series of quad output power supplies are capable of delivering 100 watts of continuous output power, with convection cooling, within the voltage-current rating of each output. Small in size and lightweight, these supplies are oriented for today's electronic system needs, and they are designed to comply with national and international safety standards such as UL, CSA, VDE and IEC. Along with the standard outputs, each model has an extra, completely isolated output of either 5V, 12V, 15V or 24V, capable of driving disk drives, printers or other pulsed load electromechanical devices, thus eliminating interference with system integrated CRTs or other sensitive system circuits.

Although the price has been kept low by using advanced circuit and manufacturing techniques, no compromise in performance was made. The components used throughout are high grade, and extensive computerized tests and burn-in programs are performed on each unit.

BLOCK DIAGRAM SERIES 4110


AC IN
90-130VAC OR 180-250VAC 47-450 Hz
OPTIONAL RFI FILTER
RECTIFIERS AND FILTER
SWITCHING TRANSISTOR
CURRENT LIMIT
BASE DRIVE
PWM AND CONTROL
FREQUENCY OSCILLATOR
ISOLATED AUXILIARY OUTPUT
VDC(ISO) 12V OR 15V OR 24V OR 5V
ISO RETURN
DUAL AUX OUTPUTS RECTIFIERS AND FILTERS
+12VDC
-12VDC
PRI OUTPUT RECTIFIERS AND FILTERS
+5VDC/±VDC COMMON
+5VDC
ERROR AMPLIFIER
REFERENCE VOLTAGE
-12V
SERIES-PASS REGULATOR (4110-5)
-5V

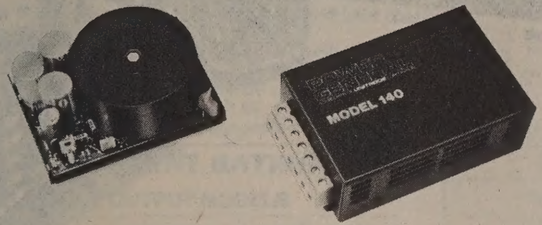
POWER GENERAL 152 WILL DRIVE, CANTON, MA 02021 TWX: 710-348-0200 TELEPHONE: (617) 828-6216

NEW FROM POWER GENERAL
NEW PRODUCTS — LINEAR SUPPLIES

POWER GENERAL
A SUBSIDIARY OF **UNITRODE** CORPORATION

3.5 TO 15 WATT
NONENCAPSULATED LINEAR AC/DC MODULES
LOW CASE TEMP. RISE
HIGH MTBF

140, 240 SERIES



FEATURES

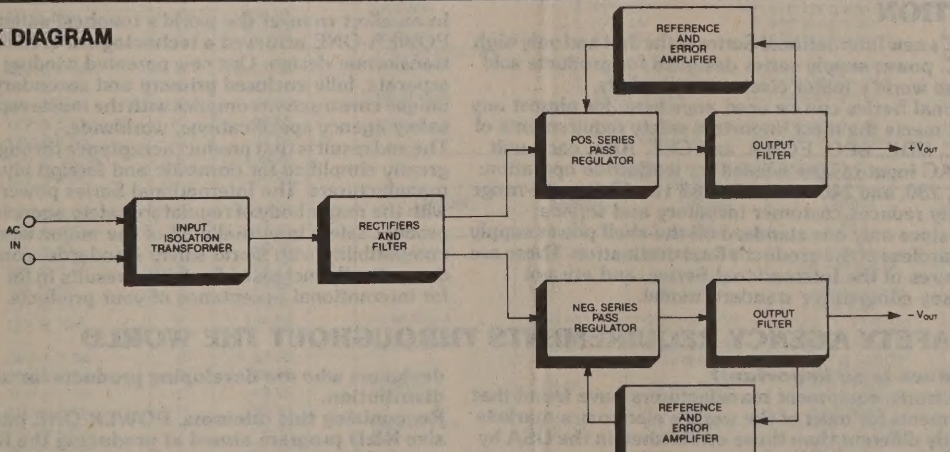
- REPAIRABLE, nonencapsulated, construction
- Low case temperature rise
- 120,000 hour MTBF
- P.C. Mount or Chassis Mount Models
- Continuous short circuit protection
- Plug-in compatible with competing Power Products, Semiconductor Circuits and Acopian models

GENERAL DESCRIPTION

Power Generals 140/240 Series is a family of high reliability AC/DC linear power supplies. Featuring an MTBF of 120,000 hours; their nonencapsulated, metal cased design allows the easy repair of rare component failures by the OEM or Power General, at about one-third the cost of scrapping the entire unit. Convection cooling of this mechanical design results in a lower case temperature rise, significantly improving reliability. Each unit must pass stringent testing and an eight hour burn-in prior to shipment.

Units are available with single outputs of 5, 12, 15 or 24 VDC and dual outputs of ± 12 or ± 15 VDC. All models are available for either P.C. board or chassis mount and are capable of either series or parallel operation. The 140/240 series is plug-in compatible with competing encapsulated units available from Power Products, Semiconductor Circuits, Acopian, etc.

BLOCK DIAGRAM


AC IN
INPUT ISOLATION TRANSFORMER
RECTIFIERS AND FILTER
REFERENCE AND ERROR AMPLIFIER
POS. SERIES PASS REGULATOR
OUTPUT FILTER
+ V_{OUT}
NEG. SERIES PASS REGULATOR
OUTPUT FILTER
− V_{OUT}
REFERENCE AND ERROR AMPLIFIER

SALES REPRESENTATIVES

Alabama	205-539-8476
Arizona	602-994-5153
California	714-998-8200 800-874-3821 408-945-1250 415-369-3677
Colorado	303-799-6063
Connecticut	203-678-0123
Delaware	800-336-3747
Florida	305-724-1027 305-587-7146 813-924-7415
Georgia	919-722-9445
Idaho	208-343-3753
Illinois	312-991-2144
Indiana	614-459-1280
Iowa	319-365-8071
Kansas	913-831-0555
Kentucky	614-459-1280
Maine	617-828-6216
Maryland	800-336-3747
Michigan	313-644-0173 616-459-4425
Minnesota	612-888-7011
Mississippi	919-722-9445
Missouri	314-839-0800
Montana	206-353-1833
Nebraska	314-839-0800
Nevada	408-945-1250 415-369-3677
New Hampshire	617-828-6216
New Jersey	201-826-8050
New Mexico	602-994-5153
New York	516-422-2500 201-624-4408 716-467-4538
North Carolina	919-722-9445
North Dakota	612-888-7011
Ohio	614-459-1280
Oklahoma	214-343-3786 713-462-1432
Oregon	503-649-5388
Pennsylvania	215-631-1414 614-459-1280
Rhode Island	617-828-6216
South Carolina	919-722-9445
South Dakota	612-888-7011
Tennessee	919-722-9445
Texas	214-343-3786 713-462-1432 512-835-0980
Utah	303-799-6063
Vermont	617-828-6216
Virginia	703-591-1300 800-572-0405
Washington	206-353-1833
West Virginia	614-459-1280
Wisconsin	312-991-2144

CANADA

Calgary	403-236-3697
Montreal	514-747-1217
Toronto	416-245-3600
Ottawa	613-237-3852
Vancouver	604-224-6922
Winnepeg	204-895-2064

POWER GENERAL 152 WILL DRIVE, CANTON, MA 02021 TWX: 710-348-0200 TELEPHONE: (617) 828-6216

For More Information. Circle No. 343

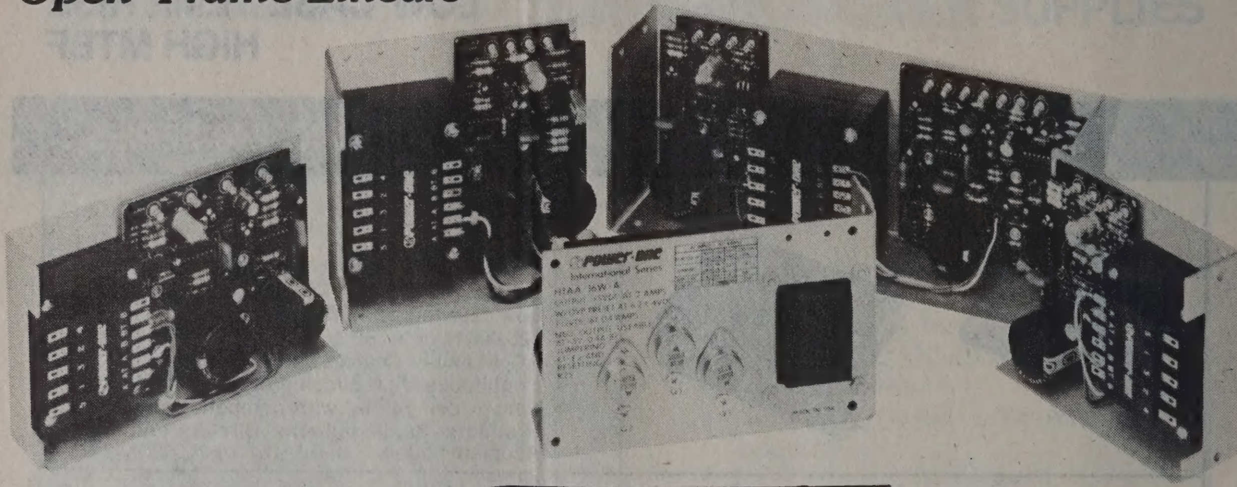
"Innovators in Power Supply Technology"

POWER-ONE D.C. POWER SUPPLIES

Power-One, Inc. • Power One Drive • Camarillo, CA 93010 • Phone: 805/987-8741 • 805/987-3891 • TWX: 910-336-1297
outside Calif. call Toll Free 1-800-235-5943

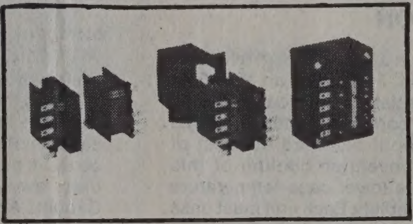
International Series
Open-Frame Linears

THE NEW WORLD STANDARD IN D.C. POWER SUPPLIES



FEATURES

- VDE TRANSFORMER CONSTRUCTION
- WORLDWIDE AC INPUT CAPABILITIES 100/120/220/230/240 VAC
- MEETS DOMESTIC AND FOREIGN SAFETY STANDARDS - UL, CSA, IEC, VDE, BPO, ECMA, CEE
- INDUSTRY STANDARD PACKAGES



Power-One's patented International Series transformers feature separate, fully enclosed, primary and secondary coils. Meets safety requirements of VDE, UL, CSA, BPO, IEC, CEE, and ECMA.

DESCRIPTION

POWER-ONE's new International Series is the first and only high reliability D.C. power supply series designed for products sold throughout the world's major electronics markets.

The International Series can be used anywhere, for almost any application. It meets the most important safety requirements of UL, CSA, IEC, VDE, BPO, ECMA, and CEE. Also, each unit provides the AC input ranges needed for worldwide operation: 100, 120, 220, 230, and 240 volts, 47 to 63 Hz. This multi-range input capability reduces customer inventory and service requirements since only one standard off-the-shelf power supply is needed, regardless of the product's final destination. These are exclusive features of the International Series, and are not available on any competitive standard model.

In an effort to meet the world's toughest safety regulations, POWER-ONE achieved a technological breakthrough in power transformer design. Our new patented winding process features separate, fully enclosed primary and secondary windings. This unique construction complies with the most respected regulatory safety agency specifications, worldwide.

The end result is that product acceptance throughout the world is greatly simplified for domestic and foreign equipment manufacturers. The International Series power supplies comply with the major body of regulatory safety agencies responsible for product safety in virtually all of the major world markets. Its compatibility with world safety standards, combined with dramatically increased flexibility, results in far greater potential for international acceptance of your products.

MEETS SAFETY AGENCY REQUIREMENTS THROUGHOUT THE WORLD

Why compliance is so important!

For years electronic equipment manufacturers have found that safety requirements for most of the world's electronics markets are significantly different than those established in the USA by Underwriters Laboratories (UL). Also, there is little consistency in the requirements among the world's regulatory safety agencies. This has created almost impossible compliance problems for designers who are developing products for worldwide distribution.

Recognizing this dilemma, POWER-ONE initiated an extensive R&D program aimed at producing the first D.C. power supply line that truly meets the world's toughest safety requirements. The innovative new International Series — the solution to the difficult problem of gaining worldwide acceptance for your products.

SAFETY AGENCIES WORLDWIDE

The following regulatory agency specifications have gained industry-wide acceptance as the most important to comply with when designing products for the world's major electronics markets. The International Series meets or exceeds the leakage current, creepage distance, and dielectric withstand test requirements of these safety agency specifications:

UL 1012
UL 478
CSA 22.2 No. 143
CSA 22.2 No. 154
IEC 380 Class I
IEC 380 Class II
IEC 435 Class I
IEC 435 Class II
VDE 0730 Part 2P Class I
VDE 0730 Part 2P Class II
VDE 0804 Class I
VDE 0804 Class II
BPO Tech. Guide No. 26
ECMA-57 Class I
ECMA-57 Class II
CEE-10 Part 2P Class I
CEE-10 Part 2P Class II

INTERNATIONAL SERIES DESIGN STANDARDS:

Leakage Current, Line to Ground: 5.0μa Max.

Safety Spacings,
Live Parts to Dead Metal: 9.0 mm
Other Than Field Terminals: 5.25 mm

Dielectric Withstand Voltage,
Input to Ground: 3750 VAC
Input to Outputs: 3750 VAC
Outputs to Ground: 500 VAC

For More Information. Circle No. 344

"Innovators in Power Supply Technology"

POWER-ONE D.C. POWER SUPPLIES

Phone or write for new brochure... see what it takes to set a new standard for the world!

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outside Calif. call Toll Free 1-800-235-5943

International Series
Open-Frame Linears

MEETS INTERNATIONAL SAFETY REQUIREMENTS THROUGHOUT THE WORLD

SPECIFICATIONS

AC Input: 100/120/220/240 VAC +10% −13%. 47-63 Hz. Tolerance for 230 VAC operation is +15%, −10%. Derate output current 10% for 50 Hz operation.

DC Output: See Voltage/Current Rating Chart. Adjustment range ±5% minimum.

Line Regulation: ±.05% for a 10% line change.

Load Regulation: ±.05% for a 50% load change.

Output Ripple: 5V through 15V models: 5.0 mV PK-PK maximum; 24V and 28V models: 0.2% PK-PK maximum.

Transient Response: 50μ seconds for a 50% load change.

Short Circuit and Overload Protection: Automatic current limit/foldback.

Overvoltage Protection: Provided on 5V outputs where indicated. Set at 6.2V ±0.4V. Other outputs use optional overvoltage protectors OVP-12 and OVP-24.

Stability: ±0.3% for 24 hours after warm-up.

Temperature Rating: 0°C to 50°C full-rated, derated linearly to 40% at 70°C.

Temperature Coefficient: .01%/°C typical, .03%/°C maximum.

Efficiency: (typical)

5V outputs:	45%
12V and 15V outputs:	55%
24V and 28V outputs:	60%

Vibration: Per MIL-STD-810C, Method 514, Procedure X

Shock: Per MIL-STD-810C, Method 516, Procedure V

EMI/RFI: These linear power supplies have inherently low conducted and radiated noise levels. For most system applications they will meet the requirements of FCC Docket 20780 for Class A equipment and VDE 0871 for Class A equipment without additional noise filtering.

VOLTAGE/CURRENT RATING CHART

SINGLE OUTPUT MODELS

Model	Voltage/ Current	Case Size	Price (1–24)
2 VOLTS			
HB2-3-A	2V @ 3A	B	$ 34.95
HC2-6-A	2V @ 6A	C	54.95
HD2-12-A	2V @ 12A	D	84.95
HE2-18-A	2V @ 18A	E	119.95
5 VOLTS			
HA5-1.5/OVP-A*	5V @ 1.5A	B	$ 27.95
HB5-3/OVP-A*	5V @ 3A	B	32.95
HC5-6/OVP-A*	5V @ 6A	C	54.95
HN5-9/OVP-A*	5V @ 9A	N	74.95
HD5-12/OVP-A*	5V @ 12A	D	84.95
HE5-18/OVP-A*	5V @ 18A	E	119.95
F5-25/OVP-A*	5V @ 25A	F	154.95
G5-35/OVP-A*	5V @ 35A	F	194.95
CP197-A*	5V @ 50A	F	224.95
12 VOLTS			
HA15-0.9-A	12V @ 0.9A	B	$ 27.95
HB12-1.7-A	12V @ 1.7A	B	32.95
HC12-3.4-A	12V @ 3.4A	C	49.95
HN12-5.1-A	12V @ 5.1A	N	69.95
HD12-6.8-A	12V @ 6.8A	D	79.95
HE12-10.2-A	12V @ 10.2A	E	109.95
F15-15-A	12V @ 16A	F	154.95
15 VOLTS			
HA15-0.9-A	15V @ 0.9A	B	$ 27.95
HB15-1.5-A	15V @ 1.5A	B	32.95
HC15-3-A	15V @ 3A	C	49.95
HN15-4.5-A	15V @ 4.5A	N	69.95
HD15-6-A	15V @ 6A	D	79.95
HE15-9-A	15V @ 9A	E	109.95
F15-15-A	15V @ 15A	F	154.95
24 VOLTS			
HA24-0.5-A	24V @ 0.5A	B	$ 27.95
HB24-1.2-A	24V @ 1.2A	B	32.95
HC24-2.4-A	24V @ 2.4A	C	49.95
HN24-3.6-A	24V @ 3.6A	N	69.95
HD24-4.8-A	24V @ 4.8A	D	79.95
HE24-7.2-A	24V @ 7.2A	E	109.95
F24-12-A	24V @ 12.A	F	154.95
28 VOLTS			
HA24-0.5-A	28V @ 0.5A	B	$ 27.95
HB28-1-A	28V @ 1A	B	32.95
HC28-2-A	28V @ 2A	C	49.95
HN28-3-A	28V @ 3A	N	69.95
HD28-4-A	28V @ 4A	D	79.95
HE28-6-A	28V @ 6A	E	109.95
F24-12-A	28V @ 10A	F	154.95
48 VOLTS			
HB48-0.5-A	48V @ 0.5A	B	$ 34.95
HC48-1-A	48V @ 1A	C	54.95
HD48-3-A	48V @ 3A	D	84.95
HE48-4-A	48V @ 4A	E	119.95
180/200 VOLTS			
HB200-0.12-A	175-210V @ 0.12A	B	$ 39.95
250 VOLTS			
HB250-0.1-A	250V @ 0.1A	B	$ 39.95

*INCLUDES OVERVOLTAGE PROTECTION.

DUAL OUTPUT MODELS

Model	Output #1	Output #2	Case Size	Price (1–24)
±5 VOLTS				
HAA5-1.5/OVP-A	5V @ 1.5A*	−5V @1.5A*	AA	$ 49.95
HBB5-3/OVP-A	5V @ 3A*	−5V @3A*	BB	64.95
HCC5-6/OVP-A	5V @ 6A*	−5V @ 6A*	CC	96.95
±12 TO 15 VOLTS				
HAD12-0.4-A	12V @ 0.4A	−12V @ 0.4A	B	36.95
HAD15-0.4-A	15V @ 0.4A	−15V @ 0.4A	B	32.95
HAA15-0.8-A	12V @ 1A OR 15V @ 0.8A	−12V @ 1A OR −15V @ 0.8A OR −5V @ 0.4A	AA	42.95
HBB15-1.5-A	12V @ 1.7A OR 15V @ 1.5A	−12V @ 1.7A OR −15V @ 1.5A OR −5V @ 0.7A	BB	54.95
HCC15-3-A	12V @ 3.4A OR 15V @ 3A	−12V @ 3.4A OR −15V @ 3A	CC	87.95
HDD15-5-A	12V TO 15V@ 5A	(−) 12V TO 15V@5A	E	129.95
5 VOLTS AND 9 TO 15 VOLTS (Isolated Outputs)				
HAA512-A	5V @ 2A*	9 TO 15V @ 0.5A	AA	$ 49.95
HBB512-A	5V @ 3A*	9 TO 15V @ 1.25A	BB	59.95
HCC512-A	5V @ 6A*	9 TO 15V @ 2.5A	CC	94.95
±18 TO 24 VOLTS				
HAA24-0.6-A	18-20V @ 0.4A OR 24V @ 0.6A	(−)18-20V @ 0.4A OR −24V @ 0.6A	AA	42.95
HBB24-1.2-A	18-20V @ 0.9A OR 24V @ 1.2A	(−)18-20V @ 0.9A OR −24V @ 1.2A	BB	54.95
HCC24-2.4-A	18-20V @ 1.8A OR 24V @ 2.4A	(−)18-20V @ 1.8A OR −24V @ 2.4A	CC	87.95

TRIPLE OUTPUT MODELS

Model	Output #1	Output #2	Output #3	Case Size	Price (1–24)
HTAA-16W-A	5V @ 2A*	9 TO 15V @ 0.4A	(−)9 TO 15V @0.4A OR −5V @ 0.4A	AA	$ 54.95
HBAA-40W-A	5V @ 3A*	12V @ 1A OR 15V @ 0.8A	−12V @1A OR −15V @ 0.8A OR −5V @ 0.4A	BAA	75.95
HCAA-60W-A	5V @ 6A*	12 TO 15V @ 1A	(−)12 TO 15V @ 1A OR −5V @ 0.4A	D	89.95
HCBB-75W-A	5V @ 6A*	12V @ 1.7A OR 15V @ 1.5A	−12V @ 1.7A OR −15V @ 1.5A OR −5V @ 0.7A	CBB	99.95
CP131-A	5V @ 8A*	12V @ 1.7A OR 15V @ 1.5A	−12V @ 1.7A OR −15V @ 1.5A OR −5V @ 0.7A	131	119.95
HDBB-105W-A	5V @ 12A*	12V @ 1.7A OR 15V @ 1.5A	−12V @ 1.7A OR −15V @ 1.5A OR −5V @ 0.7A	DBB	134.95
HDCC-150W-A	5V @ 12A*	12V @ 3.4A OR 15V @ 3A	−12V @ 3.4A OR −15V @ 3A	DCC	154.95

DISK-DRIVE MODELS

Model	Output #1	Output #2	Output #3	Output #4	Output #5	Case Size	Price (1–24)
CP340-A	5V @ 0.5A/ 0.7A PK*	12V @ 0.9A/ 1.8A PK				CP340-A	$ 44.95
CP205-A	5V @ 1.A*	−5V @ 0.5A*	24V @ 1.5A/ 1.7A PK			BAA	75.95
CP510-A	5V @ 6A*	12V @ 2.5A/ 7.5A PK				CP510-A	79.95
CP323-A	5V @ 2A*					N	79.95
CP162-A	5V @ 3A*	−5V @ 0.6A*	24V @ 5A/6A PK			131	129.95
CP498-A	5V @ 6A*	12V @ 5A/ 10A PK	−12V @ 0.5A OR −5V @ 0.25A			131	129.95
CP379-A	5V @ 6A*	−5V @ 1.2A OR −12V @ 1.2A	24V @ 3.5A/ 8A PK			131	129.95
CP503-A	5V @ 6A*	12V @ 1.2A	−12V @ 0.8A	24V @ 2.5A/ 4APK		CBB	129.95
CP384-A	5V @ 9A*	−5V @ 1.2A OR −12V @ 1.2A	24V @ 2A/ 8A PK			131	129.95

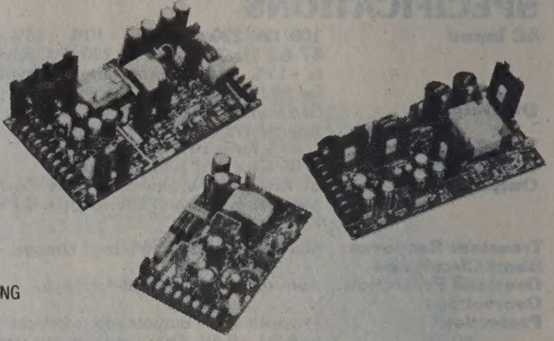
"Innovators in Power Supply Technology"

POWER-ONE D.C. POWER SUPPLIES

Switching Products Division
833 Flynn Road • Camarillo, CA 93010 • Phone: 805/482-0757. • Western Union: 752083

International Series
Open-Frame Switchers

SINGLE AND MULTIPLE OUTPUT MODELS, WITH WORLDWIDE CAPABILITIES



FEATURES

- EFFICIENT, RELIABLE, ECONOMICAL
- 11 MODELS, 40 TO 250 WATTS
- UP TO 5 TIGHTLY REGULATED OUTPUTS
- VDE CONSTRUCTION
- MEETS DOMESTIC AND INTERNATIONAL SAFETY:
  - 3750 VAC ISOLATION
  - VDE SAFETY SPACINGS
- MEETS DOMESTIC AND INTERNATIONAL EMI:
  - FCC DOCKET 20780, CLASS A
  - VDE 0871/6.78, CLASS A
- TÜV CERTIFIED TO:
  - VDE 0804 IEC 380
  - VDE 0805 (Proposed) IEC 435
  - VDE 0806
- WORLDWIDE AC INPUT, 90-132/180-264 VAC, USER SELECTABLE
- POPULAR INDUSTRY STANDARD PACKAGES
- UL RECOGNIZED, CSA CERTIFIED
- FULL LOAD BURN-IN AND THERMAL CYCLING
- 2 YEAR WARRANTY

Description

Multioutput switchers designed for personal computers, disk-drives, intelligent terminals, word processors and other systems targeted for worldwide distribution.

High capacity 5V outputs easily handle the increased demand of today's 5V-only logic chips, while tightly regulated auxiliary outputs provide the high surge current capability required by disk-drives and printers.

All models meet the world's toughest safety and EMI standards resulting in easier system approval and international marketing.

SPECIFICATIONS

AC Input	90-132 VAC or 180-264 VAC, user selectable. 47-63 HZ, single phase.
DC Outputs:	See Voltage/Current Rating Charts.
Brown-Out Protection:	Regulation is maintained down to 90/180 VAC.
Hold-Up Time:	20 msec minimum at full rated load and nominal AC input voltage.
Efficiency:	Measured at full rated output power and nominal AC input voltage: 70% ± 5%
Regulation Characteristics:	See Voltage/Current Rating Charts. Line: Measured over a 90-132 VAC or 180-264 VAC line change. Load: Measured by varying the load current from 60% of full rated to either 20% or 100% of full rated.
Cross Regulation:	Cross regulation specifies the maximum voltage change when the +5V output load current is varied from 75% of full rated to either 50% or 100% of full rated.
Output Noise and Ripple:	0.3% RMS, 1% PK-PK maximum.
Transient Response:	Main 5V output only. Recovery Time: 500μsec typical for a 50-100% load change.
Output Overload Protection:	Fully protected against output overload and short circuit.
Overvoltage Protection:	Provided on +5V outputs.
Reverse Voltage Protection:	Fully protected from damage due to application of reverse polarity voltage across DC output terminals.
Input Protection:	AC input line fuse provided. Internally located.
Inrush Current:	Internally limited by thermistor.
Temperature Rating:	Operating: 0°C to +70°C. Storage: −55°C to +85°C
Temperature Coefficient:	±0.03%/°C typical, ±0.05%/°C maximum.
Vibration:	Per Mil-Std-810C, Method 514, Procedure X, Catagory G-1.
Shock:	Per Mil-Std-810C, Method 516, Procedure V.
Warranty:	2 years.

OPTIONS

Input/Output Connectors:	Barrier terminal blocks standard on all models. Consult factory for optional connector styles.
Safety Covers:	Available for SPL130 and SPL200 series models.
User Specified Outputs:	Output voltage and current ratings may be configured to user specified requirements. Consult factory for details.

VOLTAGE/CURRENT RATING CHARTS

SPL40 SERIES **$105 SINGLE QUANTITY**
40 WATTS CONTINUOUS

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION	CROSS REGULATION
SPL40 -4000	+5V	5A	ADJUSTABLE NOTE A	±0.1%	±0.5%	N A
	+12V	0.5A	±4% NOTE B	±0.1%	±1%	N A
	−12V	0.5A	±4% NOTE B	±0.1%	±1%	N A
	−5V	0.5A	±4% NOTE B	±0.1%	±1%	N A

SPL53 SERIES **$125 SINGLE QUANTITY**
80 WATTS CONTINUOUS

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION	CROSS REGULATION
SPL53 -4000	+5V	8A	ADJUSTABLE NOTE A	±0.1%	±1%	N/A
	+12V	2.5A/ 5A PK	ADJUSTABLE NOTE D	±0.1%	±1%	N/A
	−12V	0.6A	±4% NOTE B	±0.1%	±1%	N/A
	−5V	0.6A	±4% NOTE B	±0.1%	±1%	N/A
SPL53 -4101	+5V	8A	ADJUSTABLE NOTE A	±0.1%	±1%	N/A
	+12V	1.2A	±4% NOTE B	±0.1%	±1%	N/A
	−12V	0.6A	±4% NOTE B	±0.1%	±1%	N/A
	+24V	1.5A/ 3A PK	±5% NOTE C	±0.2%	±5%	±5%

SPL53 SERIES (continued)

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION	CROSS REGULATION
SPL53 -4102	+5V	8A	ADJUSTABLE NOTE A	±0.1%	±1%	N/A
	+12V	1.2A	±4% NOTE B	±0.1%	±1%	N/A
	+12V	2.5A/ 5A PK	±5% NOTE C	±0.2%	±5%	±5%
	−12V	0.6A	±4% NOTE B	±0.1%	±1%	N/A

SPL65 SERIES **$150 SINGLE QUANTITY**
85 WATTS CONTINUOUS, 95 WATTS PEAK

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION	CROSS REGULATION
SPL65 -5000	+5V	8A	ADJUSTABLE NOTE A	±0.1%	±1%	N/A
	+12V	1.2A	±4% NOTE B	±0.1%	±1%	N/A
	−12V	1.2A	±4% NOTE B	±0.1%	±1%	N/A
	+24V	1.2A/ 1.5A PK	±4% NOTE B	±0.1%	±1%	N/A
	−5V	0.5A	±4% NOTE B	±0.1%	±1%	N/A

NOTES
A. Voltage level adjustable from 4.75V to OVP trip point.
B. Fully regulated output, voltage fixed (3 terminal regulator).
C. Quasi-regulated output.
D. Fully regulated output, voltage adjustable ±5% minimum.
E. The sum of the +5V and *Aux I* load currents must not exceed 20A.
F. The sum of the +5V and *Aux I* load currents must not exceed 35A.

For More Information. Circle No. 344

"Innovators in Power Supply Technology"

POWER-ONE D.C. POWER SUPPLIES

Switching Products Division

833 Flynn Road • Camarillo, CA 93010 • Phone: 805/482-0757. • Western Union: 752083

Phone or write for new brochure... see what it takes to set a new standard for the world!

International Series

Open-Frame Switchers

MEETS THE WORLD'S TOUGHEST SAFETY AND EMI STANDARDS

VOLTAGE / CURRENT RATING CHARTS (continued)

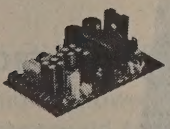
SPL130 SERIES $198 SINGLE QUANTITY
130 WATTS CONTINUOUS, 150 WATTS PEAK

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION	CROSS REGULATION
SPL130 -4102P	+5V	20A NOTE E	ADJUSTABLE NOTE A	±0 1%	±1%	N A
	+12V AUX I	4A 6A PK	±5% NOTE C	±0 2%	±3%	±5%
	-12V	1 5A	±4% NOTE B	±0 1%	±1%	N A
	-5V	1 5A	±4% NOTE B	±0 1%	±1%	N A
SPL130 -4101P	+5V	20A NOTE E	ADJUSTABLE NOTE A	±0 1%	±1%	N A
	+12V	1 5A	±4% NOTE B	±0 1%	±1%	N A
	-12V	1 5A	±4% NOTE B	±0 1%	±1%	N A
	+24V AUX I	2A/ 4A PK	±5% NOTE C	±0 2%	±5%	±5%
SPL130 -4100P	+5V	20A NOTE E	ADJUSTABLE NOTE A	±0 1%	±1%	N/A
	+12V AUX I	4A/ 6A PK	±5% NOTE C	±0 2%	±3%	±5%
	+12V	1 5A	±4% NOTE B	±0 1%	±1%	N/A
	-12V	1 5A	±4% NOTE B	±0 1%	±1%	N/A

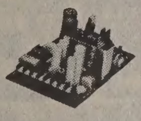
SPL200 SERIES $270 SINGLE QUANTITY
200 WATTS CONTINUOUS, 250 WATTS PEAK

MODEL	VOLTAGE	CURRENT	INITIAL SETTING TOLERANCE	LINE REGULATION	LOAD REGULATION	CROSS REGULATION
SPL200 -4100P	+5V	35A NOTE F	ADJUSTABLE NOTE A	±0 1%	±1%	N/A
	+12V AUX I	4A/ 8A PK	±5% NOTE C	±0.2%	±3%	±3%
	-12V	1 5A	±4% NOTE B	±0 1%	±1%	N/A
	-5V	1 5A	±4% NOTE B	±0 1%	±1%	N/A
SPL200 -5200P	+5V	35A NOTE F	ADJUSTABLE NOTE A	±0 1%	±1%	N/A
	+12V AUX I	4A/ 8A PK	±5% NOTE C	±0 2%	±3%	±3%
	-12V	1 5A	±4% NOTE B	±0 1%	±1%	N/A
	-5V	1 5A	±4% NOTE B	±0 1%	±1%	N/A
	+24V	4A/ 6A PK	±5% NOTE C	±0 2%	±5%	±5%
SPL200 -5100P	+5V	35A NOTE F	ADJUSTABLE NOTE A	±0 1%	±1%	N/A
	+12V AUX I	4A 8A PK	±5% NOTE C	±0 2%	±3%	±3%
	+12V	1 5A	±4% NOTE B	±0 1%	±1%	N/A
	-12V	1 5A	±4% NOTE B	±0 1%	±1%	N/A
	-5V	1 5A	±4% NOTE B	±0 1%	±1%	N/A

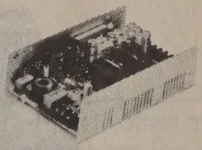
Single Output Switchers



SPL53 CASE



SPL40 CASE



SPL250 CASE

FEATURES

- 5V TO 28V
- 40W TO 250W
- 115/230 VAC INPUT
- VDE CONSTRUCTION
- UL, CSA APPROVED
- 2 YEAR WARRANTY
- MEETS INTERNATIONAL SAFETY AND EMI SPECS

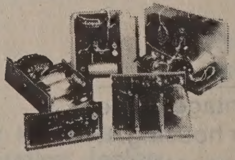
MODEL	VOLTAGE	CURRENT	PRICE (UNIT QTY.)
5 Volts			
SPL 40-1005	5V	8A	$95.00
SPL 53-1005	5V	16A	120.00
SPL130-1005	5V	26A	170.00
SPL250-1005	5V	50A	250.00
12-15 Volts			
SPL 40-1012	12-15V	3.3A/2.7A	$95.00
SPL 53-1012	12-15V	6.7A/5.3A	120.00
SPL130-1012	12-15V	11A/9A	170.00
SPL250-1012	12-15V	21A/17A	250.00
24-28 Volts			
SPL 40-1024	24-28V	1.6A/1.4A	$95.00
SPL 53-1024	24-28V	3.3A/2.8A	120.00
SPL130-1024	24-28V	5.5A/4.5A	170.00
SPL250-1024	24-28V	10A/7A	250.00

−5V Sub-Regulator Module

AR5-0.6/OVP

The AR5-0.6/OVP will provide a −5V regulated output from any −7V to −30V filtered DC source. Designed to be connected to the negative output of any multiple output power supply, the AR5-0.6/OVP will supply the −5V output required in many microcomputer applications. Price (Unit Qty): $10.95

Custom Designs



POWER-ONE is an experienced manufacturer of custom power supplies for high-quantity applications requiring special electrical and mechanical configurations. We excell at open frame multiple output designs, regulated or unregulated.

Overvoltage Protection

OVP-24

OVP-12

These optional Overvoltage Protection modules are available for use with any power supply NOT supplied with built-in OVP. Each is adjustable from 6.4V to 34V and should be used when maximum load protection is of prime importance.

Mounting holes are provided on all power supplies to accommodate these modules, which mount within the specified outline dimensions of each supply.

OVP-12 For use on all models except E & F case sizes (when used on ±9V thru ±15V models, one OVP-12 protects both outputs): Price Unit Qty: $7.95

OVP-24 For use on E & F case models: Price Unit Qty: $14.95

Dimension Chart

Case Size	Dimension Inches	Case Size	Dimension Inches	Case Size	Dimension Inches	Case Size	Dimension Inches
B	4.87 × 4.0 × 1.62	CBB	11.0 × 4.87 × 2.75	SWITCHERS, MULTIPLE OUTPUT		SWITCHERS, SINGLE OUTPUT	
C	5.62 × 4.87 × 2.5	DBB	14.25 × 4.87 × 2.75	SPL40	6.30 × 3.92 × 2.00	SPL40	5.75 × 3.92 × 2.20
N	7.0 × 4.87 × 2.75	DCC	15.0 × 4.88 × 3.75	SPL53	8.25 × 4.25 × 2.10	SPL53	8.25 × 4.25 × 2.20
D	9.0 × 4.87 × 2.75	131	11.0 × 4.87 × 2.75	SPL65	9.00 × 5.00 × 2.10	SPL130	8.90 × 5.00 × 2.45
E	14.0 × 4.87 × 2.75	CP340-A	5.5 × 4.0 × 1.62	SPL130	10.50 × 5.00 × 2.45	SPL250	12.00 × 4.94 × 2.45
F	16.75 × 4.87 × 5.0	CP510-A	8.25 × 4.87 × 2.75	SPL200	13.00 × 5.00 × 2.45		
AA	6.5 × 4.0 × 1.62	OVP-12	1.6 × 1.6 × 0.7				
BB	7.0 × 4.87 × 2.5	OVP-24	2.8 × 2.0 × 0.9				
CC	9.38 × 4.87 × 2.75	AR5-0.6/OVP	1.5 × 1.55 × 0.8				
BAA	10.25 × 4.0 × 2.5						

For More Information. Circle No. 344

Power Systems, Inc.

12 TOBEY ROAD, BLOOMFIELD, CT 06002 • (203) 243-0357
TWX #710 - 425 - 8778

Custom Designed Power Supplies

Feature: **Optimum Performance**
Systems Interface
Cost Effectiveness

Specifications

The custom designed supply provides the correct current ratings for each output voltage, at proper temperature ratings for your systems' cooling provisions. The final design is checked out under actual system operating conditions. The system designer may specify adjustment pots, in the desired location for the outputs that require this feature. Also, the custom supply can provide the exact amount of extra current for those optional "expansion" features.

Configuration Control

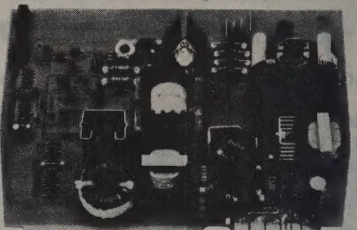
Form and fit are tailored to employ the available space in the most efficient way. We can use flat assemblies or rectangular modules, fully enclosed or open, match cabinet fittings, bend around corners and mount in any plane. It provides for functional human-engineering as well as aesthetic considerations.

Thermal Design Options

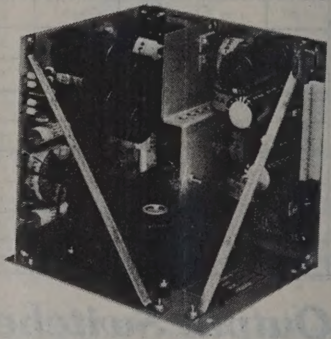
The custom supply can take maximum advantage of the cooling methods designed into the cabinet or housing. It can "sink" heat into sheet metal, or place fins in optimum convection areas. Often the supply includes a fan which ventilates the entire cabinet. 115 VAC for fans is available regardless of the input voltage used (115 or 230 VAC).

Input/Output Connections

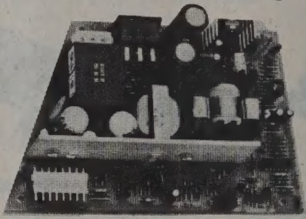
Custom designed power supplies allow the system designer to locate input and output connectors for minimum cabling and ease of assembly. Choices include plated-edge pcb or pin-type connectors, flying-lead cables, solder terminals or barrier-terminal blocks.



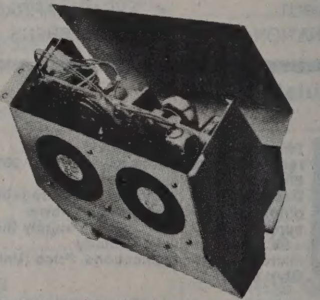
250 Watt Avg. 800 Watt Peak/ 3 Output Printer Power Supply



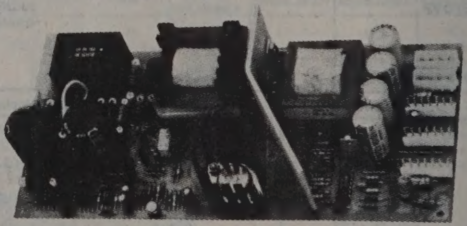
214 Watt/5 Output Ticketing Terminal



50 Watt/3 Output Terminal Power Supply with Synch.



450 Watt/7 Output High Speed Ticketing Terminal



150 Watt/3 Output with PFS Multi-User Microcomputer

For More Information. Circle No. 345

System Related Features

System interface logic of many types is a highly useful advantage that is easy to obtain in a custom design. Standard TTL logic may signal AC power failure, DC power failure, DC power good (one or all outputs), remote inhibit one or all outputs and remote turn-on or off. Choice of digital or analog functions to remote program an output voltage.

Example #1 Complete AC to DC power system with AC PWR Fail, DC PWR Good, Remote Sense, external inhibit and AC fan power.

Example #2 CRT terminal logic supply. To eliminate any interference with the display, we synchronize the switching frequency to the horizontal retrace.

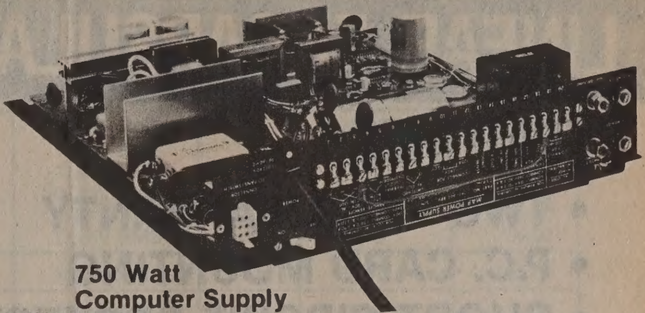
Agency Approvals

PSI designs to meet applicable UL and CSA standards as well as FCC and VDE Safety and EMI/RFI standards. Cards listing Power Systems model numbers already approved by UL and CSA are available upon request. Several supplies have been approved by TUV Rhineland as being compliant with VDE and IEC Safety Standards.

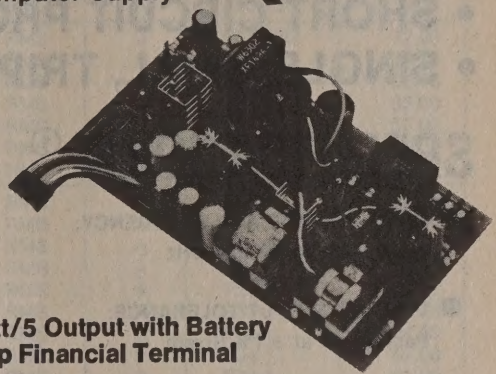
Cost Effectiveness

A higher-power rated "catalog" supply is often needed to compensate for current reduction by derating at higher temperatures. Prices often include unnecessary features. Front-end costs are generally required for a custom design program. When amortized over the total quantity for the product life, this becomes insignificant. The end result of a custom designed power supply is a form, fit and function that exactly matches the needs of the system, thereby optimizing system performance and cost.

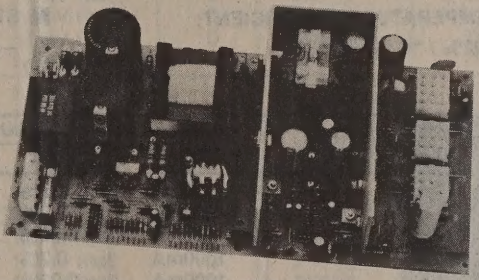
Our application engineers will be happy to assist in writing specifications, advising on configuration design or reviewing cost tradeoffs. Send for a free copy of "Guidelines for Custom Specifications" by contacting our offices or your nearest sales representative.



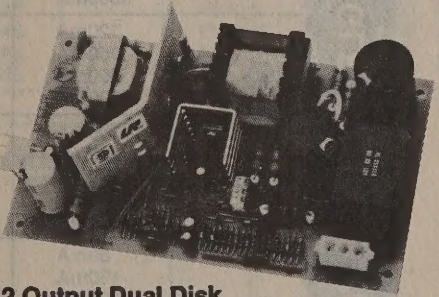
750 Watt Computer Supply



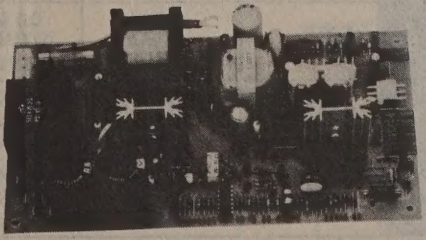
81 Watt/5 Output with Battery Backup Financial Terminal



170 Watt/3 Output IBM 3270 Compatible Controller



73 Watt/2 Output Dual Disk Power Supply



90 Watt/4 Output with Synch Terminal Power Supply

Power Systems, Inc.

12 Tobey Road/Bloomfield, CT 06002
Area Code 203-243-0357 TWX #710-425-8778

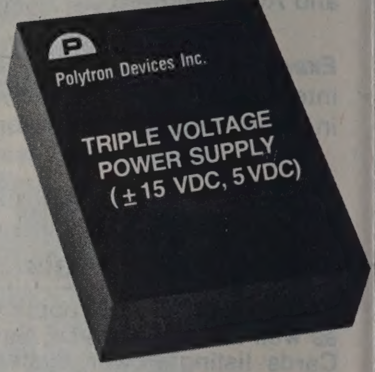
For More Information. Circle No. 345

LINEAR ENCAPSULATED POWER MODULES

FEATURES:

- TWO YEAR WARRANTY
- P.C. CARD MOUNTING
- SHORT CIRCUIT PROTECTION
- SINGLE, DUAL, TRIPLE OUTPUTS

FROM STOCK



SPECIFICATIONS: ①

- **INPUT VOLTAGE AND FREQUENCY:** 105 to 125Vac-50 to 440Hz
- **VOLTAGE OUTPUT TOLERANCE:** Factory set at ±1% (fixed)
- **TEMPERATURE COEFFICIENT:** 0.02% / °C typical
- **INPUT ISOLATION:** 50 Mohms
- **OPERATING TEMPERATURE:** −25°C to +71°C
- **STORAGE TEMPERATURE:** −25°C to 85°C

	OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		RIPPLE AND NOISE	CASE SIZE	MODEL NUMBER	PRICE 1-9 QTY.
			LINE	LOAD				
SINGLE VOLTAGE UNITS	5V	200mA	0.2%	.2%	1.0mV RMS	G	P34-5SM	32.00
		500mA	0.2%	.2%	0.5mV RMS	A	P37	27.00
		500mA	0.02%	0.05%	0.5mV RMS	A	P37-1	37.00
		1000mA	0.2%	0.2%	1.0mV RMS	B	P38	46.00
		1000mA	0.02%	0.05%	1.0mV RMS	B	P38-1	56.00
		1000mA	0.02%	0.05%	0.5mV RMS	C	P38/1.56	59.00
		2000mA	0.02%	0.1%	1.0mV RMS	D	P39	69.00
		3000mA	0.02%	0.15%	1.0mV RMS	D	P39-3	85.00
	10V	120mA	0.1%	0.1%	1.0mV RMS	E	P33-10SM	46.00
		150mA	0.1%	0.1%	1.0mV RMS	A	P33-10S	25.00
		250mA	0.1%	0.1%	1.0mV RMS	B	P34-10S	36.00
		500mA	0.02%	0.05%	0.5mV RMS	C	P37-10S	49.00
	12V	100mA	0.1%	0.1%	1.0mV RMS	E	P33-12SM	46.00
		120mA	0.02%	0.1%	1.0mV RMS	A	P33-12S	25.00
		200mA	0.1%	0.1%	1.0mV RMS	B	P34-12S	35.00
		500mA	0.02%	0.1%	0.5mV RMS	C	P37-12S	49.00
		1000mA	0.1%	0.1%	1.0mV RMS	D	P38-12S	62.00
	15V	80mA	0.1%	0.1%	1.0mV RMS	E	P33-15SM	46.00
		120mA	0.02%	0.1%	1.0mV RMS	A	P33-15S	23.00
		200mA	0.1%	0.1%	1.0mV RMS	B	P34-15S	34.00
		300mA	0.1%	0.1%	1.0mV RMS	C	P35-15S	42.00
		500mA	0.02%	0.1%	0.5mV RMS	C	P37-15S	53.00
		800mA	0.02%	0.1%	1.0mV RMS	D	P38-15S	62.00
	18V	50mA	0.1%	0.1%	1.0mV RMS	E	P32-18SM	46.00
		50mA	0.02%	0.05%	1.0mV RMS	A	P32-18S	28.00
		100mA	0.02%	0.05%	1.0mV RMS	A	P33-18S	30.00
	24V	50mA	0.1%	0.1%	1.0mV RMS	E	P32-24SM	46.00
		100mA	0.1%	0.1%	1.0mV RMS	A	P33-24S	28.00
		300mA	0.1%	0.1%	1.0mV RMS	C	P35-24S	51.00
	48V	50mA	0.2%	0.2%	2.0mV RMS	B	P32-48S	38.00
		100mA	0.2%	0.2%	2.0mV RMS	B	P33-48S	49.00
		200mA	0.2%	0.2%	2.0mV RMS	C	P34-48S	69.00

① 115 VAC, 50 to 400 Hz, @25°C

POLYTRON DEVICES, INC.

P.O. BOX 398, PATERSON, N.J. 07544 (201) 345-5885

For More Information. Circle No. 346

LINEAR POWER MODULES (Continued)

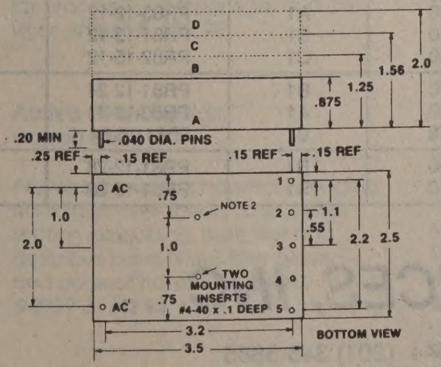
	OUTPUT VOLTAGE	OUTPUT CURRENT	REGULATION		RIPPLE AND NOISE	CASE SIZE	MODEL NUMBER	PRICE 1-9 QTY.
			LINE	LOAD				
DUAL VOLTAGE	± 5V	± 50mA	0.02%	0.02%	1.0mV RMS	A	P32-5	28.00
		± 100mA	0.1%	0.1%	1.0mV RMS	A	P33-5	39.00
		± 200mA	0.1%	0.1%	1.0mV RMS	B	P34-5	48.00
		± 300mA	0.02%	0.05%	0.5mV RMS	C	P35-5	52.00
		± 500mA	0.02%	0.05%	0.5mV RMS	D	P37-5	59.00
		± 1000mA	0.1%	0.1%	1.0mV RMS	D	P38-5	79.00
	± 8V	± 500mA	0.1%	0.1%	1.0mV RMS	D	P37-8	65.00
	± 10V	± 100mA	0.02%	.05%	0.5mV RMS	A	P33-10	36.00
	± 12V	± 25mA	0.1%	0.1%	2mV RMS	G	P31-12M	32.00
		± 25mA	0.02%	0.05%	0.5mV RMS	A	P31-12	19.75
		± 50mA	0.02%	0.05%	0.5mV RMS	A	P32-12	26.50
		± 100mA	0.1%	0.1%	1.0mV RMS	A	P33-12	36.00
		± 200mA	0.1%	0.1%	1.0mV RMS	B	P34-12	53.00
		± 300mA	0.1%	0.1%	1.0mV RMS	C	P35-12	62.00
		± 500mA	0.1%	0.1%	1.0mV RMS	D	P37-12	78.00
	± 15V	± 25mA	0.1%	0.1%	2mV RMS	G	P31-M	32.00
		± 25mA	0.2%	0.2%	1.0mV RMS	A	P31	19.75
		± 25mA	0.02%	0.02%	0.5mV RMS	A	P31-1	23.00
		± 50mA	0.2%	0.2%	1.0mV RMS	A	P32	25.00
		± 50mA	0.02%	0.02%	0.5mV RMS	A	P32-1	33.00
		± 100mA	0.2%	0.2%	1.0mV RMS	A	P33	34.00
		± 100mA	0.02%	0.02%	1.0mV RMS	A	P33-1	38.00
		± 200mA	0.2%	0.2%	1.0mV RMS	B	P34	51.00
		± 200mA	0.02%	0.05%	1.0mV RMS	B	P34-1	61.00
		± 350mA	0.2%	0.2%	1.0mV RMS	C	P35	61.00
		± 350mA	0.02%	0.05%	1.0mV RMS	C	P35-1	71.00
		± 500mA	0.1%	0.1%	1.0mV RMS	D	P37-15	79.00
	± 18V	± 50mA	0.1%	0.1%	1.0mV RMS	A	P32-18	28.50
		± 100mA	0.1%	0.1%	1.0mV RMS	A	P33-18	41.00
	± 24V	± 50mA	0.1%	0.1%	1.0mV RMS	B	P32-24	42.00
		± 100mA	0.1%	0.2%	1.0mV RMS	B	P33-24	62.00
		± 200mA	0.1%	0.2%	1.0mV RMS	C	P34-24	84.00
TRIPLE VOLTAGE	5V/ ± 12V	250/ ± 60mA	.02%	0.1%	1.0mV RMS	C	P51-12	48.00
		250/ ± 120mA	.02%	0.1%	1.0mV RMS	C	P52-12	59.00
		500/ ± 120mA	.02%	0.1%	1.0mV RMS	C	P53-12	65.00
		1000/ ± 150mA	.02%	0.1%	1.0mV RMS	D	P53-1280	85.00
	5V/ ± 15V	250/ ± 50mA	.02%	0.1%	1.0mV RMS	C	P51-15	47.00
		250/ ± 100mA	.02%	0.1%	1.0mV RMS	C	P52-15	55.00
		300/ ± 150mA	.02%	0.1%	1.0mV RMS	C	P53-15L	64.00
		500/ ± 100mA	0.02%	0.1%	1.0mV RMS	C	P53-15	64.00
		1000/ ± 150mA	0.02%	0.1%	1.0mV RMS	D	P53-1580	89.00

OUTPUT PIN	SINGLE AND DUAL UNITS	TRIPLE OUTPUT UNITS
1	– VDC*	COM (5)
2	NO PIN	+5 Vdc
3	COM*	12/15
4	NO PIN	COM (12/15)
5	+VDC	+12/ +15

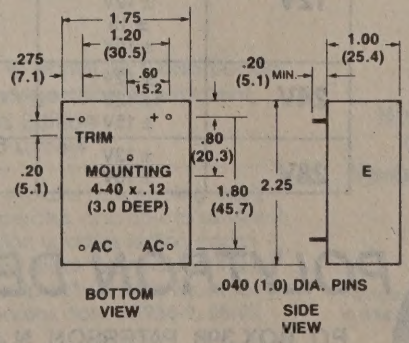
* – VDC Internally connected to COM for single output units. All dimensions are in inches.

OPTIONS AVAILABLE	SUFFIX	PRICE ADDER
220VAC	X	5.00
240VAC	XE	5.00
100VAC	Q	10.00
115/220	AX	15.00
2.2" AC pin spacing	22	NONE
Chassis mounting with terminal barrier strip	T	10.00

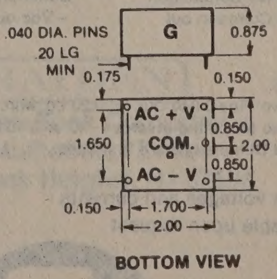
CASES A,B,C,D


D
C
B
A
2.0
1.56
1.25
.875
.20 MIN
.040 DIA. PINS
.25 REF
.15 REF
.15 REF
.15 REF
AC
AC'
.75
NOTE 2
1.0
.75
TWO MOUNTING INSERTS #4-40 x .1 DEEP
1
2
3
4
5
1.0
2.0
1.1
.55
2.2
2.5
3.2
3.5
BOTTOM VIEW

CASE E


1.75
1.20
(30.5)
.60
15.2
.275
(7.1)
.20
(5.1)
TRIM
+
MOUNTING
4-40 x .12
(3.0 DEEP)
AC
AC
.80
(20.3)
1.80
(45.7)
2.25
.20
(5.1) MIN.
1.00
(25.4)
E
BOTTOM VIEW
.040 (1.0) DIA. PINS
SIDE VIEW

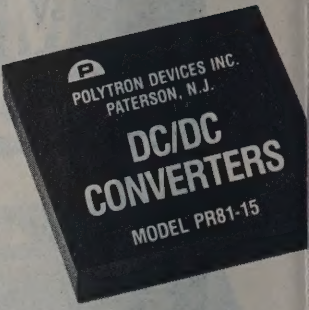
CASE G


.040 DIA. PINS
.20 LG
MIN
G
0.875
0.175
0.150
AC + V
COM.
AC – V
0.850
0.850
2.00
1.650
0.150
1.700
2.00
BOTTOM VIEW

REGULATED DC/DC CONVERTERS

FEATURES:

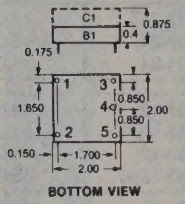
- HIGH PERFORMANCE TT INPUT FILTER
- SHORT CIRCUIT PROTECTED
- EXTREMELY LOW OUTPUT NOISE
- HIGHLY REGULATED FLOATING OUTPUTS
- LOW INPUT REFLECTED RIPPLE
- P.C. CARD MOUNTING


POLYTRON DEVICES INC.
PATERSON, N.J.
DC/DC
CONVERTERS
MODEL PR81-15

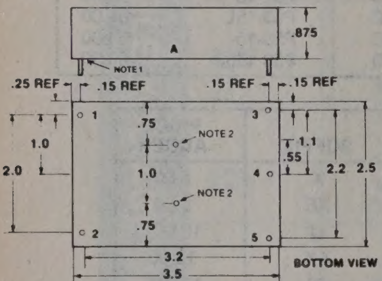
SPECIFICATIONS:

- **INPUT REFLECTED RIPPLE**
  1% of input voltage (max.)
- **OUTPUT VOLTAGE TOLERANCE**
  Factory set at ± 1% (fixed)
- **REGULATION**
  Line-0.05%
  Load-0.05%; 0.1% for PR87S
- **RIPPLE AND NOISE**
  1 MV RMS (max.)
- **INPUT—OUTPUT ISOLATION**
  300 VDC (min.)
- **OPERATING TEMPERATURE**
  −25°C to +71°C
- **STORAGE TEMPERATURE**
  −55°C to +85°C
- **EFFICIENCY**
  Nominal line at full load 55–65%

CASE B1, C1


C1
B1
0.875
0.4
0.175
1
3
4
2
5
1.650
0.850
2.00
0.850
0.150
1.700
2.00
BOTTOM VIEW

CASE A1


A
.875
NOTE 1
.25 REF
.15 REF
.15 REF
.15 REF
1
3
.75
NOTE 2
1.0
1.1
.55
2.0
1.0
4
2.2
2.5
NOTE 2
.75
2
5
3.2
3.5
BOTTOM VIEW

CONNECTIONS (A1, B1, C1)

PINS	Single Outputs	Dual Outputs
1	+Vdc in	+Vdc in
2	Common in	Common in
3	+Vdc out	+Vdc out
4	No Connection	Common out
5	Common out	−Vdc out

NOTES:
1. Five Pins 0.040 Dia. × 0.20 Lg. Min.
2. Two Mounting Inserts 4-40 × 0.10 Min.
3. All Dimensions are in Inches.

* Other voltages and currents available upon request

INPUT VOLTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	CASE SIZE	MODEL NUMBER	PRICE 1-9 QT
5V	5V	600	B1	PR87S	59.00
	5V	1000	C1	PR88S	65.00
	5V	2000	A1	PR89S	89.00
	12V	400	B1	PR12S	65.00
	15V	300	B1	PR15S	65.00
12V	5V	600	B1	PR87S-12	59.00
	5V	1000	C1	PR88S-12	65.00
	5V	2000	A1	PR89S-12	89.00
	12V	400	B1	PR12S-12	65.00
	15V	300	B1	PR15S-12	65.00
24V	5V	600	B1	PR87S-24	59.00
	5V	1000	C1	PR88S-24	65.00
	12V	400	B1	PR12S-24	65.00
	15V	300	B1	PR15S-24	65.00
28V	5V	600	B1	PR87S-28	59.00
	5V	1000	C1	PR88S-28	65.00
	12V	400	B1	PR12S-28	65.00
	15V	300	B1	PR15S-28	65.00
5V	±12V	±150	B1	PR81-12	59.00
	±12V	±250	C1	PR82-12	65.00
	±12V	±350	A1	PR83-12	85.00
	±15V	±150	B1	PR81-15	59.00
	±15V	±250	C1	PR82-15	65.00
12V	±12V	±150	B1	PR81-12-12	59.00
	±12V	±250	C1	PR82-12-12	65.00
	±12V	±350	A1	PR83-12-12	85.00
	±15	±150	B1	PR81-15-12	59.00
	±15V	±250	C1	PR82-15-12	65.00
24V	±12V	±150	B1	PR81-12-24	59.00
	±12V	±350	A1	PR83-12-24	85.00
	±15V	±150	B1	PR81-15-24	59.00
28V	±12V	±150	B1	PR81-12-28	59.00
	±15V	±150	B1	PR81-15-28	59.00

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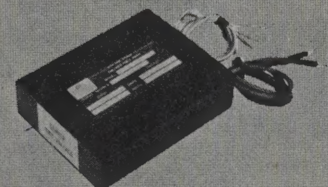
HE/NE LASER POWER SUPPLY

MODEL L23

Many shapes and sizes of this very compact supply are offered to fit a large variety of instrument packages. Numerous options are available, including an inhibit circuit to replace electromechanical relays for BRH compliance. Switching mode regulation provides exceptionally high efficiency while operating a plasma tube with a regulation of ± 1mA. The high efficiency allows operation with a minimum of heat sink and a minimum of heating within an instrument, increasing the life of heat sensitive components.

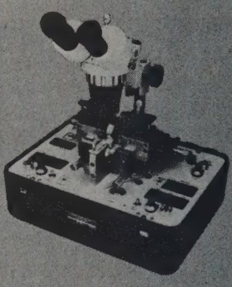
HE/NE LASER POWER SUPPLY



MODEL L92

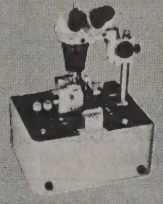
Features of this product include isolation of the laser tube or leads from the AC line, operation from either 115 or 230VAC by switching one lead, switching mode current regulation for high efficiency, and power output of 5 to 18W. The L92 is housed in a molded fiberglass case, and fully potted for maximum protection from dust and moisture. Size: 1.15 x 3.30 x 4.25" (29.2 x 83.8 x 108mm).

The Model L45 same as Model L92 except case dimensions. Contact P.T.I. for further information.



PFS-300 SERIES OPTICAL FIBER SPLICER

Operating from internal batteries or from a variety of external power sources, the PFS-300 Series splicers are ideal universal instruments in the laboratory, out in the field during installations and repairs, or as part of a production line. The combination of ruggedness and rigidity that makes this splicer so versatile has many important ramifications, particularly in the field of single mode lightwave transmissions.



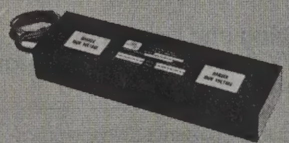
MODEL PFS-240 OPTICAL FIBER SPLICER

Featuring a modular stereo microscope and sturdy aluminum case, 'P.T.I.'s Model PFS-240 provides high level splicing performance, convenience, ease of operation, and ruggedness.

The stereo microscope will satisfy the most critical requirements for high-quality 3-D magnified images. With objectives 2X-4X as standard, rotation of a knurled ring selects either 40X or 80X. A lense attachment of 1.5X allows magnification of 60X to 120X.

Stereo zoom microscope, with magnification of 14X to 90X, provides large flat fields of view, crisply resolved. By rotating a knurled ring, magnifications are variable. A 1.5X lense attachment will allow magnification of 21X to 135X.

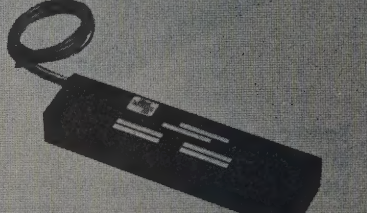
With the added features, our PFS-200 basic design is maintained. See inside page for specifications.



40 AND 75W HeNe AND CO_2 LASER POWER SUPPLIES

Operating from 115 or 230VAC. All units are housed in black fiberglass cases and are fully potted for maximum protection from dust and moisture. Typical applications of the L87 is 20-25MW HeNe while the L93 is 10-15MW HeNe. Typical applications of the CO2 L89 is 75W input and 40W input for the L94. L87 and L89 sizes: 1.42 x 2.79 x 9.10" (36 x 69 x 231mm). L93 and L94 sizes: 1.15 x 2.43 x 8.60" (29.2 x 61.7 x 219mm).

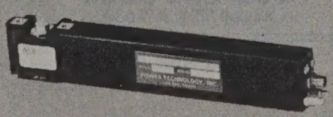
HE/NE LASER POWER SUPPLY



MODELS L41, L43

This series allows your choice of AC input voltages at 50-400Hz, which makes it particularly suitable for export. Features include isolation of the laser tube or lead from the AC line, switching mode current regulation, high efficiency, and exceptional compactness for a supply that delivers 4 to 20W output. All models are housed in black fiberglass cases and are of a fully potted construction for maximum protection from dust and moisture. Size: .945 x 1.445 x 6.05" (24 x 36.7 x 154mm).

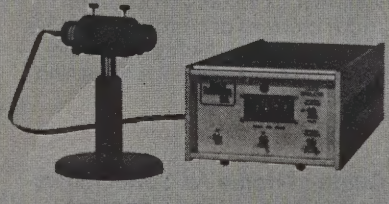
ILM LASER DIODE PULSER



ILM SERIES

The ILM Series Laser Diode Pulser is designed to drive the ITT Ls 7711 or Laser Diode Labs LDT 350 Series Fiber Coupled laser arrays. An internal power supply allows operation from any available D.C. voltage between 10 and 28 volts. Pulser dimensions and mountings is compatible with close spaced multiple arrays such as the ITT Ls7729, Ls7717, Ls7730, and Laser Diode Labs LDT 391.

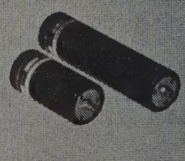
LASER DIODE SIMULATOR



CS100

This convenient, easy to use simulator is compact and self contained. It provides a pulsed 1.06 micron infrared signal source simulating a laser. Because of its portability, it is ideally suited to laboratory or field testing of laser systems or fiber optics. A double pulse option allows testing of laser rangefinders. Output power is 20mW at 20ns and 1.06 microns. Input voltage can be 115VAC, 230VAC or 12VDC.

LASER DIODE PULSER



ILC SERIES

The ILC produces more average output power for driving laser diodes at 7 to 200ns widths than avalanche or SCR pulsers. Models are available for pulse current of 1 through 100A. Fast rise and fall times, with internal clock for pulse rates of 100 through 10,000PPS. Size: (for internal supply) 1" x 4.25" (25mm x 108mm) or 1.25" x 4.25" (32mm x 108mm); (with customer supplied external supply) 1" x 2.5" (25mm x 64mm) or 1.25" x 2.5" (32mm x 64mm).

For More Information. Circle No. 347

RO ASSOCIATES

switching power supplies

- MTBF'S TO 126,000 HOURS
- 90/110/240 VAC INPUTS AVAILABLE
- ST SERIES MEETS MIL-STD-810C
- 17 YEARS EXPERIENCE IN SWITCHING POWER SUPPLIES
- OVER 200,000 SWITCHERS DELIVERED

SINGLE OUTPUTS

Volts DC	Amps	Model	Price
1.5-6V	5	105	$135.00
5.0	1	ET-13	87.00
	5	105	135.00
	10	210	299.00
	25	925	199.00
	25	325	320.00
	25	325ST	480.00
	35	UC-35	275.00
	100	710	595.00
	120	712	650.00
6.0	5	105	135.00
	20	325C	320.00
	20	325STC	480.00
	100	710C	650.00
6-12	3	108	135.00
6-28	1.5	106	135.00
12	3	108	135.00
	10	940	199.00
12-15	2.5	107	135.00
	4	250	315.00
	10	350	320.00
	10	350ST	480.00
	40	750	595.00
15	8	950	199.00
16-23	1.5	106	135.00
24	5	951	199.00
24-28	1.5	106	135.00
	2	251	315.00
	5	351	320.00
	5	351ST	480.00
	20	751	595.00
30	5	351	320.00
	20	751	595.00
250	.030	ET-19	95.00

MULTI OUTPUTS

Output 1	Output 2	Output 3	Output 4	Model	Price
5V @ .6A	+12V @ .1A	-12V @ .1A	—	ET-31	$108.00
5V @ .5A	+15V @ .1A	-15V @ .1A	—	ET-32	108.00
5V @ 5A	+12V @ .4A	-12V @ .4A	—	213C	395.00
5V @ 5A	+15V @ .4A	-15V @ .4A	—	213	395.00
5V @ 10A	12V @ 2A	—	—	314	375.00
5V @ 10A	12V @ 2A	—	—	314ST	562.50
5V @ 8A	12V @ 3A	—	—	315	375.00
5V @ 8A	12V @ 3A	—	—	315ST	562.50
5V @ 12A	12V @ 1A	—	—	316	375.00
5V @ 12A	12V @ 1A	—	—	316ST	562.50
5V @ 10A	+12V @ 1A	-12V @ 1A	—	312	395.00
5V @ 10A	+12V @ 1A	-12V @ 1A	—	312ST	592.50
5V @ 10A	+15V @ 1A	-15V @ 1A	—	313	395.00
5V @ 10A	+15V @ 1A	-15V @ 1A	—	313ST	592.50
5V @ 15A	+12V @ 1.0A	-12V @ 1.0A	-5V @ .5A	910	225.00
5V @ 15A	+15V @ .8A	-15V @ .8A	-5V @ .5A	910	225.00
5V @ 20A	+12V @ 3A	-12V @ 1A	-5V @ .5A	UC-10	325.00
5V @ 20A	+15V @ 2.5A	-15V @ 1A	-5V @ .5A	UC-10	325.00
5V @ 15A	+(12-15)V @ 2A	-(12-15)V @ 1A	+12V @ 4.0A	UC-22	325.00
5V @ 15A	+(12-15)V @ 2A	-(12-15)V @ 1A	+24V @ 2.0A	UC-24	325.00
5V @ 50A	+(12-15)V @ 10A	-(12-15)V @ 10A	-5V @ 1A	713	750.00

700 SERIES
900 SERIES
UC SERIES
ET SERIES
100 SERIES
200 and 2000 SERIES
300 AND ST SERIES

DC to DC CONVERTERS

Input	Output 1	Output 2	Output 3	Output 4	Output 5	Model	Price
40-70VDC	5V @ 20A	+12V @ 4.0A	-12V @ 4.0A	-5V @ 0.5A	—	1110	$395.00
40-70VDC	5V @ 20A	+15V @ 3.0A	-15V @ 3.0A	-5V @ 0.5A	—	1110	395.00
40-70VDC	5V @ 20A	+12V @ 4.0A	+12V @ 3.0A	-12V @ 2.0A	-5V @ 0.5A	1112	395.00
40-70VDC	5V @ 20A	+12V @ 4.0A	+15V @ 2.5A	-15V @ 1.5A	-5V @ 0.5A	1112	395.00
40-70VDC	5V @ 20A	+24V @ 2.0A	+12V @ 3.0A	-12V @ 2.0A	-5V @ 0.5A	1124	395.00
40-70VDC	5V @ 20A	+24V @ 2.0A	+15V @ 2.5A	-15V @ 1.5A	-5V @ 0.5A	1124	395.00

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For More Information. Circle No. 348

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For More Information. Circle No. 326

SEMICONDUCTOR CIRCUITS

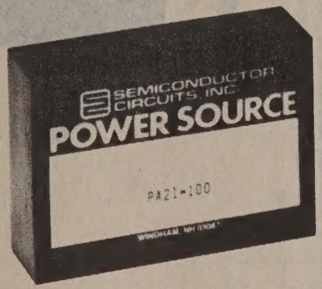
AC OPERATED POWER SUPPLIES & SWITCHERS DC/DC CONVERTERS

AC/DC Linear Power Supplies (Encapsulated)

5V Thru 180V Single Outputs
±5 Thru ±15V Dual Outputs
5V/±12V and 5V/±15V Triple Outputs

- 1, 2 and 3 Output Models
- Extremely Low Noise Operation
- −25° to + 71° C Operation

OUTPUT		INPUT VOLTAGE Vac	REGULATION		PACKAGE W x L x H	MODEL[3] NO.
VOLTAGE Vdc	CURRENT mA		LINE %	LOAD %		
5V[2]	200	105-125V SEE NOTE 1	0.25	0.4	2 x 2 x 0.88	SQ11-020
	500		0.25	0.4	2.3 x 2.3 x 1.25	SQ11-050
	500		0.05	0.05	2.5 x 3.5 x 0.88	P11-050
	500		0.05	0.05	2.5 x 3.5 x 0.88	PA11-050
	1000		0.05	0.1	2.5 x 3.5 x 1.25	P11-100
	1000		0.05	0.1	2.5 x 3.5 x 1.25	PA11-100
	1000		0.05	0.1	2.5 x 3.5 x 1.56	CM11-100
12V	100		0.25	0.4	2 x 2 x 0.88	SQ12-010
	500		0.05	0.1	2.5 x 3.5 x 1.25	P12-050
	500		0.05	0.1	2.5 x 3.5 x 1.56	CM12-050
180V	30		1.0	1.0	2.5 x 3.5 x 1.25	ED16-003



MAIN OUTPUT		OUTPUT 2		OUTPUT 3		INPUT VOLTAGE Vac	REGULATION		PACKAGE W x L x H	MODEL[3] NO.
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA		LINE %	LOAD %		
5V	500	−5V	500	–	–	105-125V STANDARD SEE NOTE 1	0.05	0.05	2.5 x 3.5 x 1.25	P21-100 PA21-100
12V	50	−12V	50	–	–		0.25	0.25	2 x 2 x 0.88	SQ22-010
	100		100	–	–		0.25	0.25	2.3 x 2.5 x 1.25	SQ22-020
	120		120	–	–		0.1	0.05	2.5 x 3.5 x 0.88	P22-020
	120		120	–	–		0.1	0.05	2.5 x 3.5 x 0.88	PA22-020
	200		200	–	–		0.05	0.1	2.5 x 3.5 x 1.56	CM22-040
	240		240	–	–		0.1	0.05	2.5 x 3.5 x 1.25	P22-040
	240		240	–	–		0.1	0.05	2.5 x 3.5 x 1.25	PA22-040
	300		300	–	–		0.01	0.05	2.5 x 3.5 x 1.56	P22-060
	300		300	–	–		0.01	0.05	2.5 x 3.5 x 1.56	PA22-060
	300		300	–	–		0.05	0.1	2.5 x 3.5 x 2	CM22-060
15V	30	−15V	30	–	–		0.25	0.25	2 x 2 x 0.88	SQ23-006
	50		50	–	–		0.25	0.25	2 x 2 x 0.88	SQ23-010
	100		100	–	–		0.25	0.25	2.3 x 2.5 x 1.25	SQ23-020
	100		100	–	–		0.01	0.05	2.5 x 3.5 x 0.88	P23-020
	100		100	–	–		0.01	0.05	2.5 x 3.5 x 0.88	PA23-020
	200		200	–	–		0.01	0.05	2.5 x 3.5 x 1.25	P23-040
	200		200	–	–		0.01	0.05	2.5 x 3.5 x 1.25	PA23-040
	200		200	–	–		0.05	0.1	2.5 x 3.5 x 1.56	CM23-040
	300		300	–	–		0.01	0.05	2.5 x 3.5 x 1.56	P23-060
	300		300	–	–		0.01	0.05	2.5 x 3.5 x 1.56	PA23-060
	300		300	–	–		0.05	0.1	2.5 x 3.5 x 2	CM23-060
5V	300	12V	150	−12V	150		0.01	0.2	2.5 x 3.5 x 1.25	MP34-060
	500		100		100		0.01	0.2	2.5 x 3.5 x 1.25	MP34-070
	300	15V	150	−15V	150		0.01	0.2	2.5 x 3.5 x 1.25	MP35-060
	500		100		100		0.01	0.2	2.5 x 3.5 x 1.25	MP35-070

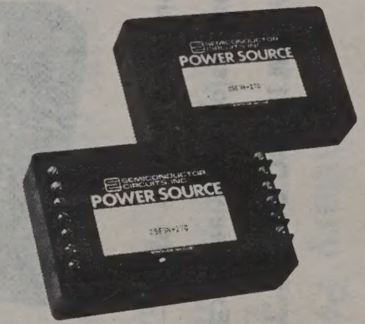
Notes:
1 Alternative input voltages available
2 Over volt protection optional
3 "A" prefix = alternate pins out available
"C" prefix = chassis mount, add 0.43 to height for terminal strip

SEMICONDUCTOR CIRCUITS, INC., 49 RANGE ROAD, WINDHAM, NEW HAMPSHIRE 03087 (603) 893-2330 TWX (710) 366-0505

For More Information. Circle No. 349

AC/DC Off-Line Switching Power Supplies (Encapsulated)
5V and 12V Single Outputs
±5V/12V and 5V/±15V Triple Outputs

- **AC or DC input: 70-140/140-280 Vac 200-400 Vdc**
- **Opto-Isolated Remote Power Shutdown**
- **Over Voltage Protection on +5V Output**

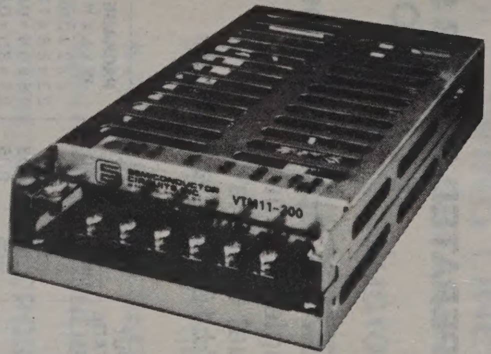


MAIN OUTPUT		OUTPUT 2		OUTPUT 3		PACKAGE W x L x H	MODEL¹ NO.
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA		
5V	5000	–	–	–	–	3.5 x 5.5 x 1.25	USE-11-500
	5000	–	–	–	–		CSE11-500
12V	2000	–	–	–	–		USE12-200
	2000	–	–	–	–		CSE12-200
5V	1000	–5	1000	12V	600		USE34-260
	1000		1000		600		CSE34-260
	2000		100		600		USE34-270
	2000		100		600		CSE34-270
5V	2000	15V	300	–15V	300		USE35-260
	2000		300		300		CSE35-260

Notes: 1 "C" indicates chassis mount, add 0.43 to height for terminal strip
Regulation: Main output, 0.2% line, 0.2% load 12V or 15V outputs, 0.1% line, 0.15% load
–5V output, 0.1% line, 0.5% load

AC/DC Off-Line Switching Power Supplies (Enclosed)
5V Thru 24V Single Outputs, ±12V and ±15V Dual Outputs
5V/±12V and 5V/±15V Triple Outputs

- **All Have Soft Start**
- **All Have O.V.P. for +5V Output**
- **All Have Metal Cases and are Chassis Mount**



OUTPUT		INPUT VOLTAGE Vac	REGULATION		PACKAGE W x L x H	MODEL NO.
VOLTAGE Vdc	CURRENT Adc		LINE %	LOAD %		
5V	3	90-132	0.8	0.9	3.2 x 4.6 x 1.0	VTM11- 300
	5		0.8	0.9	3.3 x 5.3 x 1.2	VTA11- 500
	10		0.8	0.9	3.7 x 6.2 x 1.3	VTB11-1000
	15		0.8	0.9	3.9 x 7.7 x 1.5	VTC11-1500
	20		0.8	0.9	3.8 x 8.1 x 1.9	VTD11-2000
12V	1.2		0.8	0.8	3.2 x 4.6 x 1.0	VTM12-1200
	2.1		0.8	0.8	3.3 x 5.3 x 1.2	VTA12- 210
	4.2		0.8	0.9	3.7 x 6.2 x 1.3	VTB12- 420
	6.3		0.8	0.8	3.9 x 7.7 x 1.5	VTC12- 630
	9		0.8	0.8	3.8 x 8.1 x 1.8	VTD12- 900
15V	1		0.8	0.9	3.2 x 4.6 x 1.0	VTM13- 300
	1.7		0.8	0.9	3.3 x 5.3 x 1.2	VTA13- 170
	3.4		0.8	0.9	3.7 x 6.2 x 1.3	VTB13- 340
	5		0.8	0.9	3.9 x 7.7 x 1.5	VTC13- 500
	7		0.8	0.9	3.8 x 8.1 x 1.9	VTD13- 700
24V	.62		0.8	0.8	3.2 x 4.6 x 1.0	VTM17- 062
	2.5		0.8	0.9	3.3 x 5.3 x 1.2	VTA17- 110
	2.1		0.8	0.9	3.7 x 6.2 x 1.3	VTB17- 210
	7.5		0.8	0.9	3.9 x 7.7 x 1.5	VTC17- 320
	12		0.8	0.9	3.8 x 8.1 x 1.9	VTD17- 500

MAIN OUTPUT		OUTPUT 2		OUTPUT 3		INPUT VOLTAGE Vac	REGULATION		PACKAGE W x L x H	MODEL NO.
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA		LINE %	LOAD %		
12V	.75	–12V	.50	—	—	90-132	0.8	0.9	3.2 x 4.6 x 1.0	VTM22- 125
15V	.50	–15V	.50	—	—	90-132	0.8	0.9	3.2 x 4.6 x 1.0	VTM23- 100
5V	1.8	15V	.12	–15V	.12	90-132	Note 2		3.2 x 4.6 x 1.0	MTP35- 204
	1.8	12V	.15	–12V	.15	90-132			3.2 x 4.6 x 1.0	MTP34- 210
	15.0	12V	4.0	–12V	4.0	Note 1	0.4	0.4	5 x 10.5 x 2.5	VS34- 2300
	15.0	15V	3.0	–15V	3.0	Note 1	0.4	0.4	5 x 10.5 x 2.5	VS35- 2100
	5.0	12V	1.0	–12V	1.0	90-132	0.8	0.9	3.9 x 7.7 x 1.5	VTC34- 700
	5.0	–15V	1.0	–15V	1.0	90-132	0.8	0.9	3.9 x 7.7 x 1.5	VTC35- 700

Notes:
1 70-140/140-280 Vac (200-400 Vdc)
2 Main output: line 0.2%, cross/load 0.8%
Auxiliaries: line 0.05%, cross/load 0.05%

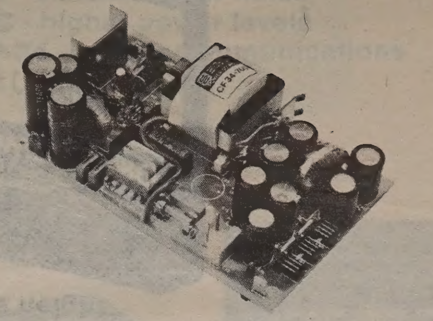
SEMICONDUCTOR CIRCUITS, INC.
49 RANGE RD., WINDHAM, N.H. 03087
(603) 893-2330 TWX (710) 366-0505

For More Information. Circle No. 349

AC/DC Off-Line Switching Power Supplies (Open Frame)

5V/±12V and 5V/±15V Triple Outputs
5V/±12V and 5V/±15V and −5V Quad Outputs

- **User Selectable Input Ranges Accommodate Domestic and European Format**
- **50 and 65 Watt Sizes**
- **3 and 4 Output Models Available**



MAIN OUTPUT		OUTPUT 2		OUTPUT 3		OUTPUT 4		INPUT VOLTAGE Vac	REGULATION		PACKAGE W x L x H	MODEL NO.
VOLTAGE Vdc	CURRENT Adc	VOLTAGE Vdc	CURRENT Adc	VOLTAGE Vdc	CURRENT Adc	VOLTAGE Vdc	CURRENT Adc		LINE %	LOAD %		
5V	5	12V	1.0	−12V	1.0	—	—	DUAL INPUT VOLTAGE STANDARD 115(230)	0.8 MAX	0.9 MAX	3.55 x 9.06 x 1.25	SEP34-700S2
	3.5		2.5		0.3				Note 1		3.9 x 6.3 x 2.0	CF34-630
	5		1.5		0.5						3.9 x 6.3 x 2.0	CF34-700
	4		3.5		0.5						3.9 x 6.3 x 2.0	CF34-800
5V	5	15V	1.0	−15V	1.0	—	—		0.8 MAX	0.9 MAX	3.55 x 9.06 x 1.25	SEP35-700S2
	4		1.5		0.5				Note 1		3.9 x 6.3 x 2.0	CF35-600
	4		1.5		1.5						3.9 x 6.3 x 2.0	CF35-700
5V	3.5	12V	2.5	−12V	0.3	−5V	0.1				3.9 x 6.3 x 2.0	CF44-640
	5.0		1.5		0.4		0.1					CF44-700
	4.0		3.5		0.4		0.1					CF44-800
5V	4.0	15V	1.5	−15V	0.4	−5V	0.1				3.9 x 6.3 x 2.0	CF45-600
	4.0		1.5		1.4		0.1					CF45-700

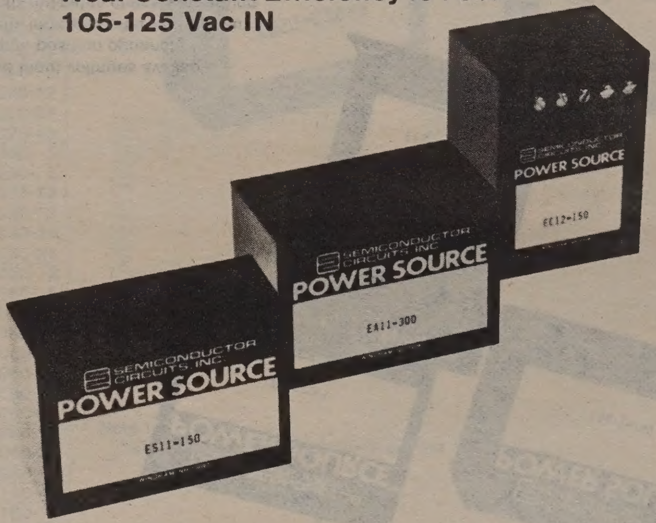
Note 1: Load curves available on request

AC/DC Switch-Mode Power Supplies (Encapsulated)

5V Thru 24V Single Outputs
±12V and ±15V Dual Outputs

- **Full Operation −25 to +71° C**
- **Line Transient Immunity >60dB**
- **Near Constant Efficiency to 70%: 105-125 Vac IN**

OUTPUT		INPUT VOLTAGE Vac	REGULATION		PACKAGE W x L x H	MODEL[3] NO.
VOLTAGE Vdc	CURRENT mA		LINE %	LOAD %		
5V[2]	1500	105 - 125 50 - 440Hz STANDARD SEE NOTE 1	0.15	0.15	2.5 x 3.5 x 1.25	ES11-150
					2.5 x 3.5 x 1.25	EA11-150
					2.5 x 3.5 x 1.56	EC11-150
	3000				2.5 x 3.5 x 1.56	ES11-300
					2.5 x 3.5 x 1.56	EA11-300
					2.5 x 3.5 x 2.0	EC11-300
	4000				2.5 x 3.5 x 2.0	ES11-400
					2.5 x 3.5 x 2.0	EA11-400
					2.5 x 3.5 x 2.0	EC11-400
12V	800				2.5 x 3.5 x 1.25	ES12-080
					2.5 x 3.5 x 1.25	EA12-080
					2.5 x 3.5 x 1.56	EC12-080
	1500				2.5 x 3.5 x 2.0	ES12-150
					2.5 x 3.5 x 2.0	EA12-150
					2.5 x 3.5 x 2.0	EC12-150
24V	400				2.5 x 3.5 x 1.25	ES17-040
					2.5 x 3.5 x 1.25	EA17-040
					2.5 x 3.5 x 1.56	EC17-040



OUTPUT 1		OUTPUT 2		INPUT VOLTAGE Vac	REGULATION		PACKAGE W x L x H	MODEL[3] NO.
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA		LINE %	LOAD %		
12V	500	−12V	500	105 - 125 50 - 440 Hz STANDARD SEE Note 1	0.15	0.15	2.5 x 3.5 x 2.0	ES22-100 EA22-100 EC22-100
15V	500	−15V	500				2.5 x 3.5 x 2.0	ES23-100 EA23-100 EC23-100

Notes:
1 Alternative input voltages available
2 Over volt protection option
3 "A" prefix = alternate pins out available
"C" prefix = chassis mounting,
add 0.43 to height for terminal strip

SEMICONDUCTOR CIRCUITS, INC.
49 RANGE RD., WINDHAM, N.H. 03087
(603) 893-2330 TWX (710) 366-0505

For More Information. Circle No. 349

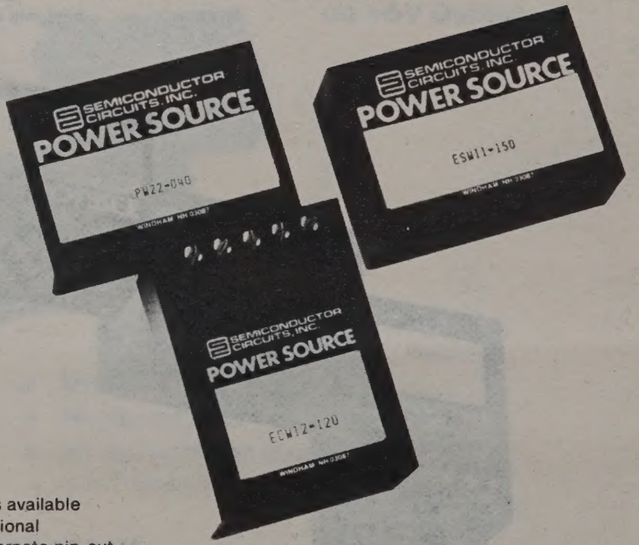
AC/DC UL544 Standard for Safety-Medical & Dental Equipment

5V and 12V Single Outputs ±12V and ±15V Dual Outputs

- Patient Contact Rated
- 2500 Vac Breakdown
- Faraday - Shielded Transformers

OUTPUT VOLTAGE Vdc	OUTPUT CURRENT mA	INPUT VOLTAGE Vac	REGULATION LINE %	REGULATION LOAD %	PACKAGE W x L x H	MODEL[3] NO.
5V[2]	1000	105 - 125V 50 - 440Hz STANDARD SEE Note 1	0.05	0.1	2.5 x 3.5 x 1.25	PW11-100
					2.5 x 3.5 x 1.25	PAW11-100
					2.5 x 3.5 x 1.56	CMW11-100
	1500		0.15	0.15	2.5 x 3.5 x 1.25	ESW11-150
					2.5 x 3.5 x 1.25	EAW11-150
					2.5 x 3.5 x 1.25	ECW11-150
	3000		0.15	0.15	2.5 x 3.5 x 1.25	ESW11-300
					2.5 x 3.5 x 1.56	EAW11-300
					2.5 x 3.5 x 2.0	ECW11-300
12V	800		0.15	0.15	2.5 x 3.5 x 1.25	ESW12-080
					2.5 x 3.5 x 1.56	ECW12-080

OUTPUT 1 VOLTAGE Vdc	OUTPUT 1 CURRENT mA	OUTPUT 2 VOLTAGE Vdc	OUTPUT 2 CURRENT mA	INPUT VOLTAGE Vac	REGULATION LINE %	REGULATION LOAD %	PACKAGE W x L x H	MODEL[3] NO.
12V	120	−12V	120	105-125V 50-440Hz STANDARD SEE Note 1	0.01	0.05	2.5 x 3.5 x 0.88	PW22-020
	200		200				2.5 x 3.5 x 1.56	CMW22-040
	240		240				2.5 x 3.5 x 1.25	PW22-040
	240		240				2.5 x 3.5 x 1.25	PAW22-040
15V	100	−15V	100		0.01	0.05	2.5 x 3.5 x 0.88	PW23-020
	100		100				2.5 x 3.5 x 0.88	PAW23-020
	200		200				2.5 x 3.5 x 1.25	PW23-040
	200		200				2.5 x 3.5 x 1.25	PAW23-040
	200		200				2.5 x 3.5 x 1.56	CMW23-040


SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCE
PW22-040
WINDHAM NH 03087
SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCE
ESW11-150
WINDHAM NH 03087
SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCE
ECW12-120
WINDHAM NH 03087

Notes:
1 Alternative input voltages available
2 Over voltage position optional
3 "A" in prefix indicates alternate pin-out
"C" in prefix indicates chassis mounting

DC/DC Regulated Converters (Encapsulated)

5V and 12V Single Outputs

- FC - extremely low noise
- RD, RA - low reflected ripple
- LA, LD - minimum case height

OUTPUT VOLTAGE Vdc	OUTPUT CURRENT mA	INPUT VOLTAGE Vdc	REGULATION LINE %	REGULATION LOAD %	PACKAGE W x L x H	MODEL[1] NO.
5V	600	4.5 - 5.5	0.02	0.1	2 x 2 x 0.4	FC11-060- 5
		10.8 x 15.0				FC11-060-12
		21.6 - 30.0				FC11-060-24
		42.0 x 56.0				FC11-060-48
5V	1000	4.5 x 6.5	0.05	0.1	2 x 2 x 0.88	RD11-100- 5
		4.5 x 5.5				RA11-100- 5
		10.8 x 13.2				RD11-100-12
		10.8 x 13.2				RA11-100-12
		21.6 - 26.4				RD11-100-24
		21.6 x 26.4				RA11-100-24
		42.0 x 56.0				RD11-100-48
		42.0 x 56.0				RA11-100-48
12V	300	4.5 x 5.5	0.05	0.05	2 x 2 x 0.375	LD12-030- 5
		10.8 - 13.2				LD12-030-12
		21.6 x 26.4				LD12-030-24
12V	500	4.5 x 5.5	0.05	0.05	2 x 2 x 0.88	RD12-050- 5
		10.8 x 13.2				RD12-050-12
		21.6 - 26.4				RD12-050-24
		42.0 x 56.0				RD12-050-48

Notes:
1 "A" in prefix indicates alternate pin-out

SEMICONDUCTOR CIRCUITS, INC.
POWER SOURCE
FC11-060-5
WINDHAM, NH 03087

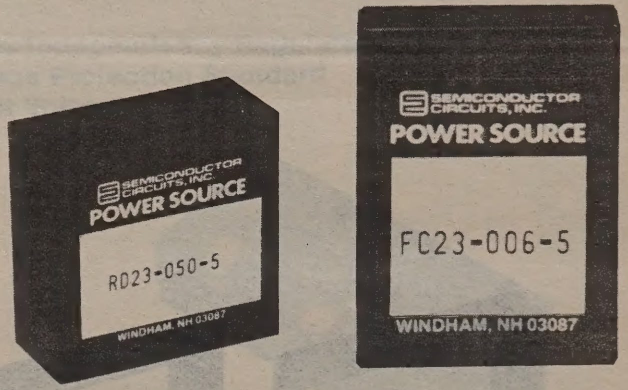
SEMICONDUCTOR CIRCUITS, INC.
49 RANGE RD., WINDHAM, N.H. 03087
(603) 893-2330 TWX (710) 366-0505

For More Information. Circle No. 349

DC/DC Regulated Converters (Encapsulated) 5V, ±12V and ±15V Dual and Triple Outputs

MAIN OUTPUT		OUTPUT 2		OUTPUT 3		INPUT VOLTAGE Vdc	REGULATION		PACKAGE W x L x H	MODEL[1] NO.
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA		LINE %	LOAD %		
12V	35	−12V	35	—	—	4.5 - 5.5 10.8 - 15.0 21.6 - 30.0 42.0 - 56.0	0.02	0.02	1.5 x 2.0 x 0.4	FC22-007- 5 FC22-007-12 FC22-007-24 FC22-007-48
12V	125	−12V	125	—	—	4.5 - 5.5 10.8 - 15.0 21.6 - 30.0 42.0 - 56.0	0.02	0.02	2.0 x 2.0 x 0.4	FC22-025- 5 FC22-025-12 FC22-025-24 FC22-025-48
12V	150	−12V	150	—	—	4.5 - 5.5 4.5 - 5.5 10.8 - 13.2 10.8 - 13.2 21.6 - 26.4 21.6 - 26.4	0.05	0.05	2.0 x 2.0 x 0.375	LD22-030- 5 LA22-030- 5 LD22-030-12 LA22-030-12 LD22-030-24 LA22-030-24
12V	250	−12V	250	—	—	4.5 - 5.5 4.5 - 5.5 10.8 - 13.2 10.8 - 13.2 21.6 - 26.4 21.6 - 26.4 42.0 - 56.0 42.0 - 56.0	0.05	0.05	2.0 x 2.0 x 0.88	RD22-050- 5 RA22-050- 5 RD22-050-12 RA22-050-12 RD22-050-24 RA22-050-24 RD22-050-48 RA22-050-48
12V	425	−12V	425	—	—	10.8 - 15.0 21.6 - 30.0 42.0 - 56.0	0.02	0.02	2.5 x 3.5 x 0.88	MC22-085-12 MC22-085-24 MC22-085-48
15V	30	−15V	30	—	—	4.5 - 5.5 10.8 - 15.0 21.6 - 30.0 42.0 - 56.0	0.02	0.02	1.5 x 2.0 x 0.4	FC23-006- 5 FC23-006-12 FC23-006-24 FC23-006-48
15V	100	−15V	100	—	—	4.5 - 5.5 10.8 - 15.0 21.6 - 30.0 42.0 - 56.0	0.02	0.02	2.0 x 2.0 x 0.4	FC23-020- 5 FC23-020-12 FC23-020-24 FC23-020-48
15V	150	−15V	150	—	—	4.5 - 5.5 4.5 - 5.5 10.8 - 13.2 10.8 - 13.2 21.6 - 26.4 21.6 - 26.4	0.05	0.05	2.0 x 2.0 x 0.375	LD23-030- 5 LA23-030- 5 LD23-030-12 LA23-030-12 LD23-030-24 LA23-030-24
15V	250	−15V	250	—	—	4.5 - 5.5 4.5 - 5.5 10.8 - 13.2 10.8 - 13.2 21.6 - 26.4 21.6 - 26.4 42.0 - 56.0 42.0 - 56.0	0.05	0.05	2.0 x 2.0 x 0.88	RD23-050- 5 RA23-050- 5 RD23-050-12 RA23-050-12 RD23-050-24 RA23-050-24 RD23-050-48 RA23-050-48
15V	330	−15V	330	—	—	10.8 - 15.0 21.6 - 30.0 42.0 - 56.0	0.02	0.02	2.5 x 3.5 x 0.88	MC23-066-12 MC23-066-24 MC23-066-48
5V	500	+12V	300	−12V	300	−44 to −56	±1	±0.5	2.58 x 4.57 x 0.83	SP34-110-48
5V	1000	15V	300	−15V	300	10.8 - 15.0 21.6 - 30.0 42.0 - 56.0 10.8 - 15.0 21.6 - 30.0 42.0 - 56.0	0.15(5V) .15(15V)	0.05(5V) .15(15V)	2.5 x 3.5 x 2.0	MC34-160-12 MC34-160-24 MC34-160-48 MC35-160-12 MC35-160-24 MC35-160-48
5V	1000	+12V	400	−12V	200	21.6 - 30.0	.15(5V) .15(12V)	0.5(15V) .15(12V)	2.5 x 3.5 x 2.0	MC34-170-24

- RD, RA - low reflected ripple
- LA, LD - minimum case height
- FC - extremely low noise
- MC - higher power levels
- SP-34 - for telecommunications



Note 1
"A" in prefix indicates alternate pin-out

SEMICONDUCTOR CIRCUITS, INC.
49 RANGE RD. WINDHAM, N.H. 03087
(603) 893-2330 TWX (710) 366-0505

For More Information. Circle No. 349

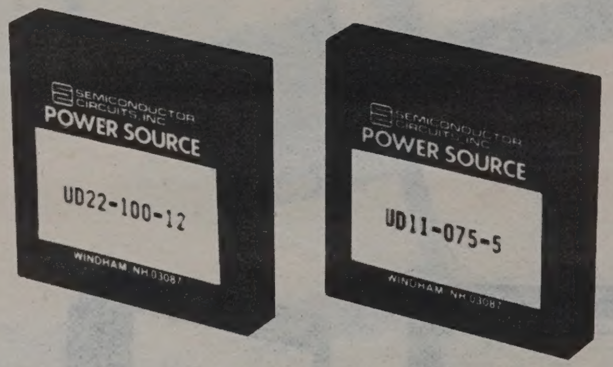
DC/DC Unregulated Isolated Converters (Encapsulated)

5V and 12V Single Outputs
5V, ±12V and ±15V Dual Outputs

- Full Operation From −25° C to +71°C
- Maximum Power Density up to 5.5 w/cu. in. up to 200,000 hrs., MTBF
- Efficiency to 85%

OUTPUT		INPUT	REGULATION		PACKAGE	MODEL
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	LINE %	LOAD %	W x L x H	NO.
5V	180	4.5 - 5.5	1%/%Vin (TYP)	LOAD CURVES AVAIL ON REQUEST	1.1 x 1.1 x 0.5	DTS11-018- 5
		10.2 - 13.8				DTS11-018-12
		20.4 - 27.6				DTS11-018-24
	450	4.5 - 5.5				DTS11-045- 5
	750	4.5 - 5.5			2.0 x 2.0 x0.4	UD11-075- 5
12V	75	4.5 - 5.5			1.1 x 1.1 x 0.5	DTS12-007- 5
	75	10.2 - 13.8				DTS12-007-12
	200	4.5 - 5.5				DTS12-020- 5
	300	10.2 - 13.8				DTS12-030-12
	600	4.5 - 5.5			2.0 x 2.0 x 0.4	UD12-060- 5
	800	4.5 - 5.5			2.0 x 2.0 x 0.88	UD12-080- 5

OUTPUT 1		OUTPUT 2		INPUT	REGULATION		PACKAGE	MODEL
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	LINE %	LOAD %	W x L x H	NO.
	300	−5V	100	4.5 - 5.5	1%/% Vin (TYP)	LOAD CURVES AVAIL ON REQUEST	2.0 x 2.0 x 0.4	UD24-040- 5
12V	38	−12V	38	4.5 - 5.5			1.1 x 1.1 x 0.5	DTD22-008- 5
				10.2 - 13.8				DTD22-008-12
	100		100	4.5 - 5.5			1.1 x 1.1 x 0.5	DTD22-020- 5
	165		165	10.2 - 13.8			1.1 x 1.1 x 0.5	DTD22-033-12
				20.4 - 27.6				DTD22-033-24
	300		300	4.5 - 5.5			2.0 x 2.0 x 0.4	UD22-060- 5
	400		400	4.5 - 5.5			2.0 x 2.0 x 0.88	UD22-080- 5
	500		500	10.8 - 13.2			2.0 x 2.0 x 0.4	UD22-100-12
	650		650	10.8 - 13.2			2.0 x 2.0 x 0.88	UD22-130-12
15V	30	−15V	30	4.5 - 5.5			1.1 x 1.1 x 0.5	DTD23-006- 5
				10.2 - 13.8				DTD23-006-12
				20.4 - 27.6				DTD23-006-24
	80		80	4.5 - 5.5			1.1 x 1.1 x 0.5	DTD23-016- 5
	135		135	10.2 - 13.8			1.1 x 1.1 x 0.5	DTD23-027-12
				20.4 - 27.6				DTD23-027-24
	300		300	4.5 - 5.5			2.0 x 2.0 x 0.4	UD23-060- 5
	400		400	4.5 - 5.5			2.0 x 2.0 x 0.88	UD23-080- 5
	500		500	10.8 - 13.2			2.0 x 2.0 x 0.4	UD23-100-12
	650		650	10.8 - 13.2			2.0 x 2.0 x 0.88	UD23-130-12

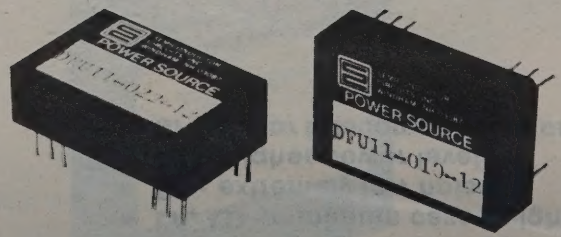


DC/DC 24 Pin-Dip Compatible Single & Dual Output Converters Unregulated with Input Filter (Encapsulated)

OUTPUT 1		OUTPUT 2		INPUT	REGULATION		PACKAGE	MODEL*
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	LINE %	LOAD %	W x L x H	NO.
5V	220	—	—	4.5 - 5.5	1%/%Vin	Note 1	0.8 x 1.25 x 0.38	DFU11-022-05
				10.8 - 13.2				DFU11-022-12
12V	50	−12V	50	4.5 - 5.5				DFU22-010-05
				10.8 - 13.2				DFU22-010-12
15V	45	−15V	45	4.5 5.5				DFU23-009-05
				10.8 - 13.2				DFU23-009-12

Note 1 Load Curves available on request

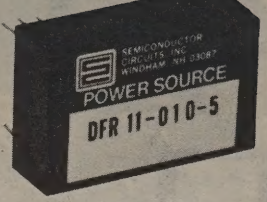
* Where input/output filters are not required, replace prefix DFU with µD



SEMICONDUCTOR CIRCUITS, INC.
49 RANGE RD. WINDHAM, N.H. 03087
(603) 893-2330 TWX (710) 366-0505

For More Information. Circle No. 349

DC/DC 24 Pin-Dip Compatible Single & Dual Output Converters Regulated with Input Filter (Encapsulated)



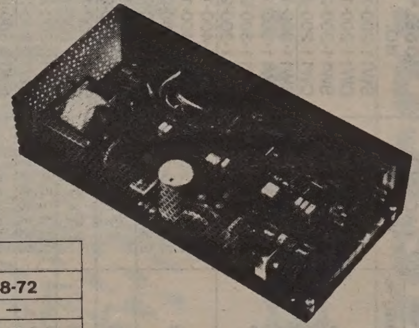
OUTPUT 1		OUTPUT 2		INPUT	REGULATION		PACKAGE	MODEL*
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	LINE %	LOAD %	W x L x H	NO.
5V	100	—	—	4.5 - 5.5	<1	0.1	0.8 x 1.25 x 0.38	DFR11-010-05
				10.8 - 13.2				DFR11-010-12
12V	40	−12V	40	4.5 - 5.5				DFR22-008-05
				10.8 - 13.2				DFR22-008-12
15V	40	−15V	40	4.5 - 5.5				DFR23-008-05
				10.8 - 13.2				DFR23-008-12

* Where input/output filters are not required, replace prefix DFR with μR

DC/DC Single and Multiple Output Converters (Enclosed)

5V, 12V and 15V Single and Multiple Outputs

- **All Outputs Independently Regulated**
- **Over Voltage Protection Standard**
- **Wide Input Voltage Range**



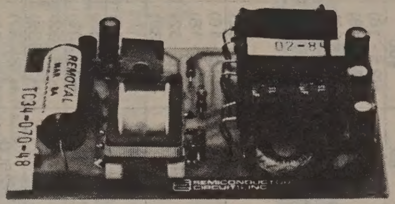
OUTPUT VOLTAGE Vdc	OUTPUT CURRENT mA	REGULATION		PACKAGE W x L x H	MODEL NO. - INPUT VOLTAGE RANGE		
		LINE %	LOAD %		9.2-16	19.2-31.2	38.4-62.4
5V	3,000	0.8	0.9	3.2 x 4.6 x 1.0	VTM11-300-12	VTM11-300-24	VTM11-300-48
12V	1,200	0.8	0.9	3.2 x 4.6 x 1.0	VTM12-120-12	VTM12-120-24	VTM12-120-48
15V	1,000	0.8	0.9	3.2 x 4.6 x 1.0	VTM13-100-12	VTM13-100-24	VTM13-100-48
24V	620	0.8	0.9	3.2 x 4.6 x 1.0	VTM17-062-12	VTM17-062-24	VTM17-062-48

OUTPUT 1		OUTPUT 2		OUTPUT 3		REGULATION		PACKAGE	MODEL NO. - INPUT VOLTAGE RANGE			
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	LINE %	LOAD %	W x L x H	9.2-16	19.2-31.2	38.4-62.4	18-72
12V	1 750	−12V	−500	—	—	0.8	0.9	3.2 x 4.6 x 1.0	VTM22-125-12	VTM22-125-24	VTM22-125-48	—
15V	500	−15V	−500	—	—				VTM23-100-12	VTM23-100-24	VTM23-100-48	—
5V	15,000	12V	4,000	12V	4,000	0.4	0.4	5 x 10.5 x 2.5	—	—	—	DS34-2300-36
	15,000	15V	3,000	15V	3,000							DS35-2100-36
5V	1,800	12V	150	−12V	−150	Note 1		3.2 x 4.6 x 1.0	MTP34-210-12	MTP34-210-24	MTP34-210-48	—
	1,800	15V	120	−15V	−120				MTP35-204-12	MTP35-204-24	MTP35-204-48	

Note 1 Main output: line 0.2%, cross/load 0.8%
Auxiliaries: line 0.05%,cross/load 0.05%

DC/DC Converter for Telecommunications

- **High Efficiency >75%**
- **High Reliability >200,000 hrs.**
- **Short Circuit Protected**



OUTPUT 1		OUTPUT 2		OUTPUT 3		INPUT	REGULATION		PACKAGE	MODEL
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	LINE %	LOAD %	W x L x H	NO.
5V	500	12V	100	−12V	100	−44 to −56	±5	NOTE 1	2.05 x 3.35 x .50	TC34-070-48

Note 1 Load Curves available on request

SEMICONDUCTOR CIRCUITS, INC.
49 RANGE RD., WINDHAM, N.H. 03087
(603) 893-2330 TWX (710) 366-0505

For More Information. Circle No. 349

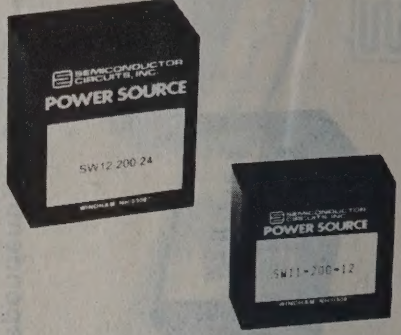
DC/DC Wide Input Range Converters (Encapsulated)

5V, 12V and 15V Single Outputs

OUTPUT		INPUT	REGULATION		PACKAGE	MODEL*
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	LINE %	LOAD %	W x L x H	NO.
+5	2000	+(9.5 - 18) +(9.5 - 18) +(18 - 32) +(18 - 32)	0.3/0.3%		2.0 x 2 x 0.88 2.5 x 3.5 x 1.25 2.3 x 2.5 x 1.25 2.5 x 3.5 x 1.25	SW11-200-12 CW11-200-12 SW11-200-24 CW11-200-24
+5V	3000	+(9.5 - 18) +(9.5 - 18) +(18 - 32) +(18 - 32)	0.3/0.3%		2.5 x 3.5 x 1.25 2.5 x 3.5 x 1.56 2.5 x 3.5 x 1.25 2.5 x 3.5 x 1.56	SW11-300-12 CW11-300-12 SW11-300-24 CW11-300-24
+5V	4000	+(9.5 - 18) +(9.5 - 18) +(18 - 32) +(18 - 32)	0.5/0.5%		2.5 x 3.5 x 1.25 2.5 x 3.5 x 1.56 2.5 x 3.5 x 1.25 2.5 x 3.5 x 1.56	SW11-400-12 CW11-400-12 SW11-400-24 CW11-400-24
+5V	6500	+(9.5 - 18) +(18 - 32)	0.5/0.5%		2.5 x 3.5 x 2	CW11-650-12 CW11-650-24
+5V	8000	+(9.5 - 18) +(18 - 32)	0.5/0.5%		2.5 x 3.5 x 2	CW11-800-12 CW11-800-24
+12V	2000	+(18 - 32) +(18 - 32)	0.3/0.3%		2.3 x 2.5 x 1.25 2.5 x 3.5 x 1.56	SW12-200-24 CW12-200-24
+12V	3500	+(18 - 32) +(18 - 32)	0.5/0.5%		2.5 x 3.5 x 2	SW12-350-24 CW12-350-24
+15V	2000	+(18 - 32) +(18 - 32)	0.3/0.3%		2.3 x 2.5 x 1.25 2.5 x 3.5 x 1.56	SW13-200-24 CW13-200-24

* "CW" designates chassis mount, add 0.43 to height for terminal strip

- **Input Protection, Shutdown**
- **Full Operation −25° to +71° C**
- **Over Voltage Protection, Standard**

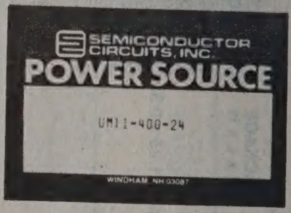


DC/DC Wide Input Range Isolated Converters (Encapsulated)

5V, 12V and 15V Single and Multiple Outputs

OUTPUT		INPUT	REGULATION		PACKAGE	MODEL*
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	LINE %	LOAD %	W x L x H	NO.
5V	3000	9 - 18 9 - 18 18 - 36 18 - 36 35 - 70 35 - 70	0.1	0.1	2.5 x 3.5 x 1.56 2.5 x 3.5 x 2 2.5 x 3.5 x 1.56 2.5 x 3.5 x 2 2.5 x 3.5 x 1.56 2.5 x 3.5 x 2	UM11-300-12 UMC11-300-12 UM11-300-24 UMC11-300-24 UM11-300-48 UMC11-300-48
5V	4000	18 - 36 18 - 36 35 - 70 35 - 70	0.1	0.1	2.5 x 3.5 x 2	UM11-400-24 UMC11-400-24 UM11-400-48 UMC11-400-48
5V	5000	Note 1	0.2	0.2	3.5 x 5.5 x 1.25	U11-500-XX CU11-500-XX
12V	1000	9 - 18 9 - 18 18 - 36 18 - 36 35 - 70 35 - 70	0.1	0.1	2.5 x 3.5 x 1.56 2.5 x 3.5 x 2 2.5 x 3.5 x 1.56 2.5 x 3.5 x 2 2.5 x 3.5 x 1.56 2.5 x 3.5 x 2	UM12-100-12 UMC12-100-12 UM12-100-24 UMC12-100-24 UM12-100-48 UMC12-100-48
12V	2000	35 - 70	0.1	0.1	2.5 x 3.5 x 2	UM12-200-48 UMC12-200-48
12V	2000	Note 1	0.2	0.2	3.5 x 5.5 x 1.25	UM12-200-XX CU12-200-XX
15V	1000	9 - 18 9 - 18 18 - 36 18 - 36 35 - 70 35 - 70	0.1	0.1	2.5 x 3.5 x 1.56 2.5 x 3.5 x 2 2.5 x 3.5 x 1.56 2.5 x 3.5 x 2 2.5 x 3.5 x 1.56 2.5 x 3.5 x 2	UM13-100-12 UMC13-100-12 UM13-100-24 UMC13-100-24 UM13-100-48 UMC13-100-48
15V	2000	35 - 70	0.1	0.1	2.5 x 3.5 x 2	UM13-200-48 UMC13-200-48

- **Output Power to 42 Watts**
- **Ideal for Battery Applications**
- **Wide Input Range - 2:1**



MAIN OUTPUT		OUTPUT 2		OUTPUT 3		OUTPUT 4		INPUT	PACKAGE	MODEL*
VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	CURRENT mA	VOLTAGE Vdc	W x L x H	NO.
5V	1000	−5V	1000	12V	600	—	—	Note 1	3.5 x 5.5 x 1.25	U34-260-XX CU34-260-XX
	2000	−5V	100	12V	600	—	—			U34-270-XX CU34-270-XX
	2000	15V	300	−15V	300	—	—			U35-260-XX CU35-260-XX
	1000	−5V	1000	12V	300	−12V	300			U44-260-XX CU44-260-XX
	2000	−5V	100	12V	300	−12V	300			U44-270-XX CU44-270-XX

* "C" in prefix designates chassis mount, add 0.43 to height for terminal strips

Note 1:
For 9-36Vdc input range, replace XX with suffix 18
For 18-72Vdc input range, replace XX with suffix 36
For 28-90Vdc input range, replace XX with suffix 48

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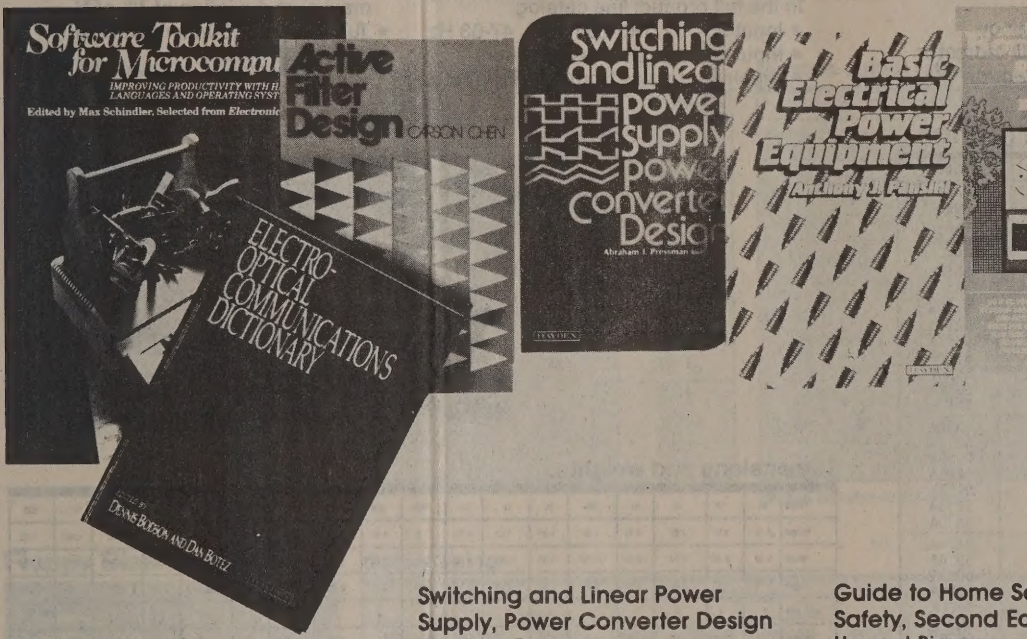
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OEM Switching Power Supplies

Features
- Dual Range AC input
- UL recognized, CSA certified
- Compliance to FCC 20780/Class A and VDE 0871/A for conducted noise
- VDE 0806/IEC 380 safety standards (7M and 5K only)
- Two year warranty
- 24-hour burn-in
- 65% to 80% efficiency
- Output status LED indicator
- Overvoltage protection
- Overload protection
- Enable/inhibit function
- Reverse polarity protection
- Convection cooled

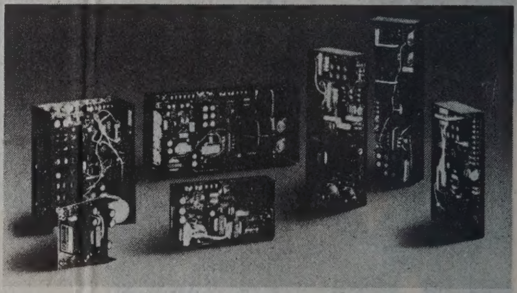
Specifications

The following is a brief summary of specifications. Comprehensive specifications for each model are included in the full product line catalog.

- Input 90-132/180-264 VAC, 47-63 Hz
- Input carry-over 16ms minimum
- Ripple and noise from 50mVp-p typical
- 0 to 40°C full rated load. Derate linearly to 50% load at 70°C
- Efficiency ranges from 65% to 80% dependent on model number
- Line regulation from 0.15%
- Load regulation from 0.15%
- Transient response from 500μs for a 50% to 100% load change with a maximum deviation of 4% of V_{out}.
- Turn-on time 100ms maximum
- Power fail option

Single output ratings

Voltage	Current	Model
5V	7.0A	5A5A
	12.0A	5B5A
	20.0A	5C5A
	35.0A	5E5A
	50.0A	5F5A
	65.0A	5G5A
	100.0A	5K5A
12V	3.3A	5A12A
	5.6A	5B12A
	8.3A	5C12A
	14.5A	5E12A
	21.0A	5F12A
	27.0A	5G12A
	41.0A	5K12A
15V	2.6A	5A15A
	4.5A	5B15A
	6.8A	5C15A
	11.8A	5E15A
	17.0A	5F15A
	22.0A	5G15A
	34.0A	5K15A
24V	1.6A	5A24A
	2.9A	5B24A
	4.5A	5C24A
	7.9A	5E24A
	11.0A	5F24A
	15.0A	5G24A
	22.0A	5K24A



Dimensions and weights:

Case	5A	5B	5C	5E	5F	5G	5K	5AX	7M45	5BX	7M65	5CX	7M100	7M150	5EX	7M200	5FX	5GX
Height	4.75	4.87	4.87	4.87	4.87	4.87	7.50	4.75	3.9	4.87	4.25	4.87	5.00	5.50	4.87	5.50	6.00	7.50
Width	5.00	6.50	8.50	10.50	13.50	15.00	15.00	6.10	6.3	8.00	8.25	11.00	9.5	10.50	15.00	11.50	15.00	15.00
Depth	2.10	1.75	2.00	2.25	2.25	2.37	3.00	2.10	2.00	1.75	2.00	2.00	2.25	2.75	2.25	2.75	2.25	2.50
MTG SDS	1	4	4	4	4	4	4	1	1	4	1	4	2	2	4	2	4	4
Weight	0.80	1.65	2.81	3.86	4.57	6.05	8.5	1.00	1.00	1.88	1.30	3.55	2.00	2.50	5.22	425	6.12	8.55

Multiple Output Ratings

1st Output		2nd Output		3rd Output		4th Output		5th Output		Max. Power	Model
Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current		
+5V	4.0A	+12V	0.5A	−12V	0.5A	−5V	0.5A	+15V	1.0A	40W	5AXMPA
+5V	5.0A	+12V	2.0A	−12V	0.5A	—	—	—	—	45W	7M45
+5V	7.0A	+12V	1.5A	−12V	0.5A	−5V	0.25A	—	—	60W	5BXMPA
+5V	8.0A**	+12V	3.0A**	−12V	0.6A	−5V*	0.1A*	—	—	70W	7M70
+5V	7.0A	+15V	1.0A	−15V	1.0A	—	—	—	—	65W	5BX515TA
+5V	10.0A	+12V	2.0A	−12V	1.0A	−5V	1.0A	—	—	90W	5CXMPA
+5V	10.0A	+15V	2.0A	−15V	1.0A	—	—	—	—	90W	5CX515TA
+5V	10.0A	+12V	1A/2APk	+12V	3A/5APk	−12V	2.0A	−5V*	0.6A*	100W	7M100
+5V	15.0A	+12V	3A/5.8APk	−12V	2.0A	−5V	0.7A	+24V	2A/3.75APk	150W	7M150
+5V	20.0A	+12V	3.0A	−12V	2.0A	−5V	1.0A	—	—	165W	5EXMPA
+5V	20.0A	+12V	4A/7.5APk	−12V	4.0A	−5V	0.7A	+24V	3.2A/6APk	200W	7M200
+5V	30.0A	+12V	5.0A	−12V	3.0A	−5V	2.0A	+24V	3.2A	250W	5FXMPA
+5V	45.0A	+12V	7.0A	−12V	5.0A	−5V	2.0A	+24V	3.2A	325W	5GXMPA

*Optional **9A Max Current between +5V and 12V outputs.

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Telephone (818) 998-9873

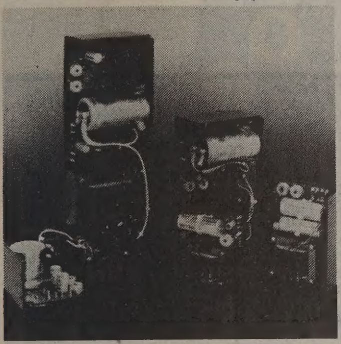
For More Information. Circle No. 351

OEM Linear Power Supplies

Features
- Dual range AC input
- Overvoltage protection
- Foldback current limiting
- Remote sense—most models
- Two year warranty
- UL recognized

Specifications
The following is a brief summary of specifications. Comprehensive specifications for each model are included in the full product line catalog.
- Input 105-125/210-250 VAC, 47-440 Hz.
- Line regulation 0.15% typical.
- Load regulation 0.15% typical
- Ripple 3mVp-p typical, 10mVp-p maximum.
- 0 to 40°C full rated load. Derate linearly to 50% load at 70°C ambient temperature.
- Dimensions on back page.

OEM III Power Supplies



Single output ratings

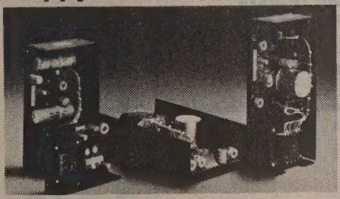
Voltage	Current	Model
5 Volts	3.0A	3B5
	6.0A	3C5
	9.0A	3CC5
	12.0A	3D5
	18.0A	3DD5
12 Volts	1.7A	3B12
	3.4A	3C12
	5.1A	3CC12
	7.0A	3D12
	10.0A	3DD12
15 Volts	1.5A	3B15
	3.0A	3C15
	4.5A	3CC15
	6.0A	3D15
	9.0A	3DD15
24 Volts	1.2A	3B24
	2.4A	3C24
	3.6A	3CC24
	4.8A	3D24
	7.0A	3DD24

Multiple output ratings

1st Output		2nd Output		3rd Output		Model
Voltage	Current	Voltage	Current	Voltage	Current	
+12V	1.0A	−12V	1.0A	—	—	2BB12D
12V	1.6A	12V	1.6A	—	—	3K12D
12V	3.2A	12V	3.2A	—	—	3L12D
+15V	0.8A	−15V	0.8A	—	—	2BB15D
15V	1.5A	15V	1.5A	—	—	3K15D
15V	3.0A	15V	3.0A	—	—	3L15D
5V	3.0A	12V	0.5A	12V	0.5A	2CC512T
5V	3.0A	+12V	1.0A	−12V	1.0A	3KX512T
5V	7.0A	12V	1.0A	12V	1.0A	2D512T
5V	8.0A	+12V	1.7A	−12V	1.7A	2P512T
5V	15.0A	+12V	3.4A	−12V	3.4A	2Q512T
5V	3.0A	15V	0.5A	15V	0.5A	2CC515TA
5V	7.0A	15V	1.0A	15V	1.0A	2D515TA
5V	8.0A	+15V	1.5A	−15V	1.5A	2P515T
5V	15.0A	+15V	3.0A	−15V	3.0A	2Q515T

Shading indicates output includes OVP

Floppy Disk Supplies

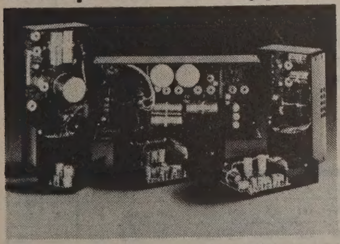


Output ratings

1st Output		2nd Output		3rd Output		4th Output*		Model
Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	
+5V	0.5A Avg 0.7A PK	+12V	0.9A Avg 1.8A PK	—	—	—	—	2BXFD
5V	1.4A	+12V	1.8A Avg 3.2A PK	—	—	—	—	2BBXFD
+5V	2.2A	− 5V	0.2A	+24V	1.2A Avg 3.0A PK	+8V	2.0A	2DFD
5V	3.0A	5V	0.6A	24V	4.0A	—	—	2PFD
+5V	6.0A	−12V	1.0A	24V	4.0A	—	—	2QXFD

Shading indicates output includes OVP *Unregulated Output

Microprocessor Supplies



Output ratings

1st Output		2nd Output		3rd Output		4th Output		Model
Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	
5V	2.0A	9-15V or 5V	0.5A 0.35A	—	—	—	—	2BBMPD
5V	2.0A	9-15V	0.25A	9-15V or 5V	0.25A 0.25A	—	—	2BBMP
5V	3.0A	12V	0.6A	9-12V or 5V	0.6A 0.38A	—	—	2CCMP
5V	7.0A	12V	1.0A	9V or 5V	1.2A 0.75A	—	—	2DMP
5V	8.0A	+12V	1.7A	−12V	1.0A	5V	0.6A	2PMP
5V	15.0A	+12V	3.4A	−12V	1.7A	5V	1.0A	2QMP

Shading indicates output includes OVP

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Micro-Reg Low Power Supplies

Features
- Smallest open frame construction available
- Overvoltage protection
- Monolithic voltage regulation
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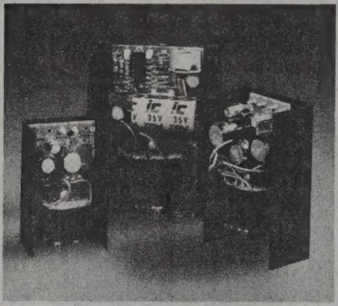
- Economical replacement for encapsulated supplies
- Two year warranty
- UL recognized
- Overcurrent protection



Specifications

The following is a brief summary of specifications. Comprehensive specifications for each model are included in the full product line catalog.
- Input 105-125 VAC, 47-440 Hz.
- Line regulation for 1C single output models 0.15% for a low-high line change. All others 0.5%.
- Load regulation for 1C single output models 0.15% for a 0 to 100% load change. All others 0.5%.
- Ripple 3mVp-p typical, 10mVp-p maximum on 1C single output models. 10mVp-p typical, 50mVp-p maximum on all others.
- 0° to 40°C full rated load. Derate linearly to 50% load at 70°C ambient temperature.

Single output ratings

Voltage	Current	Model
5V	0.5A	1A5
5V	1.1A	1B5
5V	2.2A	1C5
12V	0.25A	1A12
12V	0.6A	1B12
12V	1.2A	1C12
15V	0.2A	1A15
15V	0.5A	1B15
15V	1.0A	1C15
24V	0.5A	1C24

Shading indicates output includes OVP

Multiple output ratings

1st Output		2nd Output		3rd Output		Model
Voltage	Current	Voltage	Current	Voltage	Current	
+12V	0.13A	−12V	0.13A	—	—	1A12D
+12V	0.30A	−12V	0.30A	—	—	1B12D
+12V	0.60A	−12V	0.60A	—	—	1C12D
+15V	0.10A	−15V	0.10A	—	—	1A15D
+15V	0.25A	−15V	0.25A	—	—	1B15D
+15V	0.50A	−15V	0.50A	—	—	1C15D
+ 5V	0.25A	+12V	0.06A	−12V	0.06A	1A512T
+ 5V	0.50A	+12V	0.13A	−12V	0.13A	1B512T
+ 5V	1.00A	+12V	0.25A	−12V	0.25A	1C512T
+ 5V	0.25A	+15V	0.05A	−15V	0.05A	1A515T
+ 5V	0.50A	+15V	0.13A	−15V	0.13A	1B515T
+ 5V	1.00A	+15V	0.25A	−15V	0.25A	1C515T
+ 5V	1.00A	+12V	0.25A	− 5V	0.40A	1CMP

Shading indicates output includes OVP

S-100 Bus Power Supplies

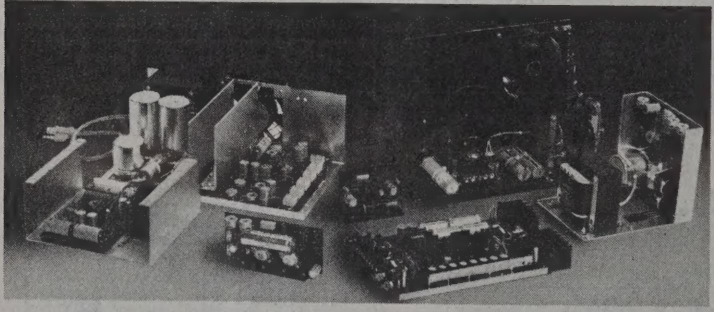
Features:
- Standard units provide 128W and 288W output power
- Dual range AC input
- Unregulated supplies for "on-board" regulators

Specifications
- Input 115/230 VAC ±10%, 47-440 Hz.
- Outputs below 20A are fused.

Output ratings

Model	Output 1 +8V @	Output 2 +16V @	Output 3 −16V @
2D-S100	8A	2.0A	2.0A
2F-S100	20A	4.0A	4.0A

Custom Power Supplies



Sierracin is presently supplying open frame custom power supplies in high volume to a large number of customers for application in floppy disk drives, CRT terminals, electronic games, computers, etc. Contact Sierracin for a quotation on custom power supplies for your specific requirements.

Outline Dimensions and Weights

The table describes overall outline dimension of the power supply envelope. Detailed dimension and mounting patterns are included in the full product line catalog.

	1A	1B	1C	2BB	2BX	2CC	2D	2P	2Q	2QX	3B	3C	3CC	3D	3DD	3K	3KX	3L	2DS	2FS
Height:	1.80	2.20	3.20	4.00	4.00	4.87	4.87	4.87	6.25	6.25	4.00	4.87	4.87	4.87	4.87	4.00	4.00	4.87	4.87	4.87
Width:	2.80	3.50	4.00	6.50	5.50	7.00	9.00	11.00	13.50	10.50	4.87	5.62	7.00	9.00	14.00	7.88	10.25	9.38	9.00	11.25
Depth																				
Overall:	1.48	1.88	2.07	1.93	1.93	3.20	3.20	3.13	4.00	3.25	2.07	2.95	3.20	3.20	3.20	2.95	2.95	3.20	3.20	4.12
Chassis:	1.10	1.35	1.65	1.62	1.62	2.75	2.75	2.75	3.37	2.87	1.62	2.50	2.75	2.75	2.75	2.50	2.50	2.75	2.70	3.75
Mtg. Sides	3	3	3	3	2	4	4	4	3	3	3	3	4	4	4	4	4	4	4	2
Weight:	0.50	0.90	1.55	2.15	1.95	4.25	7.20	7.85	11.3	9.4	1.9	4.0	4.25	7.75	10.2	4.1	4.25	7.35	7.55	12.2

NOTE: All dimensions are in inches and are ± 0.030 inches.

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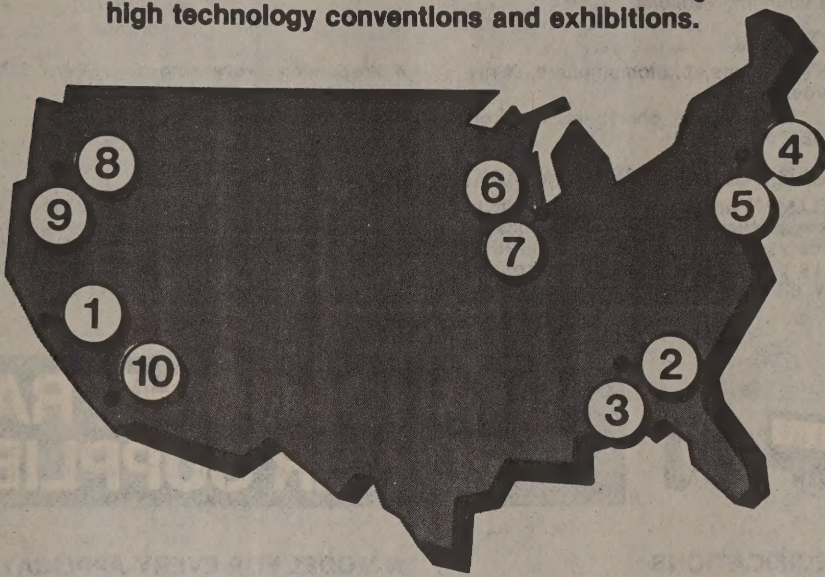

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2	**Southcon**	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
3	**Mini/Micro Southeast**	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
4	**Electro**	April 23, 24, 25, 1985 New York Coliseum New York
5	**Mini/Micro Northeast**	April 23, 24, 25, 1985 Albert Hall New York
6	**Midcon**	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
7	**Mini/Micro Midwest**	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
8	**Northcon**	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
9	**Mini/Micro Northwest**	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
10	**Wescon**	November 19, 20, 21, 22, 1985 Anaheim Convention Center Anaheim, California

For Additional Exhibitor or Registration Information, contact:

Electronic Conventions Management
Subsidiary of Electronic Conventions, Inc.
P.O. Box 92275, Worldway Postal Center, Los Angeles, CA 90009
Telephone: 213/772-2965 • Telex: 181350

For More Information. Circle No. 21

SPELLMAN High Voltage Electronics Corporation

HIGH VOLTAGE POWER SUPPLIES

- Voltages as high as 400 KV
- Models from low to high power (0 to 100 KW)
- Rack and modular configurations
- Standard, custom and OEM designs
- Highly regulated and economy versions
- Designs for laboratory, production or military applications
- Protection against shorts, overload, and arcing
- Low ripple

TYPICAL APPLICATIONS:

- **HV devices** . . . CRT's, lasers, photomultipliers, X-ray tubes, capacitor chargers
- **HV instrumentation** . . . ionization chambers, electron beam accelerators, SEM's
- **Production processing** . . . X-ray lithography, ion implantation, electrostatics
- Medical x-ray imaging
- Nuclear magnetic resonance

SPELLMAN'S EXPERIENCE IN HV DESIGN MAKES THE DIFFERENCE

For over 42 years SPELLMAN has been a leader in high voltage technology as a **specialist** in supplying high voltage power sources for a wide variety of applications. The **RHP** models use SPELLMAN's proprietary new series resonant technology. This highly efficient design allows switching rates of over 20 KHz. At the same time it avoids spikes and RFI problems previously associated with switching and pulse width modulated supplies. The **RHR/UHR/RHSR** models utilize a solid state RF high voltage circuit that feeds to an RF oscillator circuit operating at 35-40 KHz.

SPELLMAN
HIGH VOLTAGE DC SUPPLY
POWER

STANDARD HV RACK POWER SUPPLIES

SUMMARY OF SPECIFICATIONS

INPUT: 105-125 VAC, 50-60 Hz (optional 100V or 220 VAC, 50-60 Hz); RHP: 208 VAC ±10%, 3φ, 50-60 Hz; (Others available on request).

OUTPUT: continuously adjustable current limited to 100% of rated load.

PROTECTION: overload, short circuit and arc.

FEATURES: contact factory for complete details on available options for each model and to receive a full line catalog.

SPECIFICATION	UHR	RHP	RHR	RHSR	CRT30/40 (anode)	CRT30/40 (focus)
MAXIMUM OUTPUT:						
Voltage (KV)	400	200	400	60	40	6.5**
Wattage (W)	150	3-30 KW	400	60	120	.3
MINIMUM OUTPUT VOLTAGE: (KV)	40	3	5	5	5	0
REGULATION: 0 to full load (%)	±0.1	0.02	0.01 +1V	0.001	0.01 +1V	1
±10% line change (%)	±0.1	0.01	0.01 +1V	±.001	±.01 +1V	±0.01
RIPPLE: (RMS) (%)	0.1	0.1 (x)	0.02 +2V*	0.001	0.02 +2V	0.1 (.05 no load)
STABILITY: per hour (%)	0.2	0.02	0.02 +2V	0.005	0.02 +2V	
per 8 hours (%)	—	0.05	0.05 +5V	0.01	0.05 +5V	
TEMPERATURE: Coefficient/°C (%)	0.2	0.01	0.02 +2V	0.005	0.02% +2V	
Operating (°C)	0-50	0-50	−20 to +55	0-50	0-50	

* 0.1% at or over 100 KV
(x) lower ripple available
** Other voltages available — consult factory (1-30 KV @ .3-10 watts)

A MODEL FOR EVERY APPLICATION

	CUSTOM	MOST APPLICABLE MODEL (a) UHR	RHP	RHR	RHSR	CRT
General high quality lab	●		●	●	●	
CRT:						
General				●		
High resolution					●	
Production testing	●	●		●		●
Scanning electron microscope	●			●	●	
Mass spectrometer	●				●	
Ionization chamber				●		
Electron beam guns	●	●		●		
High power (welding, cutting)	●		●			
Capacitor charging	●	●	●	●		
Ion Implantation:	●		●	●		
Predeposition	●		●			
X-ray:						
Lab and Industrial	●		●	●		
Medical Imaging	●		●(b)			
Lithography	●		●(b)			
Photomultiplier		●		●	●	
Laser: High power (pulsed & CW)	●	●	●(b)	●		
Image Intensifier	●	●		●		
TWT and Klystron	●		●(b)			
Magnet and NMR	●					
Electrostatics:						
Production (flocking, spraying)	●	●				
Production:						
CRT test						●
Plasma etching			●			
Corona test				●		
Hi Pot Insulation Testing		●		●		

FOOTNOTES
(a) Depending upon the specific application, other models may be more suitable; see the individual specifications or consult the factory.
(b) Consult factory for (RHPX) special product designs

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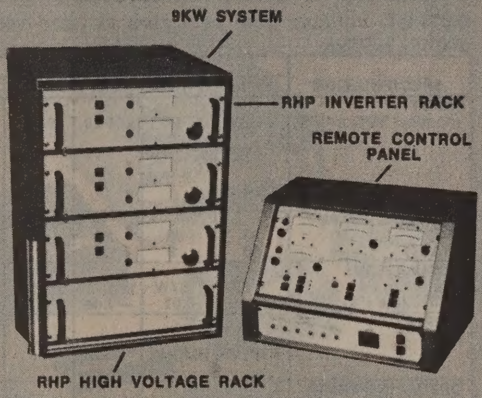
For More Information. Circle No. 352

SPELLMAN High Voltage Electronics Corporation

Standard HV RACK power supplies

continued from previous page

Refer to the charts below to select appropriate models. If specifications do not meet exact requirements consult factory. Custom designs available upon request.



RACK MOUNTED POWER SUPPLY MODELS

RHP Series High wattage without large size (due to a uniquely efficient design technique), digital metering and IEEE bus available; can be paralled for up to 9 KW (15-100 KW also available).

RHR Series A general purpose unit for a variety of uses with a reasonable compromise between power, regulation, stability, ripple, size and price.

RHSR Series For demanding applications featuring exceptional regulation and stability with very low ripple; remote voltage and resistance programming and monitoring is standard.

UHR Series Most economical unit with satisfactory performance for many uses such as production test.

CRT 30/40 Designed specifically for testing CRT's; provides variable anode and focus voltages; remote voltage and resistance control with monitoring of both voltage and current.

RHR SERIES

POLARITY		FIXED (a)			REVERSIBLE	
Max. Output Voltage (KV)	Max. Output Current (mA)	(c) Rack Height In (mm)	(b) Model Number	Net Weight Lbs (kg)	(b) Model Number	Net Weight Lbs (kg)
5	2	5¼ (133)	RHR5*10	25 (12)	---	--
	6	5¼ (133)	RHR5*30	30 (14)	RHR5PN30	25 (12)
	10	5¼ (133)	RHR5*50	30 (14)	RHR5PN50	30 (14)
	20	5¼ (133)	RHR5*100	55 (25)	RHR5PN100	60 (27)
10	1	5¼ (133)	RHR10*10	25 (12)	--	--
	3	5¼ (133)	RHR10*30	30 (14)	RHR10PN30	25 (12)
	6	5¼ (133)	RHR10*60	30 (14)	RHR10PN60	30 (14)
	10	5¼ (133)	RHR10*100	30 (14)	RHR10PN100	30 (14)
	20	10½ (267)	RHR10*200	55 (25)	RHR10PN200	60 (27)
15	0.67	5¼ (133)	RHR15*10	25 (12)	--	--
	2	5¼ (133)	RHR15*30	25 (12)	RHR15PN30	25 (12)
	4	5¼ (133)	RHR15*60	30 (14)	RHR15PN60	30 (14)
	8	5¼ (133)	RHR15*120	30 (14)	RHR15PN120	30 (14)
	15	10½ (267)	RHR15*225	55 (25)	RHR15PN225	60 (27)
20	0.5	5¼ (133)	RHR20*10	25 (12)	--	--
	1.5	5¼ (133)	RHR20*30	25 (12)	RHR20PN30	25 (12)
	3	5¼ (133)	RHR20*60	30 (14)	RHR20PN60	30 (14)
	6	5¼ (133)	RHR20*120	30 (14)	RHR20PN120	30 (14)
	12	10½ (267)	RHR20*240	55 (25)	RHR20PN240	60 (27)
30	0.33	5¼ (133)	RHR30*10	25 (12)	--	--
	1	5¼ (133)	RHR30*30	25 (12)	RHR30PN30	25 (12)
	2	5¼ (133)	RHR30*60	30 (14)	RHR30PN60	30 (14)
	4	5¼ (133)	RHR30*120	30 (14)	RHR30PN120	30 (14)
	5	5¼ (133)	RHR30*150	50 (23)	RHR30PN150	55 (25)
	8	10½ (267)	RHR30*240	55 (25)	RHR30PN240	60 (27)
40	0.75	5¼ (133)	RHR40*30	40 (18)	RHR40PN30	40 (18)
	1.5	5¼ (133)	RHR40*60	40 (18)	RHR40PN60	40 (18)
	3	5¼ (133)	RHR40*120	40 (18)	RHR40PN120	40 (18)
	6	10½ (267)	RHR40*240	60 (27)	RHR40PN240	60 (27)
50	0.5	5¼ (133)	RHR50*25	40 (18)	RHR50PN25	52 (24)
	1	5¼ (133)	RHR50*50	40 (18)	RHR50PN50	52 (24)
	3	5¼ (133)	RHR50*150	55 (25)	RHR50PN150	70 (32)
	5	10½ (267)	RHR50*250	60 (27)	RHR50PN250	75 (34)
60	0.5	5¼ (133)	RHR60*30	40 (18)	RHR60PN30	52 (24)
	1	5¼ (133)	RHR60*60	40 (18)	RHR60PN60	52 (24)
	2	5¼ (133)	RHR60*120	40 (18)	RHR60PN120	52 (24)
	4	10½ (267)	RHR60*240	60 (27)	RHR60PN240	75 (34)
80	1	8¾ (222)	RHR80*80	52 (24)	RHR80PN80	52 (24)
	3	10½ (267)	RHR80*240	72 (33)	RHR80PN240	75 (34)
100	1	8¾ (222)	RHR100*100	52 (24)	RHR100PN100	52 (24)
	1.5	8¾ (222)	RHR100*150	69 (31)	RHR100PN150	70 (32)
	2	10½ (267)	RHR100*200	72 (33)	RHR100PN200	75 (34)
150 (e)	1	34 (864)	RHR150*150	125 (57)	Consult Factory	Consult Factory
	2	40 (1016)	RHR150*300	145 (66)		
200 (e)	0.5	34 (864)	RHR200*100	150 (68)	Consult Factory	Consult Factory
	1	34 (864)	RHR200*200	170 (77)		
300 (e)	0.5	48 (1220)	RHR300*150	175 (80)	Consult Factory	Consult Factory
	1	60 (1554)	RHR300*300	200 (91)		
400 (e)	0.5	48 (1220)	RHR400*200	225 (102)	Consult Factory	Consult Factory
	1	60 (1554)	RHR400*400	225 (102)		

RHSR SERIES (REVERSIBLE POLARITY)*

Output Voltage (KV)	Max. Output Current (mA)	Rack (c) Height In (mm)	Model (b) Number	Net Weight Lbs (kg)
0-5	10	5¼ (133)	RHSR5PN50	30 (14)
0-10	6	5¼ (133)	RHSR10PN60	30 (14)
0-15	4	5¼ (133)	RHSR15PN60	30 (14)
0-20	3	5¼ (133)	RHSR20PN60	30 (14)
0-25	2.4	5¼ (133)	RHSR25PN60	30 (14)
0-30	2	5¼ (133)	RHSR30PN60	30 (14)
0-40	1.5	8¾ (222)	RHSR40PN60	52 (24)
0-50	1	8¾ (222)	RHSR50PN50	52 (24)
0-60	1	8¾ (222)	RHSR60PN60	52 (24)

* Fixed polarity also available — consult factory.

RHP 3 KW SERIES (FIXED POLARITY(a))

0-3	1000	14 (356)	RHP3*3	144 (65)
0-6	500	14 (356)	RHP6*3	144 (65)
0-10	300	14 (356)	RHP10*3	144 (65)
0-15	200	14 (356)	RHP15*3	144 (65)
0-20	150	14 (356)	RHP20*3	144 (65)
0-30	100	14 (356)	RHP30*3	144 (65)
0-40	75	14 (356)	RHP40*3	144 (65)
0-50	60	14 (356)	RHP50*3	144 (65)
0-60	50	14 (356)	RHP60*3	144 (65)
0-80	40	15¾ (445)	RHP80*3	150 (68)
0-100	30	15¾ (445)	RHP100*3	150 (68)
0-120(b)	25	22 (559)	RHP120*3	140 (63)
0-150(b)	20	22 (559)	RHP150*3	140 (63)
0-170(b)	17	27 (686)	RHP170*3	155 (70)
0-180(b)	16	27 (686)	RHP180*3	155 (70)
0-200(b)	15	27 (686)	RHP200*3	155 (70)

Consult factory for reversible models & availability of 6 KW, 9 KW, & higher.

UHR SERIES (FIXED POLARITY(a))

0-40	0.75	5¼ (133)	UHR40*30	40 (18)
	1.5	5¼ (133)	UHR40*60	40 (18)
	3	5¼ (133)	UHR40*120	40 (18)
0-60	0.5	5¼ (133)	UHR60*30	40 (18)
	1	5¼ (133)	UHR60*60	40 (18)
	2	5¼ (133)	UHR60*120	40 (18)
0-100	1	8¾ (222)	UHR100*100	52 (24)
0-150	1	34 (864)	UHR150*150	125 (57)
0-200	0.75	34 (1016)	UHR200*150	150 (68)
0-300	0.5	48 (1220)	UHR300*150	175 (80)
0-400	0.25	48 (1220)	UHR400*100	225 (102)

CRT SERIES (d)

0-30	4	5¼ (133)	CRT30	25 (11)
0-40	3	5¼ (133)	CRT40	25 (11)

FOOTNOTES

(a) (*) Specify "P" (positive) or "N" (negative) in place of (*).

(b) High voltage output is an air insulated toroid terminated stack.

(c) 19 inches wide (rack) x 16½ inches deep, except 18½ inches deep for units 150 KV and larger.

(d) Also includes FOCUS voltage output 0-6.5 KV, 50 μA

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SPELLMAN High Voltage Electronics Corporation

STANDARD HV MODULAR POWER SUPPLIES

SUMMARY OF SPECIFICATIONS

OUTPUT: Variable from near zero to rated voltage using an input control voltage

SPECIFICATION	MODEL WRM	RM	UM	LRD	RV	LCM	RIM30
INPUT: (nominal VDC ±10%)	+28	+28	+28	2-12	+28	±12 to ±31	+24 VDC or 115/230 VAC
MAXIMUM OUTPUT: (KV) (WATT)	30 30	30 9	24 1.5	3 3	20 10	30 10	30 1.0
REGULATION: 0-full load (%) ±10% line (%)	0.05 ±0.01	1%/W 0.01	15%/W ~ line	5% (b)	0.05 0.005	0.05 0.05	1.0 .5
RIPPLE: (%)	0.01 PTP/W	0.1 RMS/W	0.1 RMS	1 (c) PTP	0.05 (c) PTP	2V	0.3 PTP
OPERATING TEMP: (°C)	0-60	0-60	0-60	0-60	0-60	0-60	0-60
AUXILIARY OUTPUTS:	—	—	—	—	+600V to +800V (a) (d)	+1400 VDC focus & grid (opt) (d)	(G1) 100-400 (G2) 0-2000 (G3) 0-12KV (G4) 3KV
PROGRAMMABLE: (Voltage & Resistance)	•	•			•		•
ADJUSTABLE: (Control by input and pot.)	•	•	•	•	•	•	•
PROTECTION: All Models Have: short circuit, reverse input polarity, arc-over and overload protection.							

(a) Proportional to anode (main) voltage with +600V ±5% with anode at 12 KV and +800V ±5% with anode at 16 KV; 1 mA secondary output current, 3% regulation 0-1 mA, 1% peak ripple at 1 mA. (b) one half to full load (c) at full load (d) unregulated or tracks anode

OUTPUT VOLTAGE (+KV)	MAXIMUM OUTPUT CURRENT (mA)	AUXILIARY OUTPUT	MODEL NUMBER	CASE SIZE*
RV Series for Mil Spec				
0-16	0.5	+600V to 800V, 1 mA	RV16P8/F	E
0-20	0.5			E
RIM 30 Series for Image Intensifiers				
30	1 μA	(G1) 100-210V (G2) 0-2000V (G3) 0-12,000V (G4) 3 KV	RIM30X	7⅞″ L x 5¾″ D x 2½″ W

LCM Series for CRT's

OUTPUT VOLTAGE (+KV)	MAXIMUM OUTPUT CURRENT mA	MODEL NUMBER	CASE SIZE*	AUXILIARY OUTPUT FOCUS	G1
2-3.5	5-2.8	LCM3.5	B	±1000V	±1400
3.5-5	2.8-2	LCM5	B	±1000V	±1400
5-7.5	2-1.3	LCM7.5	B	±1000V	±1400
7.5-10	1.3-1	LCM10	B	±1000V	±1400
10-14	1-0.7	LCM14	B	±1000V	±1400
14-18	0.7-0.55	LCM18	B	±1000V	±1400
18-22	0.55-0.45	LCM22	B	±1000V	±1400
22-30	0.45-0.33	LCM30	I	±1000V	±1400

Note·
* (a) Specify "P" (positive) or "N" for (negative) in place of (*)

OUTPUT VOLTAGE (KV)	MAXIMUM OUTPUT CURRENT (mA)	MODEL NUMBER (a)	CASE SIZE*
UM Series			
0-1	1000 μA	UMI*1000D	C
0-1.5	1000 μA	UM1.5*1500D	C
0-3	500 μA	UM3*1500D	C
0-6	250 μA	UM6*1500D	C
0-9	150 μA	UM9*1500D	C
0-12	100 μA	UM12*1500D	C
0-15	75 μA	UM15*1500D	D
0-18	60 μA	UM18*1500D	D
0-24	50 μA	UM24*1500D	F
0-30	50 μA	UM30*1500D	H
LRD Series (Reversible)			
80-500V	6 mA	LRD.5PN3000D	A
200-1500V	2 mA	LRD1.5PN1500D	A
400-3000V	1 mA	LRD3PN3000D	A

*Consult factory for case size letter representation.

A MODEL FOR EVERY APPLICATION

	(a) WRM	(a) RM	UM	LRD	RV	LCM	RIM30
CRT: General	•		•	•		•	
MIL, Airborne					•		
Low Cost						•	
Photomultipliers	•	•	•	•			
Image Intensifiers	•						•
Electron Beam			•				
Scintillation Counters			•				
Geiger tubes				•			
Control grid bias		•	•			•	•
Ion sources	•						
Scanning electron microscopes	•		•				
Electrostatics			•				
Lasers	•	•					

(a) Consult factory for FWRM and FRM models which provide for narrow range output.

MODULAR SUPPLY MODELS

Output Voltage (KV)	Maximum Output Current (mA)	Model Number (a)	Case Size*	Model Number (a)	Case Size (see chart)
WRM Series				**RM Series**	
0-1.5	1.0	WRM1.5*1500D	F	RM1.5*1500D	D
0-1.5	2.0	WRM1.5*3000D	F	RM1.5*3000D	D
0-1.5	4.0	WRM1.5*6000D	F	RM1.5*6000D	D
0-1.5	6.0	WRM1.5*10KD	F	RM1.5*10KD	D
0-1.5	10.0	WRM1.5*15KD	H	——	—
0-3	0.5	WRM3*1500D	F	RM3*1500D	D
0-3	1.0	WRM3*3000D	F	RM3*3000D	D
0-3	2.0	WRM3*6000D	F	RM3*6000D	D
0-3	3.0	WRM3*10KD	F	RM3*10KD	D
0-3	10.0	WRM3*30KD	H	——	—
0-6	0.25	WRM6*1500D	F	RM6*1500D	D
0-6	0.5	WRM6*3000D	F	RM6*3000D	D
0-6	1.0	WRM6*6000D	F	RM6*6000D	D
0-6	1.5	WRM6*10KD	F	RM6*10KD	D
0-6	5.0	WRM6*30KD	H	——	—
0-9	0.15	WRM9*1500D	F	RM9*1500D	D
0-9	0.3	WRM9*3000D	F	RM9*3000D	D
0-9	0.6	WRM9*6000D	F	RM9*6000D	D
0-9	1.0	WRM9*10KD	F	RM9*10KD	D
0-9	3.3	WRM9*30KD	H	——	—
0-12	0.15	WRM12*1500D	F	RM12*1500D	D
0-12	0.3	WRM12*3000D	F	RM12*3000D	D
0-12	0.6	WRM12*6000D	F	RM12*6000D	D
0-12	0.8	WRM12*10KD	F	RM12*10KD	D
0-12	2.5	WRM12*30KD	H	——	—
0-15	0.1	WRM15*1500D	F	RM15*1500D	F
0-15	0.2	WRM15*3000D	F	RM15*3000D	F
0-15	0.4	WRM15*6000D	F	RM15*6000D	F
0-15	0.6	WRM15*10KD	F	RM15*10KD	F
0-15	2.0	WRM15*30KD	H	——	—
0-18	0.08	WRM18*1500D	E	RM18*1500D	E
0-18	0.16	WRM18*3000D	E	RM18*3000D	E
0-18	0.3	WRM18*6000D	E	RM18*6000D	E
0-18	0.5	WRM18*10KD	E	RM18*10KD	E
0-18	1.6	WRM18*30KD	E	——	—
0-20	0.07	WRM20*1500D	H	RM20*1500D	F
0-20	0.15	WRM20*3000D	H	RM20*3000D	F
0-20	0.3	WRM20*6000D	H	RM20*6000D	F
0-20	0.5	WRM20*10KD	H	RM20*10KD	F
0-20	1.5	WRM20*30KD	H	——	—
0-24	0.06	WRM24*1500D	H	RM24*1500D	F
0-24	0.12	WRM24*3000D	H	RM24*3000D	F
0-24	0.24	WRM24*6000D	H	RM24*6000D	F
0-24	0.4	WRM24*10KD	H	RM24*10KD	F
0-24	1.25	WRM24*30KD	H	——	—
0-30	0.15	WRM30*1500D	H	RM30*1500D	F
0-30	0.1	WRM30*3000D	H	RM30*3000D	F
0-30	0.2	WRM30*6000D	H	RM30*6000D	F
0-30	0.3	WRM30*10KD	H	RM30*10KD	F
0-30	1.0	WRM30*30KD	H	——	—

(a) specify "p" (positive) or "n" (negative)

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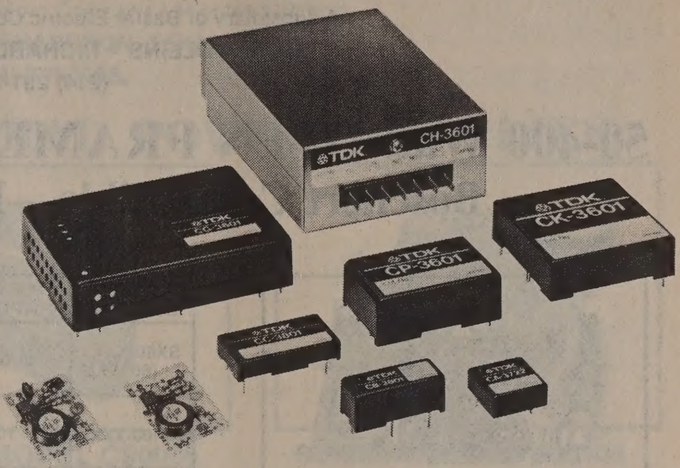
For More Information. Circle No. 352

DC TO DC CONVERTERS

TDK

TDK CORPORATION OF AMERICA 4711 West Golf Road, Suite 300, Skokie, Illinois 60076, U.S.A. Phone (312) 679-8200 LOS ANGELES BRANCH (213) 539-6631 NEW YORK BRANCH (516) 625-0100 INDIANAPOLIS BRANCH (317) 872-0370 DETROIT OFFICE (313) 353-9393 **TDK CORPORATION** 13-1, Nihonbashi 1-chome, Chuo-ku, Tokyo 103, Japan



An on-board DC to DC converter is useful in simplifying the main power supply of electronic equipment by providing precisely the required voltage at each location.

Features

1) TDK's high performance magnetic materials and original circuit technology.
2) Compact and lightweight construction.
3) Highly efficient operation.
4) Outstanding reliability.
5) Printed circuit board used (except CH series).

Applications

Computers and peripheral equipment, industrial robots, electronic measuring instruments, automotive electronic equipment, other electronic devices.

Electrical specifications VS. Part No.

Type	Output power (W)	Input-output insulation	Input (V)	Output (V) +12	+15	−12	−15	−5	5	9	12	15	−17	±12	±15	6
CA Series	0.12	No insulation	+3 to +7	3708	3709											
			−3 to −7			3722	3725									
CB Series	0.3	No insulation	+4 to +7					3810								
			+3 to +7	3801	3802	3811	3812									
CC Series	0.25	No insulation	5±5%	3801	3802	3852	3853	3851								
CP Series	1.5	Insulation (CP-36, CP-46)	5±10%						3601	3604	3607	3610		4601	4604	
			12±10%						3602	3605	3608	3611		4602	4605	
			24±10%						3603	3606	3609	3612		4603	4606	
		No insulation (Others)	+4.5 to +12.0							3801	3803	3805	3807	4801	4803	
			+10.8 to +28.8							3802	3804	3806	3808	4802	4804	
CK Series	3	Insulation	5±10%						3601		3607	3610				
			12±10%						3602		3608	3611				
			24±10%						3603		3609	3612				
CG Series	6	Insulation	5±10%						3601		3607	3610				3613
CH Series	10	Insulation	5±10%						3601		3607	3610				
CD-Series for driving fluorescent display	Up to 6W	No insulation	5±10%	Products are made in accordance with fluorescent displays.												

Type	Dimension (mm)	Terminal (mm)
CA Series	19.2X14.0X7.2	ø0.6±0.1X3
CB Series	30.5X13.3X12.2	ø0.6±0.1X4
CC Series	35.5X20.0X6.55	ø0.5±0.1X4
CP Series	38.1X30.5X16.5	ø1.0±0.1X5
CK Series	47.0X47.0X14.5	ø1.0±0.1X5
CG Series	78.0X60.0X19.0	ø1.0±0.1X5
CH Series	98X70X32	AMP#110X7
CD Series	32X24X8.5 & 10 43X31X15 & 18 51X34X20	ø0.6X4

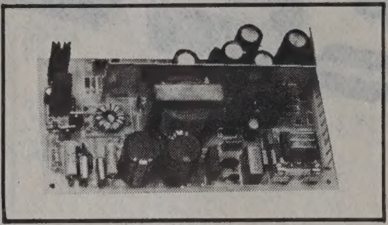
Please refer TDK catalogue.

Summit™ Electronics, Inc.

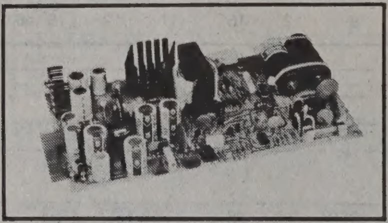
A subsidiary of Basler Electric Company • Highland, Illinois
855 E. COLLINS • RICHARDSON, TEXAS 75081
• (214) 231-1456

50-400 Watt OPEN FRAME Switching Power Supplies

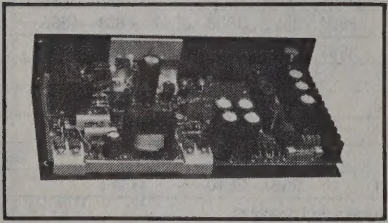
Boschert Compatible—Fit, Form & Function



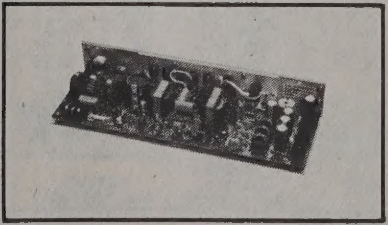
SUMMIT MODEL SX60



SUMMIT MODEL SX100



SUMMIT MODEL SX130



SUMMIT MODEL SX200

SUMMIT MODEL SS400

MODEL & WATTAGE	MAIN OUTPUT	AUX #1	AUX #2	AUX #3	AUX #4	PRICE 1-9
SX60-XXXX (65 W)	5V @ 6A	12V @ 2.5A	−12V @ .7A	−5V @ .7A 12V @ 2A 24V @ 1A		$\$99^{00}$
SX100-XXXX	5V @ 10A	12V @ 3A	−12V @ 1A	−5V @ .7A 12V @ 4A 24V @ 2A		$\$189^{00}$
SX125-XXXX	5V @ 15A	12V @ 3A	−12V @ 1A	−5V @ .7A 12V @ 4A 24V @ 2A		$\$199^{00}$
SX130-XXXX	5V @ 20A	12V @ 4A	−5V @ .7A 12V @ 4A 24V @ 2A	−12V @ 2A		$\$220^{00}$
SX200-XXXX	5V @ 35A	−5V @ 4A 24V @ 4A	12V @ 4A	−12V @ 4A		$\$299^{00}$
SS400-XXXX	5V @ 50A	−5V @ 4A	12V @ 10A 15V @ 10A	−12V @ 10A −15V @ 10A	24V @ 4A	$\$520^{00}$
SX400-XXXX	5V @ 50A	−5V @ 4A	12V @ 10A 15V @ 10A	−12V @ 10A −15V @ 10A	24V @ 4A	$\$598^{00}$

Any Combination of Voltage & Currents Is Available As Long As The Maximum Wattage Rating Is Not Exceeded For Continuous Operation.

FEATURES

- Up to five outputs, three regulated and two semi-regulated
- Choice of voltage and current on all outputs up to maximum wattage total
- Voltage adjustable on all regulated outputs
- Brownout protection
- OVP Standard on primary output
- Overload protection
- Short circuit protection
- Reverse polarity protection
- Soft start
- Adjustable current limiting on regulated outputs
- Built to UL, CSA, and VDE safety standards.
- Built to VDE and FCC EMI standards.
- Convenient 2-surface mounting
- Convection cooled
- Advanced EMI filtering
- Isolated returns

SPECIFICATIONS

Input	90-135 VAC / 180-270 VAC. 47-440Hz
Output	See Table
Line Regulation	±0.1% all outputs
Load Regulation	±1% main output ±3% aux outputs
Ripple & Noise	1% P-P max. all outputs
Efficiency	70% Typical
Operating Temperature	0-50° C at full rated load. Derate to 50% of rated output at 70° C.
Temperature Coefficient	0.02% per ° C
Overload Protection	All outputs are individually current limited and short circuit protected. Recovery is automatic when load is reduced.
Overvoltage Protection	OVP on main output is set between 6.25 ± .75V. This protection is reset by recycling input power.
Holdover Storage	16mSEC minimum, 20mSEC typical
Remote Sense	Remote sense on main output compensates for up to 0.5V in the load cable.
Overshoot	No voltage spikes on turn-on, turn-off or power fail.
Transient Response	Recovery to within 1% of nominal output voltage within 500uSEC for a 25% load step.
Power Fail (Optional)	A TTL signal (low) appears within 5mSEC at full load to warn of input voltage drop below minimum operating level.
Remote Inhibit (Optional)	Power supply can be remotely programmed off by application of TTL signal (high).

For More Information. Circle No. 354

Summit™
Electronics, Inc.

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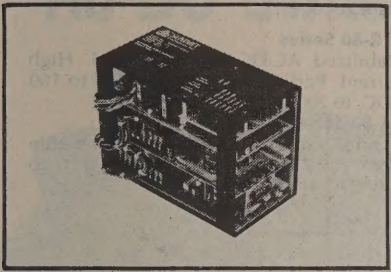
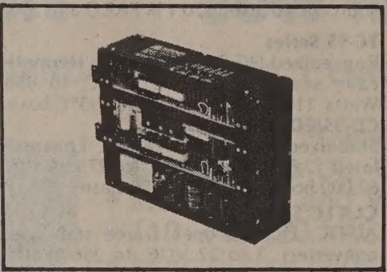
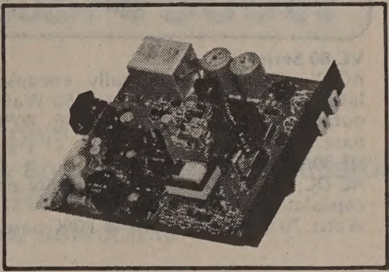
COMPUTER PERIPHERAL POWER SUPPLIES



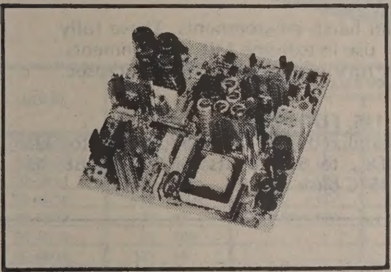
SUMMIT MODEL CS0067



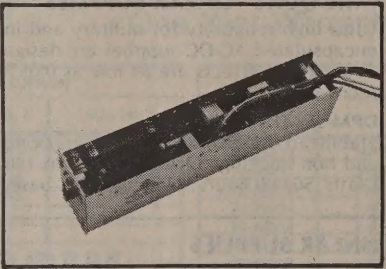
SUMMIT MODEL CS0068



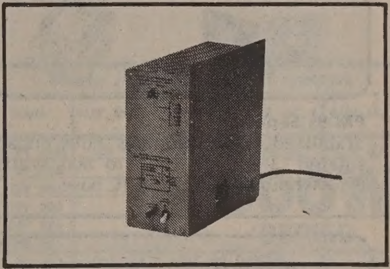
SUMMIT MODEL CS0104



SUMMIT MODEL CS0115 CRT

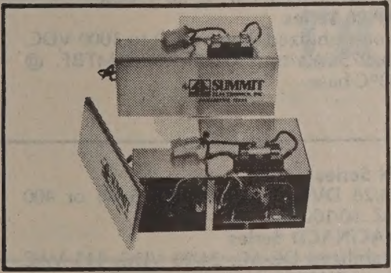


SUMMIT MODEL CS0084

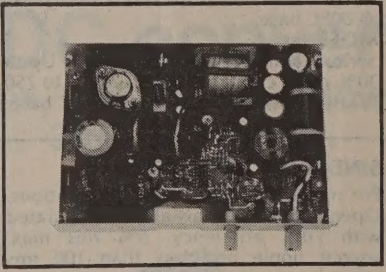


SUMMIT MODEL CS0044

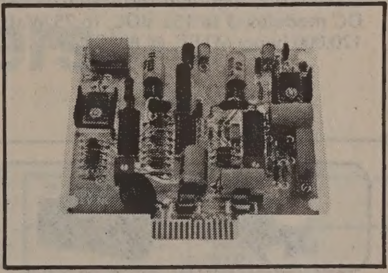
DC-DC SWITCHING POWER SUPPLIES



SUMMIT MODEL CS0121

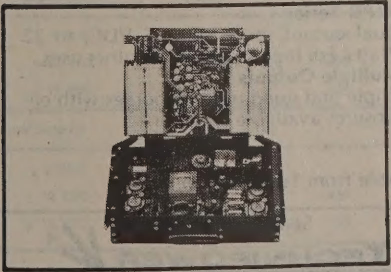


SUMMIT MODEL CS0124



SUMMIT MODEL CS0025

MILITARY SWITCHING POWER SUPPLIES



SUMMIT MODEL CS0105

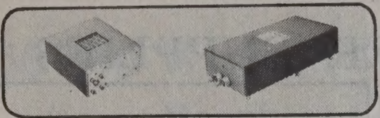
SUMMIT MODEL CS0097

For More Information. Circle No. 354

TECHNIPOWER® A Penril COMPANY

"MIL-QUAL" MODULAR POWER SUPPLIES

These Advanced Design, High Reliability, Modular Power Sources offer the systems engineer economical, proven alternatives to expensive custom built or lab types. Now, you can choose the exact source required — from an extensive selection, to meet the most demanding Mil-Spec and industrial needs. Our knowledgeable design and development group can also assist you with any product modifications or special variations to suit individual demands.



HIGH EFFICIENCY, HIGH DENSITY MODULAR SWITCHERS

Fully encapsulated, partially encapsulated or open frame, these switching power supplies are designed for high thermal application. With as low as 0.1% overall source/load effects, 0.1% PARD and 500 microsec recovery.

VC-80 Series
AC-DC Converters. Partially encapsulated, 2.8 to 125 VDC — to 450 Watts output. 110,000 hours MTBF @ 80°C base.

HF-80/HFC-80 Series
AC-DC, DC-DC stabilized. Partially encapsulated, 2.8 to 250 VDC, to 375 Watts. 70,000 hours MTBF @ 80°C base.

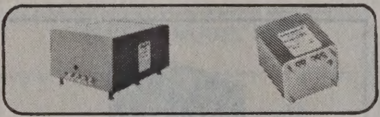
YC-95 Series
Ruggedized DC-DC Converters. Hermetically sealed, 2.8 to 125 VDC, to 450 Watts. 110,000 hours MTBF @ 95°C base.

CD-95/CDC-95 Series
Stabilized DC-DC Converters. Encapsulated. 2.8 to 250 VDC, to 275 Watts. 60,000 hours MTBF @ 95°C base.

CL/CLC Series
AC-DC, DC-DC, open frame stabilized converters. 3 to 32 VDC, to 256 Watts. 50,000 hours MTBF.

SCR-80 Series
Stabilized AC-DC phase control. High current. Partially encapsulated. 5 to 160 VDC, to 2000 Watts.

RA-80 Series
Special circuit AC-DC. Programmable from zero. Partially encapsulated. 0 to 160 VDC, to 1000 Watts.



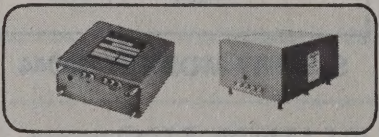
"MIL-QUAL" LINEAR SUPPLIES

Ultra high reliability for military and industrial harsh environments. These fully encapsulated AC-DC supplies are designed for use in extreme MIL environments. Source/load effects are as low as 0.05% with 1mV rms PARD and 50 Microsec. recovery.

PM-95 Series
Stabilized AC-DC modules. Fully encapsulated. 3 to 325 VDC, to 800 Watts. 80,000 hours MTBF, @ 95°C base.

DPM-95, TDPM-95 Series
Stabilized, AC-DC, dual output, tracking and non-tracking. 12 to 15 VDC, to 150 Watts. 50,000 hours MTBF, @ 95°C base.

F-115, FD-115 Series
Stabilized, AC-DC modules, 3 to 325 VDC, to 500 Watts. 50,000 MTBF, @ 115°C base.



LINEAR SUPPLIES

For industrial, military and commercial use. The partially encapsulated AC-DC stabilizers are designed for moderate environments. They have 0.05% load effect, 1mV rms PARD and generally have 50 microsecond recovery.

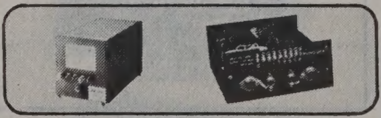
PL-80 Series
Lower cost, high density, stabilized AC-DC modules. 3 to 152 VDC, to 75 Watts, 120,000 hours MTBF, @ 80°C base.

P-80 Series
All purpose, fully encapsulated, series stabilized AC-DC modules. 3 to 325 VDC, to 800 Watts. 100,000 hours MTBF, @ 80°C base.

MC-65 Series
Series stabilized, DC-DC modules. Up to 30% more current. 3 to 152 VDC, to 750 Watts, 1,000,000 hours MTBF, 65°C base.

DP-80, TDP-80 Series
Tracking and non-tracking, AC-DC, dual output. 6 to 150 VDC, to 10 Watts. 50,000 hours MTBF, @ 80°C base.

NP-80 Series
Non-stabilized, low cost. 3 to 1000 VDC, to 975 Watts. 250,000 hours MTBF, @ 80°C base.



SINE-WAVE INVERTERS

For military and industrial applications. Open frame and partially encapsulated with 70% efficiency, 5% rms max. source ripple and less than 100 rms recovery.

IN Series
24/28 DVC, 115/220 VAC, 5-/60 or 400 HZ. 50-100VA.

NAC/NACD Series
Stabilized DC-AC, 24/28 VDC, 115 VAC rms, 60/400 Hz output, to 500 VA.

HIGH RELIABILITY, OPEN FRAME AC-DC POWER SOURCES

Practical, low cost, high performance, open frame AC/DC stabilized units. Wide variety of models. Multiple output variations available.

LP/LPC Series
UL approved, open frame, AC-DC stabilized. 5-28 VDC, 224 Watts.

LPDT/LPDTC Series
Dual output tracking ±12 to ±15 VDC, to 30 Watts. For op-amp and other commercial use.

NLP/NLPC Series
Single output, 5 to 28 VDC, to 28 Watts. For logic, op-amp and signal use.

NLPD Series
Dual output, ±12 to ±15 VDC, to 22 Watts. For logic op-amp and other uses.

Multiple Outputs
Triple and quad output sources with enclosures available on order.

CUSTOM CAPABILITIES FOR MODULE RACK MOUNTS are also available from Technipower.

VARIAC BY TECHNIPOWER
See Gold Book Page 1154 for availability of Variac® Autotransformers and Voltage Regulators produced by Technipower.

You'll Think They're Custom Built

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A Penril COMPANY
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Tel: (203) 748-7001 TWX: 710-456-9280

For More Information. Circle No. 355

TECTROL INC.

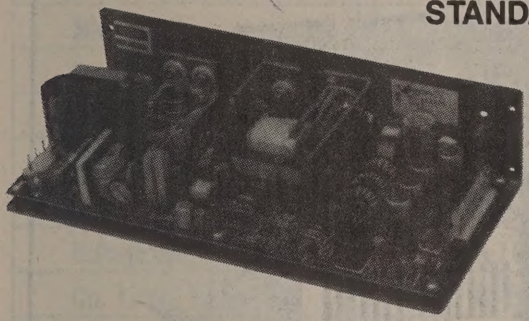
132 Central Street
Foxboro MA. USA 02035
TEL. (617)543-8268

39 Kodiak Cr., Downsview, Ont.
CANADA M3J3E5
(416)630-8108 TELEX 06-217645

Standards Modified Standards Custom Designs

AC-DC Switchers 50W THROUGH 1500W

STANDARD PRODUCT LINE



All Switching Power Supply Models Feature:
- Conforms to UL, CSA and VDE safety standards
- Meets FCC and VDE RFI/EMI standards
- 110 VAC/220 VAC user selectable.
- Main output OVP.
- Short circuit protection.
- Inrush limited and soft start.
- One Year Warranty.

50W SERIES

MODEL	NOMINAL FULL LOAD VOLTAGE & CURRENT			
	MAIN	AUX. NO. 1	AUX. NO. 2	AUX. NO. 3
TO-49/09	+5V 5A	1.5A +12V	-12V 0.5A	-5V 100MA
TO-49/10	+5V 5A	1.5A +12V	-12V 0.5A	-5V 100MA
TO-49/11	+5V 5A	1A +12V	-12V 0.5A	-5V 100MA
TO-49/12	+5V 4.5A	1A +15V	-15V 0.5A	-5V 100MA
TO-49/13	+5V 5A	1.5A +12V	-5V 1A	
TO-49/14	5V 10A			
TO-49/15	12V 4A			
TO-49/16	15V 3.4A			
TO-49/17	24V 2A			
TO-49/18	5V 5A	5A 5V		
TO-49/19	12V 2A	2A 12V		
TO-49/20	15V 1.7A	1.7A -12V		
TO-49/21	+5V 6A	1A +12V	-12V 0.5A	-5V 100MA

300W SERIES

TYPE NO.	POWER	NOMINAL FULL LOAD VOLTAGES & CURRENTS				
		MAIN	AUX. NO. 1	AUX. NO. 2	AUX. NO. 3	AUX. NO. 4
TO-302/10	300W	5V 40A	12V 10A	-12V 10A	24V 6A	5.2V 6A
TO-302/11	300W	5V 60A				
TO-302/12	300W	12V 25A				
TO-302/13	300W	15V 20A				
TO-302/14	312W	24V 13A				
TO-302/17	336W	48V 7A				
TO-302/21	300W	5V 40A	12V 15A	-12V 15A		
TO-302/22	300W	5V 40A	15V 12A	-15V 12A		

65W, 75W, 100W, 150W, 175W, 200W series not shown.
Send for complete information.

DC/DC converters

1w, 3w, 5w, 7.5w, 10w.
30w, 50w, 100w.

.3 and 5 Watt DC/DC Converters

Input voltages: SVDC, 12VDC, 24VDC, 28VDC, 48VDC

Output Voltages	Output, current (mA)	
Single ouput	3 watt	5 watt
+ 5 VDC	500	1000
+ 12 VDC	250	420
+ 15 VDC	200	330
Dual outputs		
± 5 VDC	250	-
± 12 VDC	100	210
± 15 VDC	100	165

TECTROL INC.
TECTROL INC.
TECTROL INC.
TDSD15 - 100
TDSD15 - 165

ALSO AVAILABLE UP TO 1800w, 48VDC INPUT Telecommunication DC/DC

10 Watt DC/DC Coverters
Wide Range Input

Input voltage range: 9 - 18VDC
18 - 36 VDC
36 - 72 VDC

Output voltages	Output current (mA)
Single Output	10 Watt Series
+ 5 VDC	2000
+ 12 VDC	850
+ 15 VDC	670
+ 24 VDC	420
+ 28 VDC	360
Dual outputs	
± 5 VDC	1000
± 12 VDC	416
± 15 VDC	333
± 18 VDC	277

For custom OEM power supply requirements contact your local sales office.

For More Information. Circle No. 356

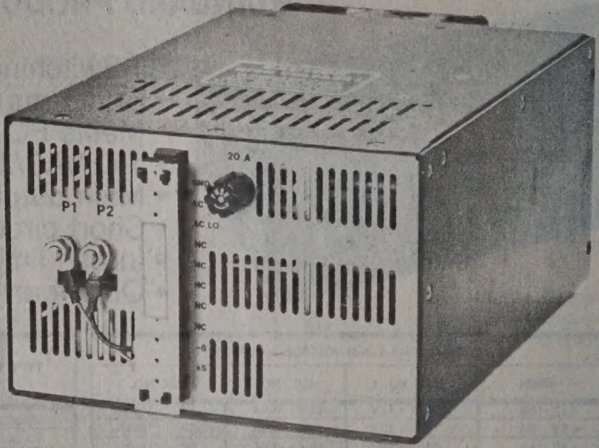
Single Output “Off-Line” Switching Power Supplies

Data Processing • Communications • Robotics & Vehicular

500—2000 *Watts*

Standard Outputs: 5V 12V 28V 48V 56V 110V

FEATURES:



8.0" x 5.0" x 11.0" (excluding fan)
Demo units available on loan

- Rugged Mechanical Design for High Shock & Vibration.
- Size & Mounting are Compatible w/Industry Standard.
- Soft Start, No Overshoots.
- High Efficiency to 85%.
- High Reliability in Accordance with Military Standards.
- Self Contained DC or AC Fan.
- 110/220V Operation • Wide Range Units Available. (80-135 VAC)
- Overload, Overvoltage & Overtemperature Protection.
- Modular Design. • RFI Filter for FCC Compliance.

also available in: **Militarized, Uninterruptable & 3 Phase Input.**

Call Us For Your Other Power Supply Needs:

• DC-DC Up To 1KW • Inverters 60Hz, 400Hz • Battery Backup Units • Battery Chargers

Custom Designs in 10 Weeks!

TECHNOLOGY
DYNAMICS
INC.

91 Carver Avenue • Westwood, New Jersey 07675
(201) 664-7636

High Reliability Power Systems For Commercial & Military Applications

For More Information. Circle No. 357

Electrical Specifications

Input Volt. Range	90-132 VRMS standard. 80-135 VRMS optional
Input Frequency	47-400Hz
Efficiency, typ. %	65-85% at full load depending on specific model
Line Regulation	±.2% thru entire range
Load Regulation	±.5% from min. load to max. load. ±1% N.L. to F.L.
Min. Load	10% of full load current
Temp coeff., %/°C	.02% per °C
Output Ripple, mvpp	1% of output or 200mvpp whichever is smaller
Hold-Up Time, msec	30ms from nominal line
Dynamic Response, ms	350 microseconds for 25% load step applied from 50% load
Voltage Adj. Range	±10% for outputs up to 24V, +5/–20% for higher outputs
Op. Temp. Range, °C	0-55°C ambient for full output
Output Power @ 70°C	Commercial units 50%. Militarized units 100%
Warranty, years	1 year standard • 2 years optional
Overload	Shorted output & O.L. protection • Foldback w/auto recovery
Overvoltage	Adjustable O.V. shut-down standard in all units
Overtemperature	O.T. shut-down standard feature in all units
Safety Regulatory	All units are designed to meet UL478 & CSA standards. VDE compliance optional.
EMI/RFI	Designed To Meet FCC Part 15 EMI Spec. Meets VDE 0871B For Radiated Noise. Meets VDE 0871B Conducted With External Filter

Standard Model Numbers

	Model	Output Voltage	Max. Current
500W	TDS 5-100	5V	100A
	TDS 12-45	12V	45A
	TDS 28-18	28V	18A
	TDS 48-12	48	12A
	TDS 110-4.5	110	4.5A
1000W	TDS 5-200	5V	200A
	TDS 12-90	12V	90A
	TDS 28-36	28V	36A
	TDS 48-25	48V	25A
	TDS 110-10	110V	10A

	Model	Output Voltage	Max. Current
1500W	TDS 5-300	5V	300A
	TDS 15-100	15V	100A
	TDS 28-55	28V	55A
	TDS 48-31	48V	31A
	TDS 110-14	110V	14A
2000W	TDS 36-55	36V	55A
	TDS 48-42	48V	42A
	TDS 60-33	60V	33A
	TDS 110-18	110V	18A

FOR OTHER THAN STANDARD OUTPUTS CONSULT FACTORY.

CUSTOM & STANDARD DESIGN OF . . .
High Reliability Power Systems

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TECHNOLOGY DYNAMICS inc.

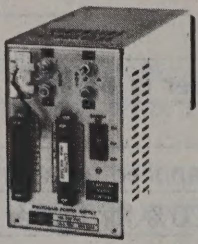
For More Information. Circle No. 357

CUSTOM AND STANDARD SWITCHING POWER SUPPLIES

HIGH POWER
Commercial or Military

800W
Single Output Uninterruptable Power Supply

TDI-184

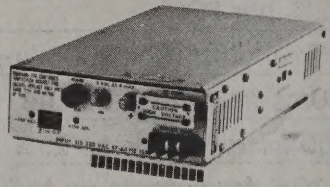


Input: 115/230VAC 50/60Hz and +12VDC battery
Output: 13.5VDC @ 55A
Regulation: ±1.0% line and load combined for a 20-100% load change
Features:
1) Battery charging circuit
2) Very low switching noise
3) OV and OL protection
4) Input RFI filter

Dimensions: 11.5″ x 8.0″ x 5.0″
Outputs Available: 24V, 48V, 56V

400W
Slim Line MULTIPLE OUTPUT

TDI-194

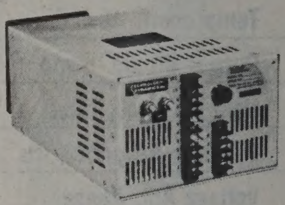


Input: 115/230VAC 50/60 Hz
Output: +5VDC @ 65A
±15VDC @ 1.5A
Line Regulation: ±0.5%
Load Regulation: ±1.0% for 10-100% load change
Features:
1) Designed to meet U.L. 544
2) Overvoltage protection
3) Overload protection
4) Remote sensing of +5V output
5) Input RFI filter

Dimensions: 13.5″ x 6.75″ x 3.0
Other output voltages may be provided upon request.

1500W
High Density Single Output

TDI-207



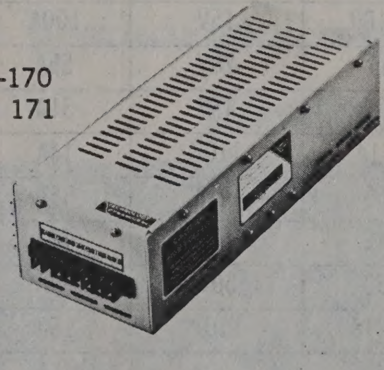
Input: 110/220VAC 47-63Hz
Output: 100VDC @ 15A
Regulation: Within ±1.0% line and load combined
Ripple and Noise: 200mVpp max
- Overvoltage and overload protection
- Remote sense
- High efficiency
- High reliability

Dimensions: 11.5″ x 8.0″ x 5.0″
Output voltages other than those shown may be provided.

150W
Multiple Output Switching Power Supply

TDI-170 and 171

TDI-170
and 171



Input: 85-132VAC 47-63Hz
Outputs:

TDI-170	TDI-171
+5V @ 8.5A	+5V @ 0.5A
+12V @ 4.0A	+15V @ 1.0A
−12V @ 1.5A	−15V @ 0.5A
−7.2V @ 6.0A	−27.5A @ 4.0A

Ripple and Noise: Within 1% peak to peak
Dimensions: 13.5″ x 6.0″ x 3.5″

- Operating temperature 0°C-70°C
- OV and OL protection
- Optional conformal coating
- Militarized for high reliability
- Other output voltages available

High Reliability Power Systems

TECHNOLOGY
DYNAMICS inc.

91 CARVER AVENUE, WESTWOOD, NJ 07675 • (201) 664-7636

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Other Products

SWITCHING POWER SUPPLIES 50-1000 Watts

Model #	Total Power	Input Voltage	Outputs	Dimensions
TDI-153	50 W	115/230VAC ±10%	+5VDC @ 10A +12VDC @ 1A −12VDC @ 1A	7.63 x 4.31 x 1.50 (Enclosed)
TDI-173	60 W	115/230VAC ±15%	+12VDC @ 5A −12VDC @ 1.5A	8.00 x 4.71 x 1.25 (PC Card)
TDI-168	60 W	110/220VAC ±20%	+5VDC @ 2.5A +12VDC @ 2.0A	7.75 x 4.25 x 2.20 (Open Frame)
TDI-149	100 W	110/220VAC ±10%	+5VDC @ 8A +24VDC @ 1A +12VDC @ 1A −12VDC @ 1A	7.75 x 4.25 x 2.20 (Open Frame)
TDI-170	150 W	110/230VAC ±15%	+5VDC @ 8.5A +12VDC @ 4.0A −12VDC @ 1.5A −7.2VDC @ 6.0A	13.5 x 6.0 x 3.5 (Enclosed)
TDI-190 (Military)	150 W	115VAC/Nominal	+12VDC @ 1.5A −12VDC @ 1.5A +5VDC @ 14A −5VDC @ 0.75A	8.75 x 7.0 x 4.5
TDI-231	150 W	110/220VAC ±10%	+5VDC @ 8A ±12VDC @ 3A ±15VDC @ 1A	8.625" x 6.875" x 3.125"
TDI-201	300 W	110/220V Versions	+50VDC @ 5A +40VDC @ 1A	11.5 x 6.25 x 2.75
TDI-194	400 W	115/230VAC ±10%	+5VDC @ 65A ±15VDC @ 1.5A	13.5 x 6.75 x 3.0
TDI-184	800 W	115/230VAC ±10% or battery	13.5VDC @ 55A	11.5 x 8.0 x 5.2 (Enclosed)
TDI-233	500 W	110/220VAC ±10%	+28VDC @ 5A +18VDC @ 15A +12VDC @ 5A	11.75" x 9.375" x 3.25"

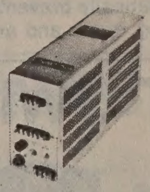
Consult Factory for 500-1000W Open Frame Inexpensive Units.

Consult Factory for New Line of Switchers (up to 1500W) with Battery Backup.

Outputs indicated above are representative of those in current production. Other outputs are available at user's request with slight circuit modifications. NRE charges may apply depending upon complexity of modification.

HIGH REL UNITS FOR SHIPBOARD & AIRBORNE APPLICATIONS.

800W
Multiple Output, Enclosed
+5V 130A & ±15V 5A ea



Input: 104-132VAC 47-440Hz

Outputs: + 5VDC @ 130A
±15VDC @ 5A ea

Regulation: ±1% line and load combined

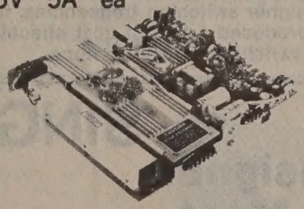
Ripple and Noise: ±1% peak-to-peak

Features:
- Militarized for high reliability
- Remote sensing of 5V output
- O.V. protection on all outputs
- Overload protection on all outputs
- RFI & EMI: Meets MIL-STD-461

Dimensions: 14" x 7.5" x 4.0"

TDI-211
Airborne
Applications

1000W
Multiple Output, Open-Frame
+5V 170A & ±15V 5A ea



Input: 104-132VAC 47-440Hz

Outputs: + 5VDC @ 170A
±15VDC @ 5A ea

Regulation: ±1% line and load combined

Ripple and Noise: ± 1% peak to peak

Features:
- Militarized for high reliability
- Remote sensing of 5V output
- O.V. protection on all outputs
- Overload protection on all outputs
- RFI & EMI: Meets MIL-STD-461

Dimensions: 15.0" x 13.5" x 2.0"

TDI-210
Shipboard
Applications

CUSTOM & STANDARD DESIGN OF . . .
High Reliability Power Systems

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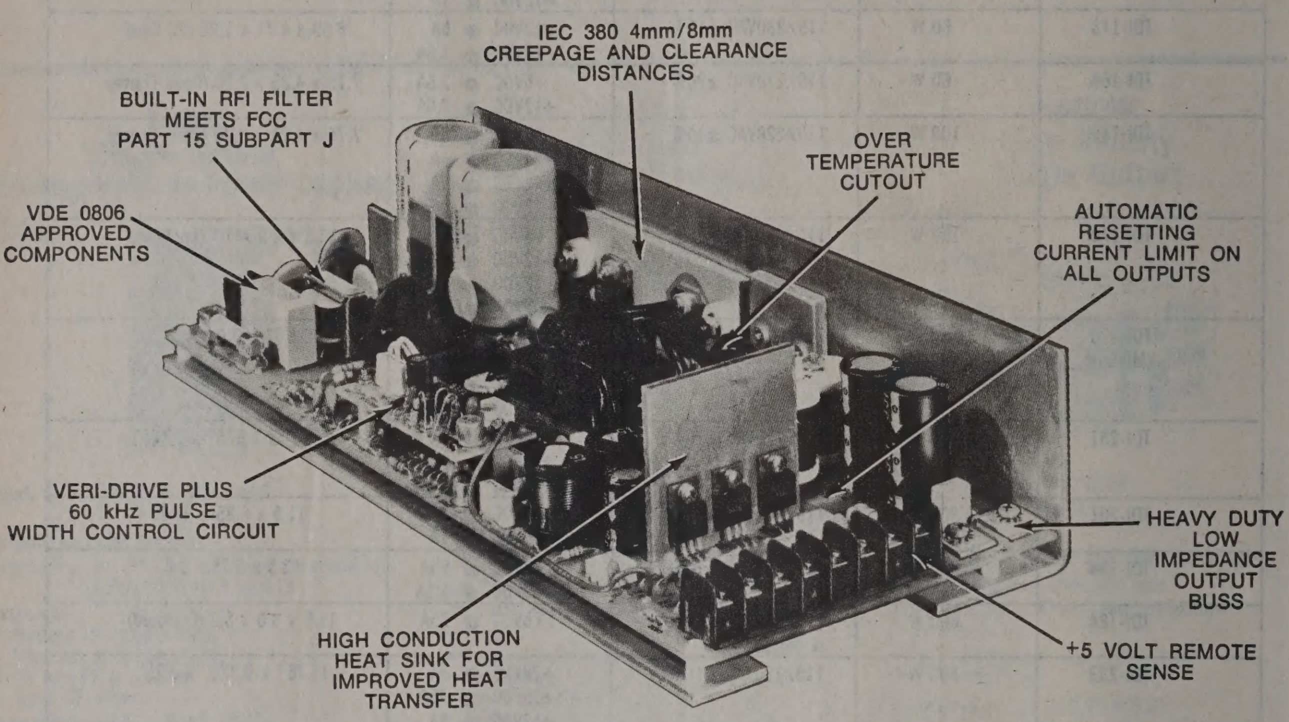

IEC 380 4mm/8mm CREEPAGE AND CLEARANCE DISTANCES
BUILT-IN RFI FILTER MEETS FCC PART 15 SUBPART J
OVER TEMPERATURE CUTOUT
VDE 0806 APPROVED COMPONENTS
AUTOMATIC RESETTING CURRENT LIMIT ON ALL OUTPUTS
VERI-DRIVE PLUS 60 kHz PULSE WIDTH CONTROL CIRCUIT
HEAVY DUTY LOW IMPEDANCE OUTPUT BUSS
HIGH CONDUCTION HEAT SINK FOR IMPROVED HEAT TRANSFER
+5 VOLT REMOTE SENSE

VERI-DRIVE PLUS

A field proven design which has accumulated hundreds of millions of trouble free field operating hours.

VERI-DRIVE PLUS is the enhanced version of Todd's proprietary VERI-DRIVE, the time tested switching power supply technology that has made Todd Products Corp. the fastest growing power supply company in the country. Using the powerful combination or VERI-DRIVE PLUS, state of the art components, and higher switching frequencies, the Todd Engineering team has produced a line of cost effective, high performance, reliable switchers second to none.

VERI-DRIVE PLUS improves switcher reliability:

- Prevents Inverter Transistor cross-conduction
- Eliminates Inverter Transistor Matching
- Reduces Transistor losses by faster switching time
- Reduces spiking due to core saturation effects

AND . . . if a failure does occur, VERI-DRIVE PLUS automatically prevents secondary component failure thus simplifying repair and analysis.

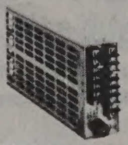
SINGLE OUTPUT SWITCHERS

Designed to Meet FCC/VDE RFI Specs

CONVECTION COOLED

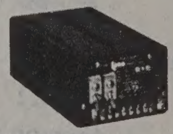
FEATURES

☐ UL recognized
☐ Convection cooled
☐ Full ratings to 50°C
☐ Remote Sense
☐ Dual AC Input



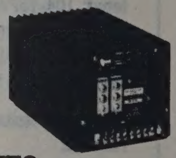
100 WATTS
Size: 1.93 x 4.63 x 9.5

MODEL	VOLTAGE	CURRENT
SW2-20	**2V**	**20A**
SW5-20	**5V**	**20A**
SW12-10	**12V**	**10A**
SW15-8	**15V**	**8A**
SW24-5	**24V**	**5A**
SW28-4.5	**28V**	**4.5A**
SW48-2.5	**48V**	**2.5A**



150 WATTS
Size: 3.11 x 4.85 x 8.5

MODEL	VOLTAGE	CURRENT
SW2-30	**2V**	**30A**
SW5-30	**5V**	**30A**
SW12-15	**12V**	**15A**
SW15-12	**15V**	**12A**
SW24-7.5	**24V**	**7.5A**
SW28-6.5	**28V**	**6.5A**
SW48-4	**48V**	**4.0A**



300 WATTS
Size: 4.85 x 5.13 x 9.12

MODEL	VOLTAGE	CURRENT
SW2-60	**2V**	**60A**
SW5-60	**5V**	**60A**
SW12-30	**12V**	**30A**
SW15-24	**15V**	**24A**
SW24-15	**24V**	**15A**
SW28-13	**28V**	**13A**
SW48-7.5	**48V**	**7.5A**

CUSTOMIZED VERSIONS OF ALL MODELS AVAILABLE CONSULT FACTORY

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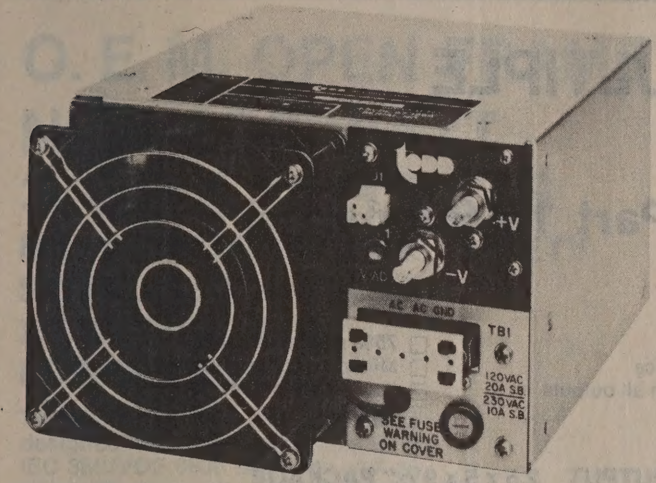


NEW SINGLE OUTPUT SWITCHERS

HIGH POWER 625 WATT SWITCHER... UNDER**60c PER WATT

FEATURES

- ☐ Small size — 5 x 8 x 10 inches
- ☐ Industry standard mounting
- ☐ Meets FCC RFI (Part 15 Subpart J)
- ☐ U/L recognized
- ☐ IEC 380 version available
- ☐ 50 KHz VERI-DRIVE PLUS design
- ☐ Optional AC power fail
- ☐ Optional remote margining

625 WATTS

Size: 5 x 8 x 10 inches

MODEL	VOLTAGE	CURRENT
SOX-2-125*	2V	125A
SOX-3-125*	3V	125A
SOX-5-125*	5V	125A
SOX-12-52*	12V	52A
SOX-24-36*	24V	36A
SOX-28-23*	28V	23A
SOX-48-13*	48V	13A

* Specify suffix A1 for 115 VAC operation or A2 for 230 VAC.

SPECIFICATIONS: ALL SINGLE OUTPUT SWITCHERS

Input: 115/230 VAC ±15%, 47 to 63 Hz. Single phase. All models strappable except models indicated.

Output Adjustment: ±10%.

Regulation: 1% line or load.

Ripple and Noise: Less than 10 mv RMS, 50 mv P-P.

Stability: 0.1% over 8 hr.

Temperature Coefficient: Less than 0.02%/°C.

Transient Response: 500 µsec following a 50% load change. Sox, 250 µsec.

Overshoot: No turn on or turn off overshoot.

Brown Out Protection: To 85/170 VAC.

Carryover Time: 25 msec. Sox, 16 msec.

Overload Protection: Automatic resetting current limiting.

Overvoltage Protection: Latching or automatic OVP depending on model.

Remote Sensing: Standard on all models.

Reverse Voltage Protection:

Power Factor: 0.75 typical.

Temperature Range: 0°C to 50°C. Derates to 71°C.

Soft Start: Minimizes input current surge on turn-on.

Efficiency: 75% typical.

Safety: U/L recognized (most models).

Options:

A. Latching OVP (1500 and 300 watt models only)

B. AC power fail signal

C. Remote margining (Sox Series only)

** OEM Quantities

SW AND SX SERIES

FAN COOLED

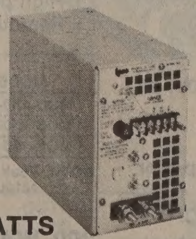
FEATURES

- ☐ Built in RFI Filter
- ☐ Power factor correction
- ☐ Fan cooled
- ☐ 50° ratings
- ☐ Fully protected

500 WATTS

Size: 4.95 x 5.5 x 10.7 in.

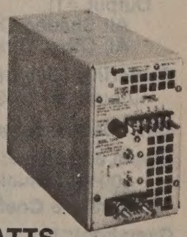
MODEL	VOLTAGE	CURRENT
SX2-100	2V	100A
SX5-100	5V	100A
SX12-50	12V	50A
SX15-40	15V	40A
SX24-25	24V	25A
SX28-22	28V	22A
SX48-13	48V	13A



750 WATTS

Size: 4.94 x 7.88 x 10.69 in.

MODEL	VOLTAGE	CURRENT
SW2-150S	2V	150A
SW5-150S	5V	150A
SW12-75S	12V	75A
SW15-60S	15V	60A
SW24-38S	24V	38A
SW28-33S	28V	33A
SW48-20S	48V	20A



1000 WATTS

Size: 4.94 x 7.88 x 10.69 in.

MODEL	VOLTAGE	CURRENT
SW2-200	2V	200A
SW5-200	5V	200A

For 625, 750 and 1000 Watt units add suffix "A1" for 115 VAC input or "A2" for 230 VAC.

CUSTOMIZED VERSIONS OF ALL MODELS AVAILABLE CONSULT FACTORY

TODD PRODUCTS CORP.

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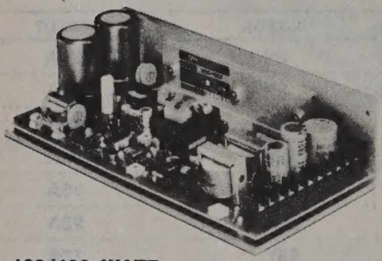
LOW COST O. E. M. MULTIPLE OUTPUT SWITCHERS

Designed to Meet FCC RFI (Part 15 Subpart J)



100/130 WATT

SPECIFICATIONS

AC Input: 90-132 VAC/180-264 VAC selectable, 47-63 Hz.

Line and Load Regulaion: (20% to 100% load).
Semi-regulated Outputs: ±3%
All Other Outputs: ±1% or 2% depending on model.

Cross Regulation: (50% Load Change on Output #1).
All Shaded Outputs: ±3%.
All Other Outputs: ±1%.

Centering (Output #1 set to +5.00V, all outputs at 60% load): ±5%.

Min. Load Required: 20%.

Ripple and Noise: 0.2% RMS, 1% p-p or 100 mV, whichever greater.

Temperature Coefficient: 0.02%/°C.

Overshoot: No turn on or off overshoot.

Overload Protection: Current limit protection on all outputs.

Overvoltage Protection: Standard.

Brownout Protection: Holds full rated regulation to 85/170 VAC.

Hold Up Time: 16 ms.

Temperature Range: 0 to 50°C full ratings, derated 50% to 71°C.

Soft Start: Reduces turn-on current surge.

Safety: U/L recognized (most models).

FEATURES

- ☐ UL recognized
- ☐ No 60 Hz magnetics
- ☐ Current limited on all outputs
- ☐ Dual AC input
- ☐ 75% typical efficiency
- ☐ Minimum component count
- ☐ Low output cross coupling
- ☐ Soft start

100 WATT 4 OUTPUT 2.5 x 5 x 9½" PACKAGE FEATURES

- ☐ High peak current disc drive output
- ☐ Tightly regulated ±12V output
- ☐ +5 remote sense
- ☐ Built in RFI filter

MODEL	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MOS-100-0512	+5A @ 15A	+12 @ 3.0A	−12 @ 2.0A	−5 @ 1A
MOS-100-2412	+5A @ 15A	+12 @ 1.5A	−12 @ 1.0A	+24 @ 4A pk
MOS-100-1212	+5A @ 15A	+12 @ 1.5A	−12 @ 1.0A	+12 @ 5A* pk

NOTE Peak currents are specified for disc drive applications. Maximum average current 2A. Shaded outputs are semi-regulated.

130 WATT 4 OUTPUT IEC 380/VDE 0806 2.5 x 5 x 9½" FEATURES

- ☐ Meets International safety standards
- ☐ High peak current disc drive output
- ☐ Built in RFI filter
- ☐ +5V remote sense

MODEL	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MOV-100-1212	+5 @ 15A	+12 @ 1.5A	−12 @ 1.5A	+12 @ 5A pk
MOV-100-2412	+5 @ 15A	+12 @ 1.5A	−12 @ 1.5A	+24 @ 4A pk

NOTE Peak currents are specified for disc drive applications. Maximum average current 50% of pk. Shaded ouputs are semi-regulated.

150 WATT 4 OR 5 OUTPUT 2.5 x 5 x 10½" PACKAGE FEATURES

- ☐ High peak current disc drive output
- ☐ Remote sense on +5
- ☐ Tightly regulated ±12
- ☐ −5V bias supply

MODEL	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	OUTPUT #5
MOS-150-0512	+5 @ 20A	+12 @ 4.0A	−12 @ 3.0A	−5 @ 1A	
MOS-150-2412	+5 @ 20A	+12 @ 1.5A	−12 @ 1.0A	−5 @ 1A	+24 @ 6A pk
MOS-150-1212	+5 @ 20A	+12 @ 1.5A	−12 @ 1.0A	−5 @ 1A	+12 @ 6A pk

NOTE Peak currents are specified for disc drive applications. Maximum average current 3A. Shaded outputs are semi-regulated.

200 WATT 4 OR 5 OUTPUT 2.5 x 5 x 13" PACKAGE FEATURES

- ☐ Adjustable regulated high current ±12V output
- ☐ +5V remote sense
- ☐ High peak current disc drive output

MODEL	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	OUTPUT #5
MOX-200-0512	+5 @ 25A	+12 @ 4.0A	−12 @ 4.0A	−5 @ 1A	
MOX-200-0515	+5 @ 25A	+15 @ 4.0A	−15 @ 4.0A	−5 @ 1A	
MOX-200-2412	+5 @ 25A	+12 @ 4.0A	−12 @ 4.0A	−5 @ 1A	+24 @ 8A pk
MOX-200-1212	+5 @ 25A	+12 @ 4.0A	−12 @ 4.0A	−5 @ 1A	+12 @ 8A pk

NOTE Peak currents are specified for disc drive applications. Maximum average current 4A. Shaded outputs are semi-regulated.

CUSTOMIZED VERSIONS OF ALL MODELS AVAILABLE CONSULT FACTORY

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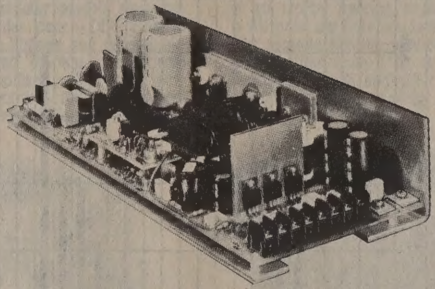
O. E. M. OPEN FRAME SWITCHERS

NEW 300 WATT 3 OR 4 OUTPUTS

MEETS INTERNATIONAL SAFETY STANDARDS IN RECORD 2.1 WATTS/CU IN POWER DENSITY



The MOR Series 60 kHz switcher is designed for application requiring IEC 380/VDE 0806 safety as well as U/L 478. The units also meet the RFI requirements of FCC Part 15 Subpart J. Size: 2.5 x 5 x 11½".

FEATURES

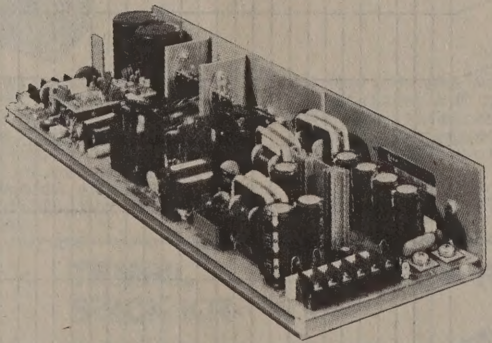
- ☐ IEC 380/VDE 0806 safety standards
- ☐ High current 45A, +5V output
- ☐ Remote Sense
- ☐ All regulated outputs
- ☐ Built in RFI filter

MODEL	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4
MOR-411-0512	**+5 @ 45A**	**+12 @ 1.5A**	**−12 @ 1.5A**	**5.2 @ 1.5A**
MOR-411-1212	**+5 @ 45A**	**+12 @ 1.5A**	**+12 @ 1.5A**	**12 @ 1.5A**
MOR-411-2412	**+5 @ 45A**	**+12 @ 1.5A**	**−12 @ 1.5A**	**24 @ 1.5A**
MOR-311-0512	**+5 @ 45A**	**+12 @ 2A**		**12 @ 2A**

- All outputs are regulated.
- Units require 60 cfm of moving air to achieve full ratings.

NEW 400 WATT 4 or 5 OUTPUTS

THE SMALLEST 400W OPEN FRAME SWITCHER IN THE INDUSTRY



This new Todd Multi-output high power open frame switcher represents a breakthrough in open frame switcher technology. Switching at 50 kHz and using Todd's VERI-DRIVE PLUS it is the only power supply delivering 50 amps at +5 VDC, and with a power density of greater than 2.1 watts per cubic inch (2.5 inches by 5 inches by 15 inches).

FEATURES

- ☐ High Current (50 Amp), Low Noise Output
- ☐ Remote Sense on +5 VDC Output
- ☐ Regulated Auxiliary outputs for ECL, or CRT display
- ☐ Built-in Thermal Protection
- ☐ High Surge Current Disk or Printer Output
- ☐ All Outputs Current Limited
- ☐ Built-in RFI Filter
- ☐ Heavy Duty High Current Output Studs
- ☐ Overvoltage and Open Sense Lead Protection

MODEL	OUTPUT #1	OUTPUT #2	OUTPUT #3	OUTPUT #4	OUTPUT #5
MOX-400-0512	**+5 @ 50A**	**+12 @ 10A**	**−12 @ 10A**	**−5 @ 5A**	
MOX-400-2412	**+5 @ 50A**	**+12 @ 10A**	**−12 @ 10A**	**−5 @ 5A**	**+24 @ 8A pk**
MOX-400-1212	**+5 @ 50A**	**+12 @ 10A**	**−12 @ 10A**	**−5 @ 5A**	**+12 @ 8A pk**
MRX-400-1212	**+5 @ 50A**	**+12 @ 10A**	**−12 @ 10A**	**+12 @ 1.5A**	
MRX-400-2412	**+5 @ 50A**	**+12 @ 10A**	**−12 @ 10A**	**+24 @ 1.5A**	
MRX-400-0512	**+5 @ 50A**	**+12 @ 10A**	**−12 @ 10A**	**−5.2 @ 3A**	

Shaded outputs are semi-regulated.

NOTE Peak currents specified are momentary, for motor starting. Reduce to 5A for maximum average current. Units require 60 cfm moving air to achieve full ratings. Combined current on outputs #2 and #3 cannot exceed 15A.

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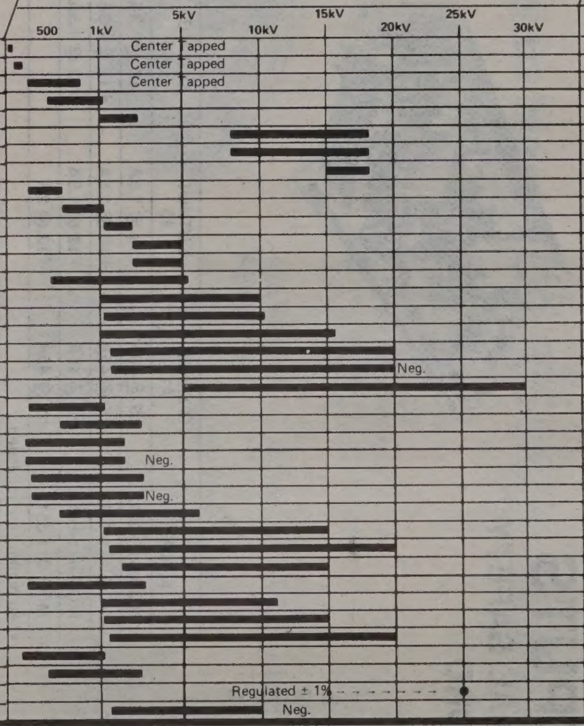
VENUS™ SCIENTIFIC, INC. Miniature High Voltage Power Supplies

Standard Products "Quick" Selection Chart — Standard Products Performance Characteristics



MODEL NO.	Output Proportional to Input	Floating Bias Supply	Multiple Output	Low Power Battery Operated	PMT	CRT	Focus	Dynamic Focus	Switching Penetration	X-Ray Microscope	High Alt. Version	Volume in Cubic Inches	Output Voltage Range	Max. current rating: -55° to +71°C Full Rating (-55° to +85°C Reduced Rating)	Max. current rating: 0° to 55°C
C-½T	√	√	√									3	Center Tapped	*	32mA
C-2T	√	√	√									3	Center Tapped	*	8mA
C-8T	√	√	√				√					3	Center Tapped	*	2mA
C-15	√	√			√		√					3		*	1mA
C-30	√	√			√		√					3		*	500uA
CS-18						√			√			180		*	200uA
CS-18/DF			√			√	√	√	√			382		*	500uA
DF-18			√			√	√	√				314		*	500uA
F-6		√					√					7		16mA	*
F-12		√			√		√					7		8mA	*
F-25		√			√		√					7		4mA	*
F-50		√				√	√					7		2mA	*
F-50A		√				√	√				√	7		2mA	*
G-6						√	√				√	15		500uA	*
G-10						√					√	15		500uA	*
G-12						√					√	15		500uA	*
H-16F			√			√	√				√	31		500uA	*
H-20						√				√	√	31		500uA	*
H-20N						√				√	√	31	Neg.	500uA	*
H-30						√				√	√	44		300uA	*
K-15(Z)	√	√			√		√				(√)	2		1mA	*
K-30(Z)	√	√			√		√				(√)	2		500uA	*
LR-2					√							33		*	10mA
LR-2N					√							33	Neg.	*	10mA
LR-3					√							33		*	6.6mA
LR-3N					√							33	Neg.	*	6.6mA
LR-6						√	√					33		– –	3.3mA
LR-15			√			√	√					33		– –	1.3mA
LR-20			√			√	√					33		– –	1mA
LU-15	√		√			√	√					27		*	300uA
MG-3					√		√					7		1mA	*
MG-12						√						7		500uA	*
MR-15			√			√	√					33		– –	1.3mA
MR-20			√			√	√					33		– –	1mA
Q-15(Z)	√	√		√	√		√				(√)	3		400uA	*
Q-30(Z)	√	√		√	√		√				(√)	3		200uA	*
SM-25			√			√	√	√				97	Regulated ± 1%	*	1.2mA
ST-10N	√			√								7	Neg.	10uA	*

Above current ratings proportional to output voltage when units are operated at less than rated output voltage. *NOTE: Contact Factory

Most of Venus' power supplies can be obtained "off-the-shelf" from a large stock of inventory. This allows the unique advantage of selecting a power supply proven through previous years of field testing in numerous applications. The benefits of selecting from inventory include immediate delivery, no non-recurring engineering and demonstrated quality at a reasonable price. A custom design service is also available where unique and exacting requirements are not compatible with existing standard products. Venus can supply custom designed units in both prototype and production quantities for both Military and Commercial applications. Please contact the Venus Engineering Sales Department for further details in formulating a cost effective design to suit your specific requirements.

VENUS™ SCIENTIFIC, INC.
399 Smith Street Farmingdale, N.Y. 11735 (516) 293-4100 TWX: 510-224-6492

For More Information. Circle No. 359

PRINTED CIRCUIT ASSEMBLY & PRODUCTION AIDS

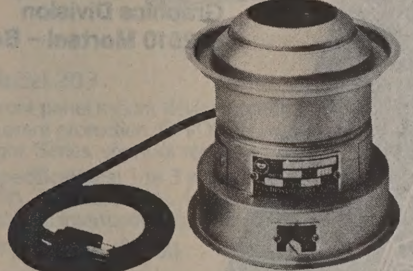
ASSEMBLY & PRODUCTION AIDS /Div. Electrovert Inc.
399 Executive Boulevard, Elmsford, NY 10523

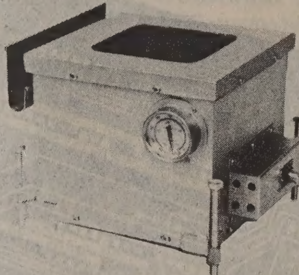
Northeast: 399 Executive Blvd., Elmsford, NY 10523 (914) 592-7322
Southeast: 3115 Gateway Dr., Norcross GA 30071 (404) 441-3644
Southwest: 10969 Shady Trail, Dallas, Texas 75220 (214) 353-9950
Midwest: 9996 Bryn Mawr Ave., Rosemont, IL 60018 (312) 678-5557
West: 1311 East Chestnut Ave., Santa Ana, CA 92701 (714) 835-2033

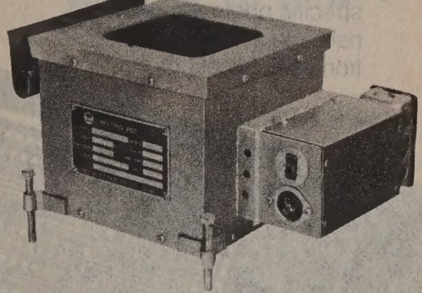
Authorized Distributors: AZ: Phoenix — Scottsdale Tool & Supply, 602-273-7376; Tempe — Marshall Claude Michael, 602-894-2188 • **CA:** Fullerton — Bertech, 714-526-3700; Sunnyvale — Marshall Claude Michael, 408-739-8720; Com-Kyl, 408-734-9660; El Monte — Marshall Claude Michael, 213-442-7204; Irvine — Marshall Claude Michael, 714-556-6500 • **CO:** Denver — Marshall Claude Michael, 303-427-1800; Solder-Tec, 303-922-6214 • **CT:** Wallingford — Technical Associates of Connecticut, 203-265-4241; Marshall Claude Michael, 203-265-3822 • **FL:** Orlando — Marshall Claude Michael, 305-841-1878; • **GA:** Norcross — Marshall Claude Michael, 404-925-1895 • **IL:** Chicago, — EMF Co., Inc., 312-889-8323; McMaster-Carr Supply, 312-834-9600; Addison International Soldering Sy. Inc., 312-628-8083; Hillside — Miltex Sales Co., 312-449-0420 • **MA:** Burlington — Marshall Claude Michael, 617-272-1234 • **MI:** Royal Oak — Murray Purcival Co., 313-548-1971 • **MN:** Excelsior — Tonka Electronic Supply, 612-474-5414 • **NJ:** Fairfield — Marshall Claude Michael, 201-882-0320; Mt. Laurel — Marshall Claude Michael, 609-778-8720 • **NM:** Albuquerque — Betatron Electronics, 505-344-2381 • **NY:** Hauppauge — Marshall Claude Michael, 516-273-1515 • **OR:** Portland — MPI Associates, 503-641-6624; Murphy Industrial Supply, 503-620-8680 • **TX:** Dallas — Roy E. Davis Co., 214-688-0652; Marshall Claude Michael, 214-233-7650; Houston — Specialized Products, 713-995-0595 • **UT:** Salt Lake City — Industrial Supply, 801-484-8644 • **Canada:** Markham, Ont — Brock Electronics, Ltd., 416-294-8080.

DEE® SOLDER POTS

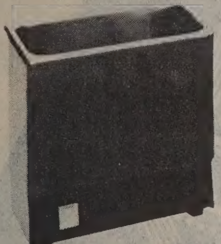
• Round, square and rectangular models from the most reliable name in solder pots — DEE Electric (an Electrovert Company) • Rugged and dependable for heavy-duty uses • High thermal conductivity guarantees rapid heating, uniform solder bath temperature, and stable temperature control • Interior of heavy-duty cast iron crucible is smooth and free of all welds, heating elements and thermocouples • All pots are fully insulated. A very low watt density ceramic heating element encircles the crucible • Capacities from 1 lb. 4 oz. to 2 lbs. 12 oz. • Heating elements and other Dee manufactured components are warranted for 18 months.







ULTRASONIC CLEANERS



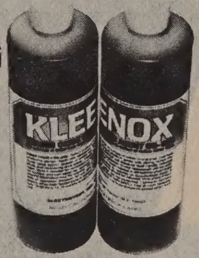
• Durable and reliable with self-contained generator and transducer elements bonded to bottom of stainless steel tank • ½, ¾, 1 and 1½ gal. capacity models with accessories • Solid state circuitry provides stable temperature in cleaning tank and stable output frequency that automatically and continually adjust to changes in solution level • Available 110/120 and 220/240 VAC, 50/60 Hz • Automatic timers and heaters available.

LEAD FORMING

A-B
QUALITY
ELECTROVERT
Rotoprep

• Rotoprep™ is a high speed unit for ⅛ to ½ watt size axial components . . . on tape and reel, or with optional attachments, card feed • Speed control can be adjusted from 0 to 33,000 parts per hour • Can be easily and quickly adjusted • To set up production run, simply loosen 2 set screws and manually position ratchets and tape guides. • Electrically operated from any standard 115 VAC, 50/60 Hz outlets. 230 VAC, 50/60 Hz optional.

KLEENOX® SOLDER RECOVERING AGENT



• A liquid solder-oxide reducing agent makes possible the recovery of 60 to 80% pure solder from molten baths • Applied after each 8 hour shift • One tablespoon will activate the bath within 5 minutes, separating the solder from the dross.

LEV CHEK SOLDERWAVE GAUGE

• A simple, effective diagnostic tool for monitoring flux coverage, wave shape, wave turbulence and conveyor leveling in wave solder systems • Permits "topside" observation of "wave-to-board" contact.

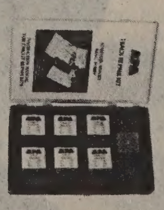
DESOLDERING TOOL

• Offers full industrial performance at an "economy" price • Features all metal precision construction • Suction is precisely regulated for efficient solder removal without damage to delicate circuitry • Self-cleaning.

TEMPIL STICK KIT

• An invaluable tool for accurate temperature measurements • To use, simply mark surface to be heated. Mark will melt when specified temperature is reached • Wide variety of temperature ratings is available.

PCB REPAIR KIT



• Repair PCB circuitry quickly, easily • Includes everything you need to repair or replace PCB circuitry, including plated through-holes • Complete ready-to-use with circuitry, tools, materials and instruction manual.

SOLDER SERVICE KITS*

1. Flux Hydrometer: for testing flux specific gravity from 0.800 to 1.000 in 0.005 graduations **2.** Illuminating Magnifying Lens: 5X power; with batteries and carrying case **3.** Thermometer: (8″) calibrated from —150 to 1000°F. **4.** Tempil Stik: rated at 175°F. **5.** Surface Pyrometer: for spot checking surface preheat. Rated 50 to 1000°F. **6.** 18″ Titanium Board Stiffener: to support large PC boards during wavesoldering. Prevents warping **7.** Safety Glasses: laminated safety eyeglasses **8.** Insulated Gloves: 1 pair, heavy duty **9.** Wavesolder Tool Kit: Allen key set (5/64″ to ¼″); open end wrench (5/16″ and ⅜″); lug wrench for solder drain valve (Electrovert Systems); stainless steel spatula; and nozzle scraper.

* Items 1 through 9 sold together as a kit, or separately. Hydrometer tips, floats, and bulbs also sold separately.

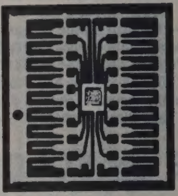
For More Information. Circle No. 360

When a complex process has to be controlled very accurately

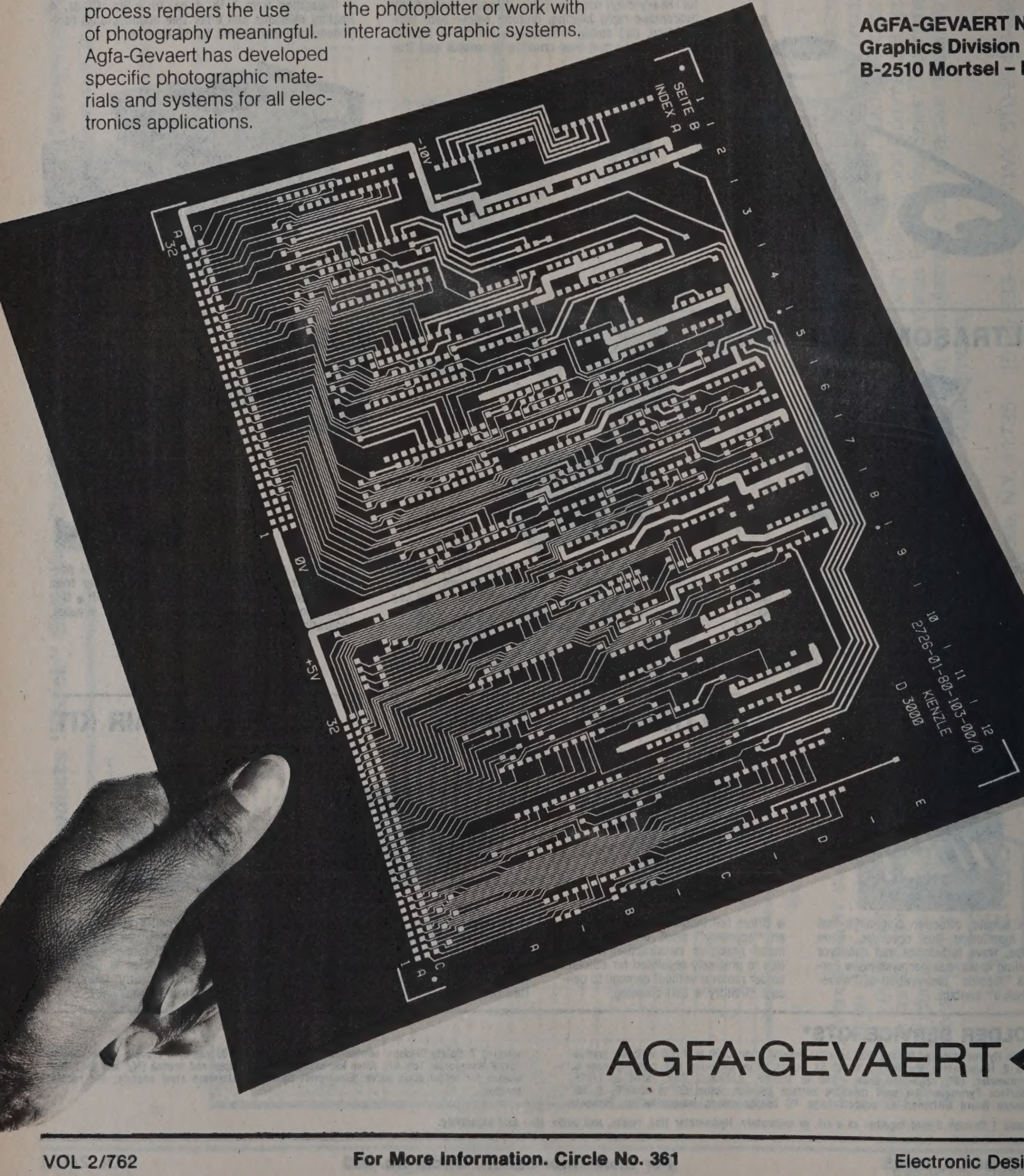
Both printed and integrated circuits have become indispensable in electronics. With regard to accuracy they have to meet extremely stringent requirements. The multi-phase manufacturing process renders the use of photography meaningful. Agfa-Gevaert has developed specific photographic materials and systems for all electronics applications.

They guarantee top quality and assist you to obtain the highest possible production efficiency. It is irrelevant whether you apply a taping technique or work by hand. Whether you digitalize with the photoplotter or work with interactive graphic systems.

Agfa-Gevaert films, processors and solutions are optimally matched, so that the best possible result will be obtained at all times. Ask for more ample information.



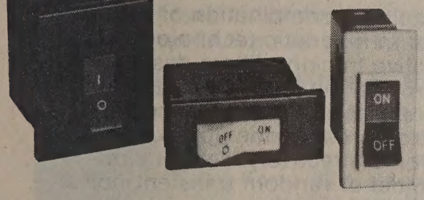
AGFA-GEVAERT N.V.
Graphics Division
B-2510 Mortsel – Belgium



AGFA-GEVAERT Agfa

For More Information. Circle No. 361

Circuit Breakers

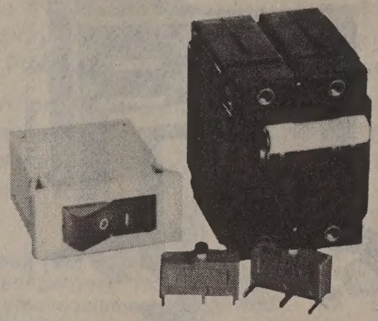


Model 203

Front panel mount device combines overcurrent protection, ON-OFF switching, pilot light. Series, shunt or relay trip.

Specifications: 1 to 3 poles. Ratings: 0.05-10A, 250Vac, 50Vdc, 10.1-20A, 120Vac, 32 Vdc. Interrupting capacity: 1000A.

Approval: SP Ⓢ ЯU



Models SNAPAK®, CARDGARD™, IPG

All conform to VDE and IEC spacing requirements. CARDGARD is pc board mountable.

Specifications: SNAPAK®: 1 or 2 pole ratings: 0.10 to 15A at 32Vdc/125Vac, 0.10 to 7.5A at 50Vdc/250Vac. 2 pole only (2 pole breaking) and ratings; 7.6 to 15A at 125/250Vac, 32/50Vdc. Interrupting capacity: 1000A at 125Vac, 32Vdc and 50Vdc.

Approval: IEC SP Ⓢ ЯU

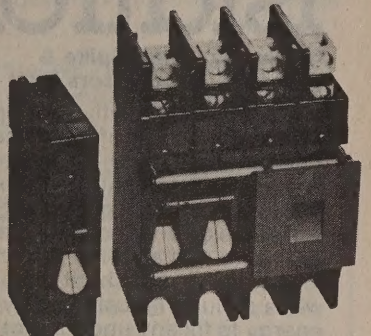
CARDGARD™: 1 pole. Ratings: 1.0 to 6.0A, 32Vdc, 250Vac. Interrupting capacity: 10 times rated current.

Approval: ЯU

IPG: 1 to 4 poles. Ratings: 0.02-30A, 250Vac, 65Vdc, 31-50A, 50Vdc. Interrupting capacity: 1000A, 250Vac, 65Vdc, and at 5000A, max. ratings of 30A at 120Vac, 20A at 250Vac, 10A at 250Vac.

Approval: SP Ⓢ ЯU

QPL: MIL-C-55629

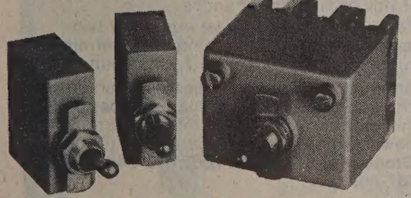


Model 209

Ideal for branch circuits. Mount in switch boards, panel enclosures, panel boards, junction boxes. Series includes 219 manual motor controller, 229 appliance controller, 249 marine power selector.

Specifications: 1 to 6 poles. Ratings: 0.10-100A, 125Vdc; 0.10-77A, 600Vac; 0.10-100A, 120, 240, 277 and 480 Vac. Interrupting capacity: 5000A.

Approval: SP Ⓢ (UL) ЯU



Models AP and UP

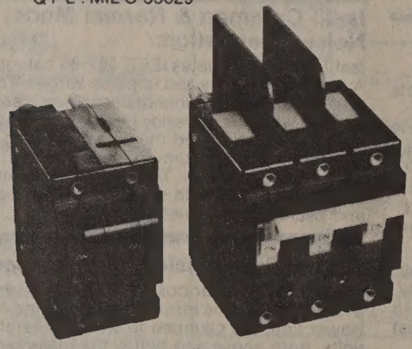
Hermetically sealed. DC, 50/60Hz or 400Hz versions. Various delays to meet your needs. UP version has wide glass terminals.

Specifications: 1 to 3 poles. Ratings: 0.05-20A, 240Vac, 50Vdc. Interrupting capacity: 1000A.

Approval: SP Ⓢ ЯU

(UP single pole series only)

QPL: MIL-C-39019



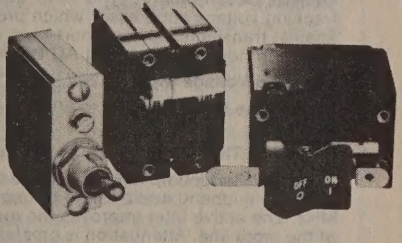
Models APL/UPL & 205

These breakers offer precision operation for critical service. Series, shunt and relay configuration options. Choice of delays, ratings. 205 dust-sealed for harsh environments.

Specifications: 1 to 9 poles. Ratings: 0.05-20A, 277Vac (Mod. 205, 277/480Vac); 0.05-50A, 250Vac, 65Vdc; 51-100A, 32Vdc. Interrupting capacity: 1000A, 65Vdc (Mod. 205 also 250Vac), 2000A, 32Vdc, 5000A, 120Vac (50A max. rating); 5000A, 277Vac (Mod. 205, 277/480Vac) (20A max. rating).

Approval: SP Ⓢ ЯU

QPL: MIL-C-55629



Models APG/UPG

Low-cost, precision operation. Multipole assemblies, single or multi-handle. For data processing, broadcast equipment, vending machines, controllers, etc.

Specifications: 1 to 4 poles. Ratings: 0.02-30A, 277Vac, 65Vdc, 31-50A, 50Vdc. Interrupting capacity: 1000A, 277Vac, 65Vdc, and at 5000A, max. ratings of 30A at 120Vac, 20A at 250Vac, 10A at 277Vac.

Approval: SP Ⓢ ЯU

QPL: MIL-C-55629

AIRPAX®

We give you control.

Airpax Corporation,
a North American Philips Company
Cambridge Division
Woods Road
Cambridge, MD 21613
(301) 228-4600

For More Information. Circle No. 362

A New Generation in State of the Art Power Conditioning by Control Concepts

Islatrol®

"Active Tracking Spike & Transient Suppressors That Work"

Islatrol's unique active suppression is the secret of its success. The patented circuitry senses spikes and transients on incoming AC power and triggers itself into action. Islatrol effectively clamps the spike and absorbs the energy in the series and shunt elements, while simultaneously supplying energy to fill any undershoot. The result is clean incoming AC power. Islatrol means active protection for sensitive solid state equipment.

Secondary induced voltages from lightning, line faults or power switching often found in commercial and manufacturing environments can generate transients far exceeding the peak value of applied voltage. If not attenuated, these microsecond pulses can destroy semiconductors, and damage normal low level logic types. Islatrol protection reduces logic errors, erroneous control or memory loss and the possibility of equipment degradation or total failure.

Islatrol Specifications

General Description: A solid state, active tracking voltage suppressor which protects against transients, spikes, short-term outages and noise on incoming AC power lines.

Standard Voltage Inputs: 120V, 240V, 480V

Power Line Frequency: 50 to 60 Hz. (400 Hz available)

Response Time: Less than 10 nanoseconds

Transient Reduction: Minimum of 40 db, from the midband audio range through 50 MHz. The active filter improves the quality of the input line. Attenuation is greater than 50 db to IEEE surge withstand capability test No. 587 Category A and B.

Preset Switch Level: +/-2V

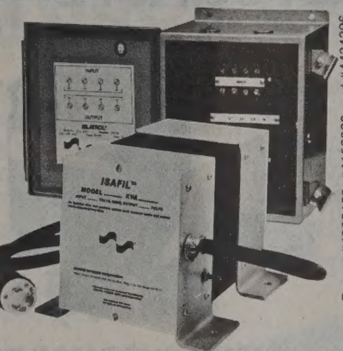
Regulation: Better than 1% no load through full load.

Leakage: Less than 50 microamperes. Voltage isolation to case 5000V RMS.

Operating Temperature: -40° C to 85° C

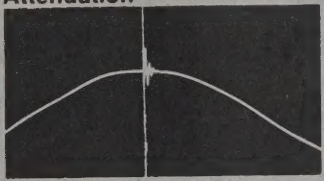
Reliability/Test Criteria: Each Islatrol unit is 300% fully tested at an input energy level of two joules for approximately 1000 spikes, superimposed at the peak of the input sinusoid at main power line distribution impedance.

Standard Available Models:
.5A to 100A, 120V Single Phase
.5A to 100A, 240V Single Phase
7.5A to 400A, 480V Single Phase
15.0 to 1500A, 240V Three Phase
15.0 to 1500A, 480V Three Phase

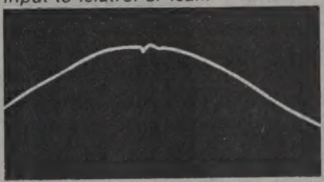


Patent #4095163, #4156838 and #4434396

Normal Mode Transient Attenuation



700V P-P 30 Microseconds Wide Input to Islatrol or Isafil



Output After Islatrol or Isafil

Isafil Common & Normal Mode Noise Attenuation:

Isafil easily attenuates IEEE 587-80 category A and B oscillatory and impulse surges. The unit incorporates a shielded isolation transformer, which is superior in common mode noise attenuation and the active tracking Islatrol filter for maximum normal mode transient attenuation. This significant attenuation occurs to both sinusoid type noise and oscillatory transient disturbances.

Islatrol Suppression Performance:

Destructive or spurious transients, present at any point on the input sine wave of the AC power line, are clamped to within several volts, both above and below the instantaneous value of a filtered input sinusoid. For example, a two joule, 1000V spike (peak-to-peak) is suppressed to 10V (peak-to-peak). The above is accompanied with minimal power line loss.

control concepts
CORPORATION

Dept. GB, P.O. Box 1380
Binghamton, New York 13902-1380
Phone (607) 724-2484

Isafil™

"The Best in Isolation and Greatest Attenuation of Common and Normal Mode Noise"

Isafil is a combination of the newest in magnetic technology plus active tracking filters designed to provide the best in isolation and greatest attenuation of common and normal mode noise. Isafil works effectively well for sinusoidal or random transient noise.

Isafil provides far superior rejection capability than other products available today. So good, in fact, that it easily attenuates IEEE 587-80 category A and B transients.

In today's electrical environment we encounter many types of power pollution that prevent power operation of sensitive electronic equipment. Transients usually show themselves by causing random errors, soft data, loss of memory or even catastrophic failures. Spikes and transients are probably the greatest cause of degradation of IC's, capacitors, diodes and other electronic components.

Isafil Specifications.

General Description: A super magnetic isloator incorporating a shielded isolation transformer offering superior isolation combined with an active tracking filter to effectively eliminate both normal and common modes of power line disturbances.

Terminals: Two-terminal input and two-terminal output, all floating. Fifth terminal, super shield, attaches to earth ground.

Attenuation: Noise voltages between power line and ground to less than one part in 20 million (146 db).* Noise voltages across the power line to less than I part in 500 (54 db).** **Greater than 50 db for IEEE 472-74 and IEEE 587-80.**

Through-Capacitance: Input to output with shield grounded, less than .0005 picofarads (5×10^{-16} Farads).

Leakage: Leakage resistance greater than 1000 Megohms D.C.

Active Filtering: Squelches either spike or oscillatory noise voltages across input terminals within 10 nanoseconds (10×10^{-9} Second).

Super Isolation: High conductivity copper barrier shield between input and output circuits gives greater protection against high energy discharges of power line, such as induced lightning surges.

Power Sizes:
125 to 600VA, Single Phase
1 to 15KVA, Single Phase
3 to 45KVA, Three Phase

*Common mode transient reduction exceeding 80 db.
**Normal mode (Transverse mode) transient reduction exceeding 80 db.

For immediate action on these items use the immediate action card in Vol. 4 or telephone Control Concepts, Dept. GB.

Islatrol/Isafil features a five year limited warranty

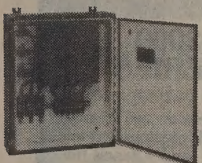
For More Information. Circle No. 363

Power Conditioning & Protection

LEA DYNATECH products provide • Complete Protection • Instant Response (less than 5 nanoseconds for SE and MB) • Very low power consumption • Low Clamping Ratio • Hybrid-Series design • Improved equipment stability • Reduced costly repair bills • Freedom from aggravation of down time

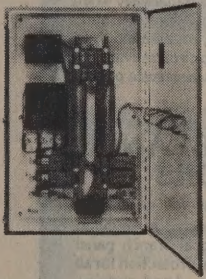
Proven Applications—Protection for Digital Systems, Computers, Uninterruptible Power Systems (UPS), Solid State Transmitters, Medical Systems, Complete Facilities, Power Distribution Centers. Additionally, **LEA DYNATECH** systems protect against equipment destruction, disruption, poor performance, brownouts, RFI/EMI, EMP, noise and AC power line transients.

LEA Surge Eliminators (SE)



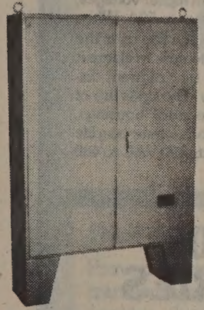
The **LEA Surge Eliminator (SE)** unit is a hybrid device installed between the incoming power and your equipment. Some **SE's** are compact devices for protecting a single 120 V AC unit. Other **SE's** are sized to protect an entire industrial facility. Especially recommended to install in front of **UPS** systems. The **SE's** primary purpose is to protect against utility and lightning surges with sizes from 1 to 3300 KVA. For 3 phase, specify WYE or DELTA.

LEA Kleanline Electronic Filters (MB)



LEA's Kleanline Electronic Filter (MB), also a series hybrid device, is designed to protect the more vulnerable solid state equipment such as solid state transmitters, computers, computer based systems and medical scanners. In addition to providing electrical surge protection, the **MB** unit provides broadband EMI/RFI filtering and noise limiting. Available sizes are 1 KVA to 1660 KVA. For 3 phase, specify WYE or DELTA.

LEA Perfect Power Sources (PPS)



LEA's Perfect Power Source (PPS) provides all of the capabilities of the **SE** and **MB** products, plus automatic tap changing voltage regulation. The **PPS** comes equipped with:

- Voltage regulation
- Surge protection from lightning and switching transients.
- Filtering for a wide spectrum of RFI, EMI, and EMP, and
- Protection from induced transients found in most environments.

The **PPS** will hold output voltages to within ±5% of nominal despite input variations of plus 10% and minus 25%, independent of load demand.

For hard wire-in units, (30 amperes and above, 7.2 KVA to 330 KVA), the **PPS** offers:

Surge/Transient Protection

Voltage	to 45,000 volts
Current	25,000 to 120,000 amperes
Energy	20,000 Joules
Reaction Time	5 Nanoseconds (Component Reaction Time)
RFI Rejection	Up to 50dB, both common and transverse modes, 25 KHZ to 100 MHZ; Plus Noise Limiting

2 Wire, Single Phase, 120 V AC RMS		SURGE ELIMINATORS	KLEANLINE ELECTRONIC FILTERS	PERFECT POWER SOURCES
Amps	**KVA**			
8	1.0	SE-(120)-10	MB-10	PP-120-8-1
15	1.8	SE-(120)-15	MB-15-3S	PP-120-15-1
30	3.6	SE-(120)-30	MB-30	PP-120-30-1
50	6.0	—	—	PP-120-50-1
60	7.2	SE-(120)-60	MB-60	—
100	12.0	SE-(120)-100	MB-100	PP-120-100-1
200	24.0	SE-(120)-200	MB-200	PP-120-200-1

3 Wire, Single Phase, 120/240 V AC RMS		SURGE ELIMINATORS	KLEANLINE ELECTRONIC FILTERS	PERFECT POWER SOURCES
Amps	**KVA**			
15	3.6	—	—	PP-120/240-15-2
30	7.2	SE-(120/240)-30	MB-30/2	PP-120/240-30-2
50	12.0	—	—	PP-120/240-50-2
60	14.4	SE-(120/240)-60	MB-60/2	—
100	24.0	SE-(120/240)-100	MB-100/2	PP-120/240-100-2
200	48.0	SE-(120/240)-200	MB-200/2	PP-120/240-200-2
300	72.0	SE-(120/240)-300	MB-300/2	—
400	96.0	SE-(120/240)-400	MB-400/2	—

4 Wire, Three Phase, 120/208 V AC RMS		SURGE ELIMINATORS	KLEANLINE ELECTRONIC FILTERS	PERFECT POWER SOURCES
Amps	**KVA**			
30	11	SE-(120/208)-30	MB-30/3	PP-120/208-30-3
50	18	—	—	PP-120/208-50-3
60	22	SE-(120/208)-60	MB-60/3	—
100	36	SE-(120/208)-100	MB-100/3	PP-120/208-100-3
200	72	SE-(120/208)-200	MB-200/3	PP-120/208-200-3
300	108	SE-(120/208)-300	MB-300/3	PP-120/208-300-3
400	144	SE-(120/208)-400	MB-400/3	PP-120/208-400-3
600	216	SE-(120/208)-600	MB-600/3	—
1000	360	SE-(120/208)-1000	MB-1000/3	—
1500	540	SE-(120/208)-1500	MB-1500/3	—
2000	720	SE-(120/208)-2000	MB-2000/3	—
4000	1440	SE-(120/208)-4000	—	—

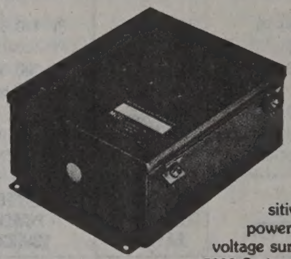
4 Wire, Three Phase, 277/480 V AC RMS		SURGE ELIMINATORS	KLEANLINE ELECTRONIC FILTERS	PERFECT POWER SOURCES
Amps	**KVA**			
30	25	SE-(277/480)-30	MB-430/3	—
50	40	—	—	PP-277/480-50-3
60	50	SE-(277/480)-60	MB-460/3	—
100	83	SE-(277/480)-100	MB-4100/3	PP-277/480-100-3
200	165	SE-(277/480)-200	MB-4200/3	PP-277/480-200-3
300	250	SE-(277/480)-300	MB-4300/3	PP-277/480-300-3
400	330	SE-(277/480)-400	MB-4400/3	PP-277/480-400-3
600	500	SE-(277/480)-600	MB-4600/3	—
1000	831	SE-(277/480)-1000	MB-41000/3	—
1500	1247	SE-(277/480)-1500	MB-41500/3	—
2000	1663	SE-(277/480)-2000	MB-42000/3	—
4000	3326	SE-(277/480)-4000	—	—

LEA DYNATECH, INC.
12516 LAKELAND ROAD • SANTA FE SPRINGS, CA 90670
PHONE (213) 944-0916 • TWX 910-586-1381

For More Information. Circle No. 364

PROTECT SENSITIVE ELECTRONIC EQUIPMENT WITH POWER LINE PROTECTORS BY MCG

COMPUTER GRADE PROTECTION



5000 SERIES

The 5000 Series offers moderate cost, high performance protection for computers, mini-computers, and other sensitive electronic equipment against power line noise and destructive high voltage surges, spikes and transients. The 5000 Series combines filtering (50db/500kz) and substantial suppression of high energy transients in a variety of protectors that respond in less than 5 nanoseconds, and have 320 joule energy handling capability. These units are suitable for operation on 120 VAC to 480 VAC, to 40 Amps for delta and wye configurations.

500 SERIES

The 500 Series has been designed to protect a wide variety of modern mini-computers that operate on the 120 VAC or 240 VAC, single phase AC lines requiring up to 30 Amps. The compact and rugged constructed protector provides vigorous transient suppression and eliminates the need for dedicated lines. In use, it is simply plugged into the AC power outlet and the equipment into it. Status monitoring, replaceable fusing, and a range of connector options make the 500 Series a versatile protector.

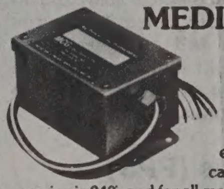
P210

Designed to keep "transients and noise" from damaging sensitive electronic equipment. The Model P210 employs a sophisticated combination of brute force surge protection and impulse filtering. The P210 reacts in 5 nanoseconds, has an energy absorption capability of 160 joules, and resets automatically when the transient has passed. In use, it is simply plugged into any AC outlet, and the equipment plugged into it. Rated at 117 VAC and 10 Amps, the P210 converts your AC wall outlet into a "dedicated line". The P210 is used where the requirement is critical and only first rate protection will suffice.

INDUSTRIAL GRADE PROTECTION FOR O.E.M.'S

2000 SERIES

The 2000 Series are Heavy Duty Shunt Protectors that install at main service panels (to 3000 Amps) and provide superior protection from lightning and hazardous transient overvoltages that commonly occur in industrial environments. The 2000 Series protects without power interruption, reacts in 5 nanoseconds, has an energy absorption capability up to 6000 joules, and resets automatically when the transient has passed. Long life and maintenance free operation make these units the perfect protectors for remote, unattended sites, for facilities, mobile vans, or stations with no back-up circuits available. Protects 120 VAC, to 480 VAC, 1 φ, 3 φ, delta and wye service panels.



MEDIUM DUTY BRANCH PROTECTORS

These units are connected in shunt to the load side of the local branch panel and provide substantial protection for all equipment on the line. Load-carrying capacity for models intended for 120 VAC service is 240j, and for all models intended for use with higher voltages, 480j. All models can be used on lines having currents up to 50A. When any form of transient appears, raising the voltage on the line over the clamping threshold, the unit reacts within 50 nanoseconds to clamp it to a safe level. The clamping mode lasts only until the transient disappears, after which the unit recovers automatically. The units are of extraordinary rugged construction, with moisture-proof housings. They are thus ideal for remote and unattended locations where long life and maintenance-free operation are essential. Protects 120 VAC to 480 VAC, 1 φ, 3 φ, delta, wye service panels.

1 2 3
MCG Electronics Inc

400 SERIES

The 400 Series install "within" a piece of equipment and is designed to keep "transients and noise" from damaging sensitive electronic equipment. The 400 Series employs a sophisticated combination of brute force surge protection and impluse filtering. Reacting in less than 5 nanoseconds, the 400 Series has an energy absorption capability exceding 200 joules and resets automatically when the transient has passed. The 400 Series will protect 120, 240 and 480 VAC, single phase lines handling currents to 15A. The 400 Series protects against lightning, EMP and switching transients.

MCG ELECTRONICS, INC. • 12 BURT DRIVE, DEER PARK, NEW YORK 11729 (516) 586-5125 • TELEX 645518

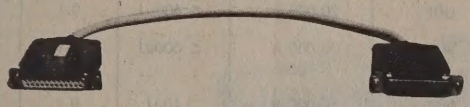
For More Information. Circle No. 365

PROTECTION FOR SIGNAL/DATA/TELEPHONE LINES

RS-232, RS-422, RS-423, 20 MA LOOPS, MODEMS

DLP-3: RS232 PROTECTION

Designed to provide complete protection for computers and terminals. RS232 connectors make installation easy, taking minutes for non-technical personnel. Pins 2, 3, 7, and 20 are protected. Other pins can be protected, consult factory.



DLP-4: MODEM PROTECTION

Dial-up protection unit puts an end to downtime and costly equipment failure for dial-up modems and CPU's. Compatible with RJ11 and RJ45 telephone jacks.

DLP-5: VIDEO CABLE PROTECTOR

Prevents coaxial cable from transmitting damaging transients to sensitive loads. Using isolated BNC connectors, the DLP-5 shunts damaging transients from the cable shield and center conductor to earth ground. Ideal for communications protection where wide baud width(to 20 mhz) is desired. The DLP-5 protects one circuit.

DLP-5

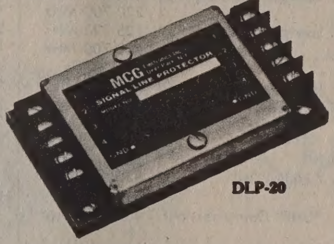
DLP-6:

Same as DLP-5 but protects 5 circuits.

Connector Options: BNC shown, twin ax, F connectors, N connectors, etc. Consult Factory.

DLP-10: MULTIPLE PROTECTION

Gives protection for 2 wires or 1 twisted pair circuit. Protection available for RS232, 20ma loops, etc.

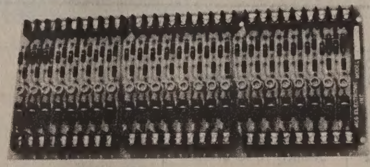


DLP-20

DLP-20: Protects 4 wires or 2 pairs.

DLP-30: Protects 8 wires or 4 pairs.

DLP-33: Open PC board, protects 24 wires or 12 pairs. Not sold with case or cover.

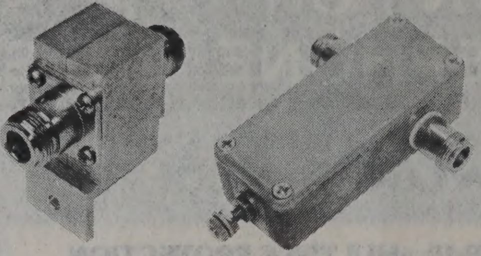


DLP-40:RACK MOUNTED PROTECTION

Independent protection for up to 20 terminals or printers per system. Plug-in protection cards for all applications: RS-232, -422, -423, 20ma loops, etc. Protects up to 100 individual lines per system. Ideal for data logging & monitoring complex instrumentation. Protects computer main frames. Interface options include terminal strips, RS-232C connectors.

MCG ELECTRONICS, INC. • 12 BURT DRIVE, DEER PARK, NEW YORK 11729 (516) 586-5125 • TELEX 645518

Nano-Fast Coax Protection from PolyPhaser Corporation



The patented PolyPhaser Impulse Suppressor Family is your best answer for protecting those vital communication links from lightning and static induced impulses.

With over 36 models of patented Impulse Suppression, PolyPhaser Corporation makes more reliable, longer lasting, faster, better VSWR, lower loss and having less throughput energy to your valuable equipment than air-gap type arrestors. Designed using the time proven controlled gas ionization discharge tube, these family members can handle tens-of-thousands of amperes time after time. They are made from quality, highly conductive aluminum with 18-8 stainless fasteners and weather-coated for marine applications.

BULKHEAD MOUNTABLE - TRANSMIT/RECEIVE

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-B50LU	Low power "UHF"	30-220 MHz 220-700 MHz	325 W 125 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50LN	Low power "N"	125-220 MHz 220-700 MHz 700-1 GHz	325 W 125 W 50 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50HU	Hi power "UHF"	30-220 MHz 220-700 MHz	500 W 250 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50HN	Hi power "N"	125-220 MHz 220-700 MHz 700-1 GHz	500 W 250 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-CT50HN	Cellular "N"	810-890 MHz	10 channels @ 70 W ea.	N**	10,000 A	≤ 10uJ	0.1	1.1 to 1
IS-UT50HN	"UHF" Combiner/out	450-512 MHz	3-375 W trans. 5-250 W trans.	N† **	10,000 A	≤ 20uJ	0.15	1.2 to 1
IS-IE50LN	Isolated Equipment	125-220 MHz 220-700 MHz	325 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.2 to 1

BULKHEAD MOUNTABLE RECEIVE ONLY

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-GF50LN	GaAs Fet	400 MHz-1 GHz	N/A	N† **	20,000 A	≤ 150 pJ	0.1	1.2 to 1
IS-GC50LN	DC Pick-off	400 MHz-1 GHz	N/A	N† **	20,000 A	≤ 150 pJ	0.2	1.2 to 1
IS-DC50LN	DC Injector	400 MHz-1 GHz	N/A	N† **	20,000 A	≤ 150 pJ	0.2	1.2 to 1

FLANGE MOUNTABLE - TRANSMIT/RECEIVE

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-50UX-C0	HF transceive	3.5-30 MHz	2 KW	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50UX-C1	Similar to IS-B50LU	30-220 MHz 220-700 MHz	325 W 125 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50NX-C1	Like IS-50UX-C1-"N"	30-220 MHz 220-700 MHz	325 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50NX-C2	Similar to IS-B50LN	220-700 MHz 700-1GHz	125 W 50 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1

DATA/VIDEO

Model	Description	Frequency	Impedance Ω	Connector	Max. Surge*	Clamp Voltage	Loss dB	VSWR
IS-50BB	HF-NEMP-R.O.	DC to 30 MHz	50	BNC	5,000 A	5.4	0.3	1.5 to 1
IS-75BB	CCTV	DC to 15 MHz	75	BNC***	5,000 A	5.4	0.3	1.2 to 1
IS-93BB	Data	DC to 10 MHz	93	BNC	5,000 A	5.4	0.3	1.5 to 1
IS-TWAX	IBM-34-36-38 Data	DC to 10 MHz	100	Twin Ax	5,000 A	2.8	0.3	1.5 to 1

POWER LINE/TV

Model	Description	Frequency	Impedance & Misc.	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-PSP	120 VAC line	50-60 Hz	3 wire (solder)	12,000 A	N/A	N/A	N/A
IS-75F-C1	Ch 2-83 TV	50-800 MHz	75Ω F58	20,000 A	≤ 600uJ	0.2	1.2 to 1
IS-300T-C2	TV Ribbon line	50-750 MHz	300Ω Screws	10,000 A	≤ 600uJ	1.0	1.5 to 1
IS-RCT	Rotor Cable 8 lines	N/A	24 VAC Max 8 Screws/lugs	2 KA ea. line 16 KA total	N/A	N/A	N/A

*Based on 8us rise/20us decay wave form; †also available in UHF; **also available in N/Male on Antenna port; ***also available in type F connector

***New products coming soon:* Field Impulse Suppressor Tester, DC Remote/Telephone Line Protector, Suppressors for 1.7 GHz - 2.3 GHz.**

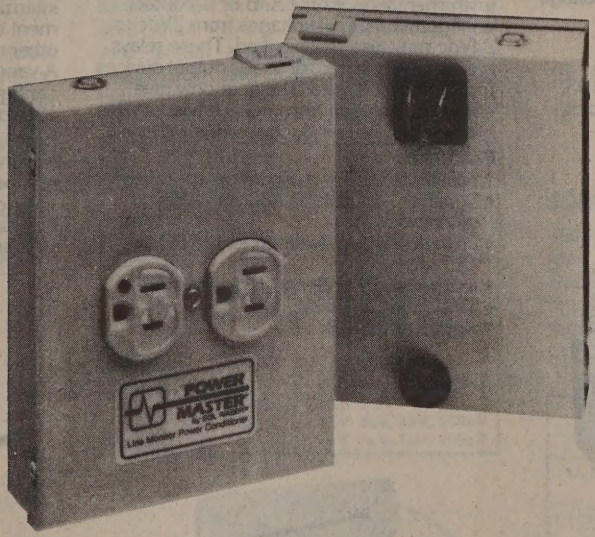
For complete information and application assistance contact:

PolyPhaser Corporation

1420 Industrial Way ● P.O. Box 1237G● Gardnerville, NV 89410
Phone: (702) 782-2511 RCA Telex: 215406 TBYT UR Attn: POLYPHASER

For More Information. Circle No. 366

AVOID EQUIPMENT FAILURE!



NEW FROM SGL WABER®

The electricity that powers your sensitive electronic testing equipment is "polluted." Filled with voltage surges and noise interference that can cause premature circuit failure and incorrect readings.

Protect your data and equipment. Purify your power with a Power Master™ Line Monitor Power Conditioner. Ready to use — just plug in. Free catalog featuring 15 models.

POWER MASTER™
by SGL WABER
Line Monitor Power Conditioner

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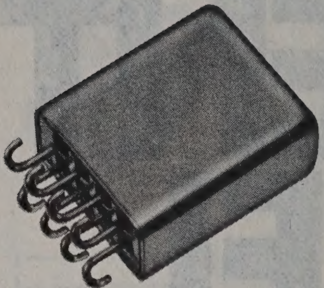
For More Information. Circle No. 367

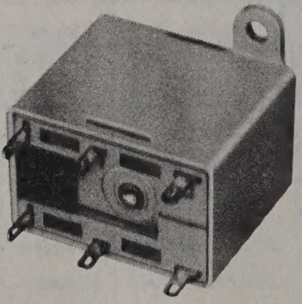
Relays and Solenoids



Series 07 – Crystal Can

Developed specifically for the aerospace industry. The standard unit features a solder terminal arrangement, 26.5Vdc coil voltage and 10 amp contacts.

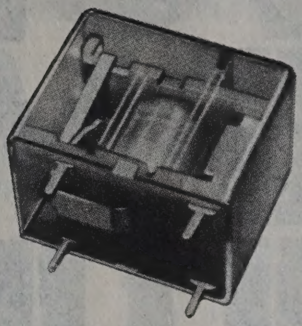
Features:
- Qualified to MIL-R-5757, M5757/23, MS 27245, MS 27247 and MIL-R-6106.
- Withstands severe vibration and shock.
- DPDT Contacts.



Series 39 – 2 Pole, 10 Amp Relay

This low-cost relay features 2 heavy-duty, 10 amp contacts available in a number of materials and configurations. Fast-on/solder combination terminals aid installation and service replacement. Ideal for home appliance where heavy work loads are common, but power to drive coils is at a premium.

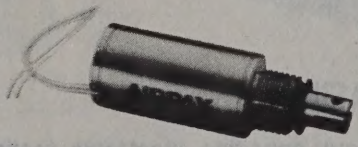
Features:
- Contact ratings available up to 15 amps.
- Can be furnished with DPNO, DPNC, DPDT.
- 470 milliwatts sensitivity.
- Available with one heavy-duty contact and one signal contact for economy.
- Approval: ЯU Ⓢ



Series 27 – Miniature General Purpose Relay

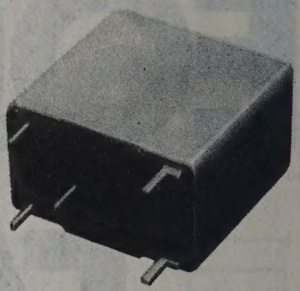
This small relay is well suited for appliance controls, remote TV tuning, automotive controls, office equipment and many types of instrumentation. Form A, B or C contact configurations. Coil voltages from 3Vdc to 24Vdc may also be specified. These relays are especially suited for use as output devices for microprocessors. They not only give complete isolation from noisy environments but can handle hi-inductive loads with ease.

Features:
- Small size – .526 cubic inches.
- Sensitive – as little as 180 milliwatts coil power.
- Powerful – can switch up to 1/3 HP at 125Vac.
- Inexpensive – under $1 typically.
- TV 5 rating available.
- Approval: ЯU Ⓢ



7019 Solenoid

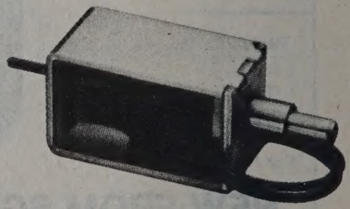
This direct Current Tubular Pull Type Solenoid is designed to provide up to 50 ozs. of force with a maximum stroke of .437".
Actual usable force will depend on the stoke and power level. Coils are available from 6Vdc to 115Vdc with a continuous duty power level of 5 watts and an intermittent (25%) duty power of 15 watts.



Series 28 – Sensitive Control Relay

Applications of this relay include automotive control functions (electronic fuel injection, intermittent windshield wiper, etc.), entertainment equipment – remote TV tuning – and other communication switching functions. A variety of D.C. coil voltages and contact configurations are available. Ratings up to 15 amp, 120Vac may also be specified.

Features:
- High amperage ratings in small package.
- Super sensitivity – 44 milliwatts coil power.
- Variety of contact materials.
- TV 5 rating available.
- Approval: ЯU Ⓢ



7007ED33-0013 D.C. Box-Frame Push-Type Solenoid

Provides up to 20 ozs. of force with a maximum stroke of .200". Actual usable force will depend on the stroke and power level. Coils are available from 6 to 115Vdc with a continuous duty power level of 3.0 watts and an intermittent (25%) duty power level of 9.0 watts.

AIRPAX®
We give you control.

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Frederick Division
Husky Park,
Frederick, MD 21701
301-663-5141

For More Information. Circle No. 368

COTO CORPORATION REED RELAYS

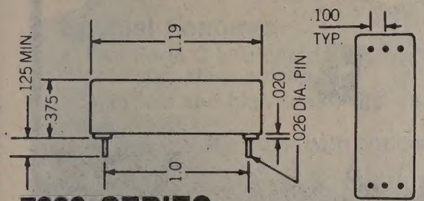
HIGH VOLTAGE, MERCURY-WETTED, LONG-LIFE
MINIATURE, ULTRA-LOW THERMAL EMF AND DIP

ONE BILLION LIFETIMES!

COTO reed relays have been life tested up to 1,000,000 operations. This assures you of complete product integrity in your most critical designs.

Each and every COTO reed relay is triple-tested in all operating parameters prior to shipment. You can depend absolutely on COTO quality and reliability.

COTO offers a wide variety of reed relays to meet every requirement.

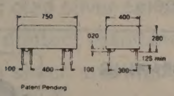


7000 SERIES

7000—Miniature series available in three types: Dry Standard (7100); Mercury Wetted (7200) and High Voltage (7300). Encapsulated in a magnetically shielding steel shell, epoxy coated. 5, 12 or 24 VDC.

Dry Std.	HG Wet	High Volt	Contact Form	Package Width
7101	7201	7301	1A	.410
7102	7202	7302	2A	.500
7103	7203	7303	3A	.660
7104	7204	7304	4A	.760
7121			1B*	.500
7122			2B*	.660
7141			1C	.410
7142			2C	.660
7143			3C	.760
7150			1AL*	.500
7160			1A/1B†	.760

* Polarized. † Make before break not guaranteed.



2600 SERIES

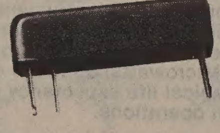
2600 — Highly reliable DIP reed relays designed for versatility. Offered in a wide variety of contact types and coil resistances. Excellent for new designs or to retro-fit lesser quality molded DIP relays. Diode coil suppression available.

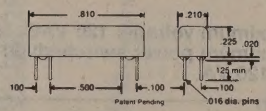
Model #	Contact Form	Switch Volt	Switch Current	E.S. Shield
2604	1A	200	0.5A	YES
2610	1C	100	0.2A	NO
2611	1C	100	0.25A	YES
2631	1A Hi-V	250	0.5A	NO
2653	2A	100	0.5A	YES

3200/3400 SERIES

3200/3400 — Low and ultra-low thermal EMF series. Feature 500 nanovolt thermals and 50 nanovolt stability. Fully encapsulated in magnetically shielding steel shell. For scanning low level analog and digital signals, multiplexing, data acquisition and automatic test equipment.

Model #	Contact Form	Thermal EMF Options (Max)
3201	1A	3μV, 1μV, 500nV
3202	2A	5μV, 3μV, 1μV, 500nV
3203	3A	5μV, 3μV, 1μV
3204	1B	5μV, 3μV, 1μV, 500nV
3205	2B	5μV, 3μV, 1μV
3206	1A/1B	5μV, 3μV, 1μV
3207	1A Latch	1μV, 200nV
3250	3A	5μV, 3μV, 1μV, 500nV
3221	1A Hi-V	5μV, 3μV
3222	2A Hi-V	5μV, 3μV
3402	2A	5μV, 3μV, 1μV, 500nV
3432	2A HG	10μV, 5 μV
3450	3A	5μV, 3μV, 1μV, 500nV
3460	3A	5μV, 3μV, 1μV, 500nV

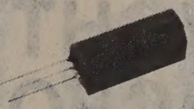


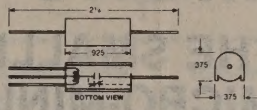


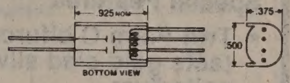
2200/2900 SERIES

2200/2900 — Microminiature reed relays for maximum versatility and dependability. Encapsulated in epoxy coated magnetically-shielding steel shell. Ideal for switching high-frequency signals. Greater than 10^{12} ohms insulation resistance available.

Model #	Contact Form	Switch Volt	Switch Current	Carry Current
2204	1A Dry	200	0.5A	1.0A
2211	1C Dry	100	0.25A	0.5A
2231	1A Hi-V	200	0.5A	1.0A
2902	1A Dry	200	0.5A	1.5A
2904	1A Dry	200	0.5A	1.5A
2911	1C Dry	150	0.25A	1.0A
2920	1A HG	500	1.0A	2.0A







4000/4200 SERIES

4000/4200 — Totally encased and sealed reed relays. Manufactured to the highest standards and 100% tested prior to shipment. Available in a wide variety of contact types and terminal configurations. Optional electrostatic or magnetic shield.

Relay Contact Type		Model #	Switch Volt DC Max	Switch Current Max Res
4000	4200			
1A Std	2A Std	4003* 4203*	200	0.5
1A Hi-Rel	2A Hi-Rel	4004* 4204*	200	0.5
1A Hi-Pwr		4005	150	1.0
1C Std	2C Std	4011 4211	150	0.25
1A HG		4020	500	2.0
1A Hi-V Low Cost	Low Cost 2A Hi-V	4030 4230	300	0.5
1A Hi-V Std	Std 2A Hi-V	4031* 4231*	500	0.5
1B Std		4240	200	0.5

* Recognized under the component program of Underwriters' Laboratory.

WRITE FOR OUR COMPLETE CATALOG #CC-83E

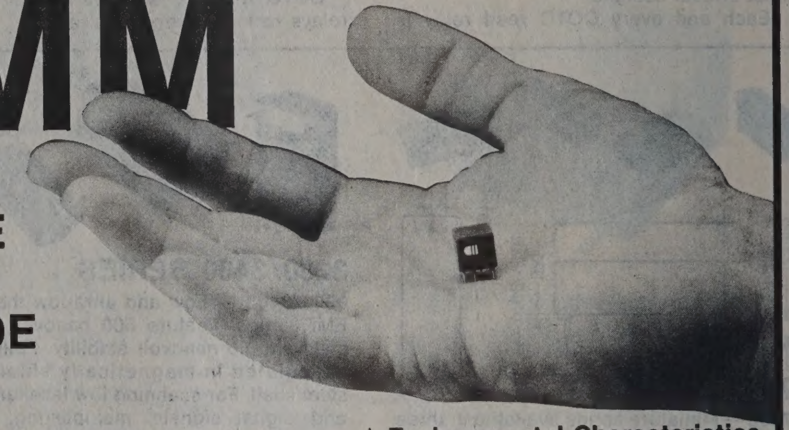
Contact nearest sales office listed in the Manufacturers' Directory.

COTO CORPORATION, 55 DUPONT DR., PROVIDENCE, RI 02907 • (401) 943-2686 • TWX: 710-381-8016

HIGH PERFORMANCE RELAYS from COMMUNICATIONS INSTRUMENTS, INC.

MIGHTY MICRO MM

THE SMALLEST MICRO-MINIATURE HIGH RELIABILITY INDUSTRIAL GRADE RELAY



Special Features

- Two Form C bifurcated contacts gold clad silver-palladium.
- Rated for low level to 2.0 amp switching.
- Requires only .155 square inch circuit board space, thus permitting a mounting density of more than six relays per square inch.
- Long Life - Mechanical life expectancy more than 100 million operations.
- High shock/high vibration resistance.
- Footprint compatible with .1 inch (2.54 mm) grid arrangement.
- Total volume less than a cubic centimeter.
- Fast operate and release time.
- Low contact resistance.

Electrical Characteristics

Contact Arrangement
CII Type MM relays are suitable for RF switching. The choice of contact materials and careful design assures consistently low contact resistance of 50 milliohms max.

Enclosure
All Communications Instruments type MM relays are epoxy sealed thus permitting automatic printed circuit board processing.

Flammability Rating
All plastic materials used in the construction of Communications Instruments type MM conform to UL 94-VO.

Contact Rating & Life Expectancy

Communications Instruments type MM relay is designed for long life, high reliability switching from low level (Microwatts) up to 2.0 amps. Mechanical life expectancy is 100 million operations.

Maximum voltage: 120 VAC, 150 VDC. Maximum power switched: 60 watts or 120 VA.

Environmental Characteristics

Ambient Temperature Rating
−35° to +70°C.

Vibration Resistance
Functional:
MML 20Gs 10 to 2000 Hz
MMS 15Gs 10 to 2000 Hz
Destructive: 50G, both types

Shock Resistance
Functional:
MML 100G 6 mS Half Sine
MMS 50G 6 mS Half Sine
Destructive: 150G, both types

Operate & Release Time
When tested at nominal rated voltage, the maximum operate time is 3 milliseconds and the maximum release time is 1.5 milliseconds.

Insulation Resistance
Insulation resistance at 500 VDC exceeds 1000 megohms.

Dielectric Withstanding Voltage
All mutually insulated points - 500 VAC - 1 minute.

Contact Bounce
Typical contact bounce characteristics are 0.5 mS on operate and 3.0 mS on release.

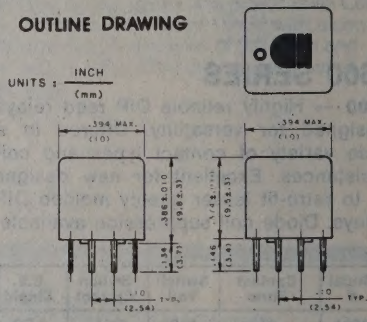
Standard Sensitivity, 2 Form C

Part Number	Nominal Voltage (DC)	Coil Resistance Ohms ± 10%	Pickup Voltage (Max)	Dropout Voltage (Min)
MML203	3	20	2.2	0.3
MML205	5	55	3.7	0.5
MML206	6	80	4.2	0.6
MML209	9	180	6.7	0.9
MML212	12	320	9.0	1.2
MML224	24	1280	18.0	2.4

High Sensitivity, 2 Form C

Part Number	Nominal Voltage (DC)	Coil Resistance Ohms ± 10%	Pickup Voltage (Max)	Dropout Voltage (Min)
MMS203	3	45	2.2	0.3
MMS205	5	125	3.7	0.5
MMS206	6	180	4.2	0.6
MMS209	9	405	6.7	0.9
MMS212	12	720	9.0	1.2
MMS224	24	1920	18.0	2.4

OUTLINE DRAWING



Communications Instruments, Inc.™

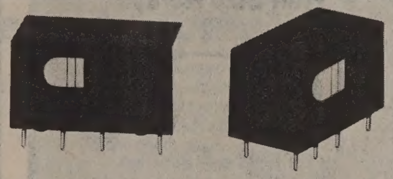
P.O. Box 520 • Fairview, North Carolina 28730
704/628-1711 • TELEX 577436
Contact Lee Holt for samples and information.

For More Information. Circle No. 370

# HIGH PERFORMANCE RELAYS
from
COMMUNICATIONS INSTRUMENTS, INC.

MINIATURE SEALED DUAL IN-LINE RELAY

MD



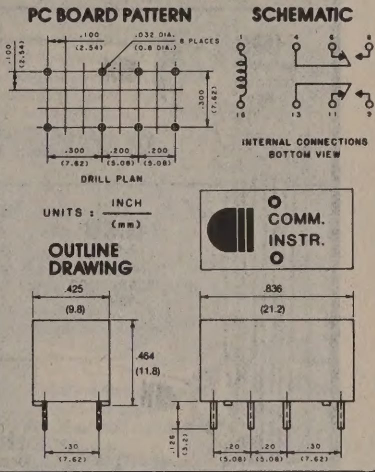
Special Features

- Two Form C bifurcated contacts – gold clad silver-palladium.
- Standard and high sensitivity models.
- Completely sealed or with optional dust cover.
- Contact rating from low level to 2.0 amps switching – 3.0 amps carry.
- Super clean construction – inert gas filled.
- Designed for low contact resistance and contact resistance stability during life.
- UL recognized component.
- Maximum voltage: 125 VAC, 150 VDC. Maximum power switched: 60 watts or 120 VA.
- Surge resistance – Type MD relay conforms to FCC Part 68-1500 V Peak.

Part Number	Coil Resistance Ohms ± 10%
MDL05H	45
MDL06H	66
MDL09H	140
MDL12H	280
MDL24H	1070
MDL48H	4000

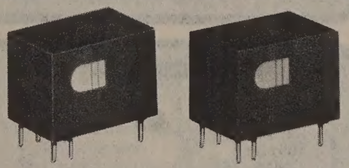
High Sensitivity, 2 Form C

Part Number	Coil Resistance Ohms ± 10%
MDS05H	164
MDS06H	240
MDS09H	540
MDS12H	960
MDS24H	2880
MDS48H	7680


PC BOARD PATTERN
SCHEMATIC
.100 (2.54)
.032 DIA. (0.8 DIA.) 8 PLACES
.300 (7.62)
.200 (5.08)
.200 (5.08)
DRILL PLAN
INTERNAL CONNECTIONS BOTTOM VIEW
UNITS : INCH (mm)
COMM. INSTR.
OUTLINE DRAWING
.425 (9.8)
.464 (11.8)
.836 (21.2)
.30 (7.62)
.125 (3.2)
.20 (5.08)
.20 (5.08)
.30 (7.62)

SEALED SINGLE POLE DUAL IN-LINE RELAY

MS



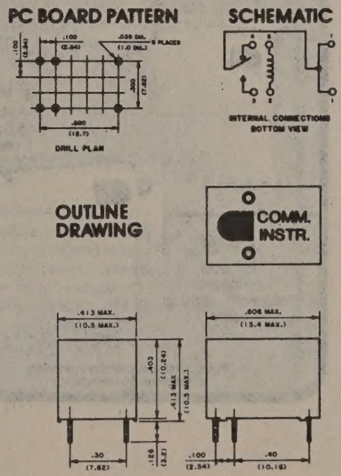
Special Features

- High reliability switching at low cost.
- Standard and high sensitivity models.
- Gold clad silver-palladium contacts.
- Low contact resistance.
- High shock and high vibration resistance.
- Super clean construction – inert gas filled.
- Low level to 2.0 amps contact switching – 3.0 amps carry.
- UL recognized component.
- Maximum voltage: 120 VAC, 100 VDC. Maximum power switched: 60 watts or 120 VA.

Part Number	Nominal Voltage (DC)	Coil Resistance Ohms ± 10%
MSL03	3	20
MSL05	5	56
MSL06	6	80
MSL09	9	180
MSL12	12	320
MSL24	24	1280
MSL48	48	5120

High Sensitivity, 1 Form C

Part Number	Nominal Voltage (DC)	Coil Resistance Ohms ± 10%
MSS03	3	45
MSS05	5	120
MSS06	6	180
MSS09	9	400
MSS12	12	700
MSS24	24	2800


PC BOARD PATTERN
SCHEMATIC
.100 (2.54)
.030 DIA. (1.0 DIA.) 6 PLACES
.300 (7.62)
.500 (12.7)
DRILL PLAN
INTERNAL CONNECTIONS BOTTOM VIEW
OUTLINE DRAWING
COMM. INSTR.
.413 MAX. (10.5 MAX.)
.606 MAX. (15.4 MAX.)
.403 (10.24)
.413 MAX. (10.5 MAX.)
.30 (7.62)
.126 (3.2)
.100 (2.54)
.40 (10.16)

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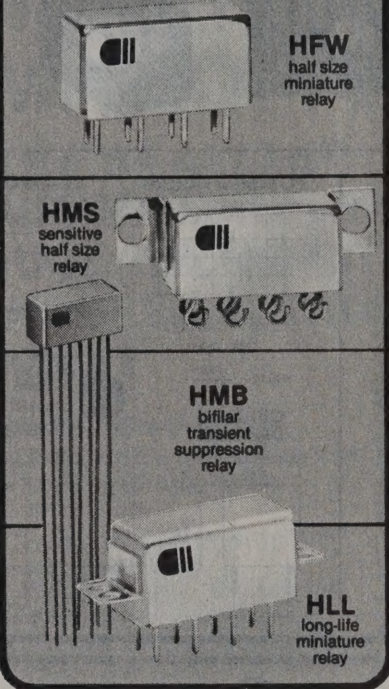
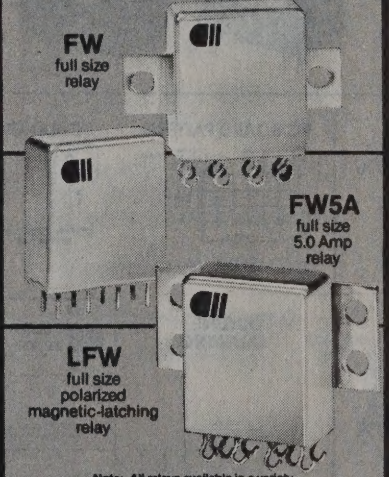
HIGH PERFORMANCE RELAYS from COMMUNICATIONS INSTRUMENTS, INC.

Half Size Relays



Contact Data	Coil Voltage	Features
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 4.0 Amps	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating −65°C to +125°C • Qualified to MIL-R-39016/6 level L, M & P *(Request Data Sheet HFW-81)*
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 2.0 Amps	5 to 36.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Energy-saving 100/125 milliwatt sensitivity • Excellent RF switching • Ambient temp rating −65°C to +125°C • Qualified to MIL-R-39016/44 level L, M & P *(Request Data Sheet HMS-83)*
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 3.0 Amps	6 to 32.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Bifilar transient suppression • Excellent RF switching • Ambient temp rating −65°C to +125°C • Qualified to MIL-R-39016/22 level L, M & P *(Request Data Sheet HMB-83)*
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 2.0 Amps	6 to 26.5 VDC Life: 100 million operations at low level	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating −65°C to +125°C • Shock and vibration resistant *(Request Data Sheet HLL-83)*

Full Size Relays



Note: All relays available in a variety of terminals and mountings.

Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 3.0 Amps	6.3 to 110 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating −65°C to +125°C • Qualified to MIL-R-5757/10 *(Request Data Sheet FW-81)*
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 5.0 Amps	6.3 to 110 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • 5.0 Amp version of FW • Excellent RF switching • Ambient temp rating −65°C to +125°C • Designed to MIL-R-5757 *(Request Data Sheet FW5A-81)*
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 3.0 Amps	3.2 to 110 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • One and two coil operation • Excellent RF switching • Ambient temp rating −65°C to +125°C • Designed to MIL-R-5757/53 *(Request Data Sheet LFW-81)*

Communications Instruments, Inc.™

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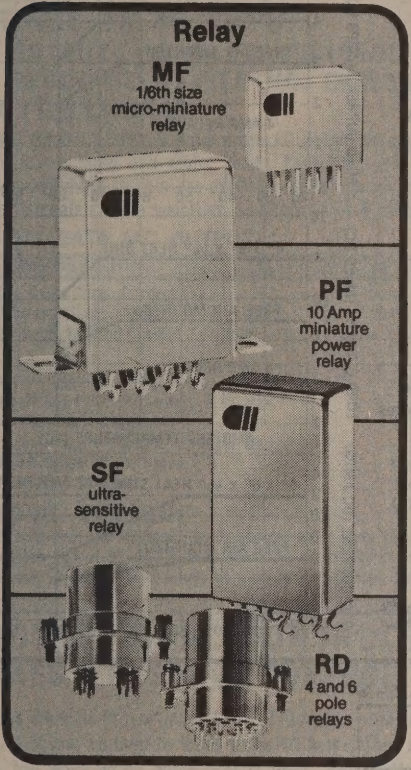
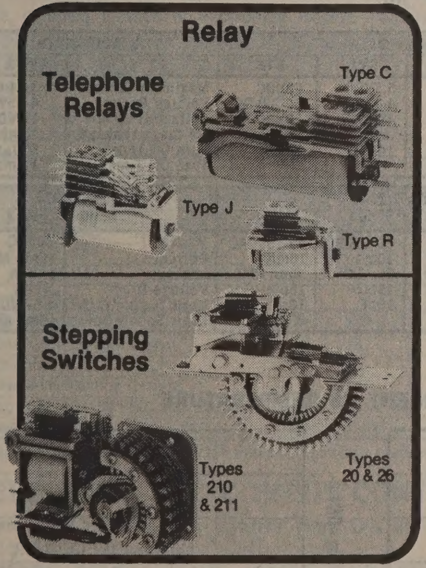
For samples and information
on our products, contact:
DAVE ARROWOOD
Product Manager for Crystal Can Relays

For More Information. Circle No. 370

HIGH PERFORMANCE RELAYS from COMMUNICATIONS INSTRUMENTS, INC.



Contact Data	Coil Voltage	Features
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 1.0 Amp	3.4 to 53.0 VDC	• Hermetically sealed enclosures • Low contact resistance • Total volume only .046 cubic inch • Excellent RF switching • Ambient temp rating −65°C to +125°C • Designed to MIL-R-39016/34 *(Request Data Sheet MF-81)*
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 10.0 Amps	6.3 to 110 VDC	• Welded, hermetically sealed enclosures • Very low contact resistance • Package volume .72 cubic inch • Excellent RF switching • Ambient temp rating −65°C to +125°C • Designed to MIL-R-5757/23 & 28 *(Request Data Sheet PF-83)*
Contact Arrangements: 1 Form C, 2 Form C, 2 Form B, 2 Form A. Contact rating: low level to 3.0 Amps	1.8 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • 40 milliwatt sensitivity • Excellent RF switching • Ambient temp rating −65°C to +125°C • Designed to MIL-R-5757/13 *(Request Data Sheet SF-81)*
Contact Arrangements: 4 Form C 6 Form C Contact rating: low level to 2.0 Amps	18.0 to 36.0 VDC	• Hermetically sealed enclosures • Low contact resistance • Optional all-welded construction • 100 G shock • Ambient temp rating −65°C to +125°C • Qualified to MIL-R-5757/1 & 7 *(Request Data Sheet RD-83)*
Contact Arrangements: Long frame: up to 8 Form C Med. frame: up to 8 Form C Short frame: up to 4 Form C Contact rating: low level to 10.0 Amps	6 to 250 VDC	• Optional hermetic sealing • Ac or dc operation • Fast operate and fast release • Variety of accessories • Ambient temp rating −55°C to +85°C • Custom designs available *(Request Catalog 502)*
Point variations: 10 to 52 point operation Contact rating: 0.1 Amp at 115 VAC or 30 VDC resistive Carry: 3.0 Amps	6 to 110 VDC	• Optional sealing • Insulation resistance 10^9 Ω at 500 VDC • Fast operate and release times • Variety of switch mounting accessories • Operating temperature −0°C to +85°C • Custom designed models available *(Request Catalog 601)*



Communications Instruments, Inc.™

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For samples and information on our products, contact:
DAVE ARROWOOD: Product Manager for Crystal Can Relays
BOB MILLER: Product Manager for Telephone Relays
and Stepping Switches

DOUGLAS RANDALL SOLID STATE COMPONENTS

Division of Kidde, Inc
KIDDE
6 PAWCATUCK AVENUE / PAWCATUCK, CONNECTICUT 02891 / (203) 599-2075 / TELEX 966427 CABLE DORANIC

SOLID STATE RELAYS SERIES K
DC OUTPUT / DC CONTROL SIGNAL

Douglas Randall Series K are SPST (NO) or (NC) relays which will switch loads of 4, 8 or 12 Amps @ 2-32VDC or 2-55VDC. They provide rapid switching and opto-isolation between input and output. The sensitive inputs are compatible with DTL or TTL logic. Arc free switching makes these relays suitable for hazardous atmospheres.

MODEL NUMBERS

Output Voltage*	Current	Model†
2-32VDC	4 Amp	K04A
	8 Amp	K08A
	12 Amp	K12A
2-55VDC	4 Amp	K04B
	8 Amp	K08B
	12 Amp	K12B

*Inductive loads must be diode suppressed.
† Normally closed add — (NC) K04A-NC.

INPUT SIGNAL DATA

Range	3-32VDC
Must Operate	3VDC
Must Release	1VDC
Input Impedance	1000Ω Min.
Isolation	
Signal to Load	1500V
Signal to Base	1500V
Temperature	−30°C to +80°C

OUTPUT DATA

Continuous Current	4A, 8A, or 12A
DC Line Voltage	2-32VDC or 2-55VDC
Off State Leakage	2mA DC
Turn On Time	50 Micro Sec.
Turn Off Time	500 Micro Sec.
Voltage Drop @ Rate Current	1.5VDC Max.
Isolation Load to Base	1500V

SIZE:
2¼L x 1¾W x 1⅛H Max.

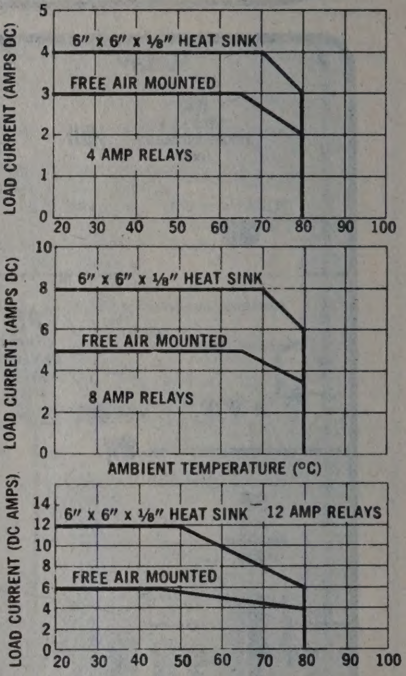
WEIGHT:
4 Ounces Max.

TERMINATION:
Standard Models —
Control Signal:
6-32 Screws
Output:
8-32 Screws

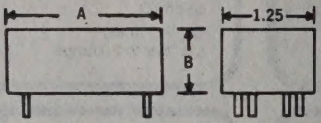
Special Models can be provided with lead wires or other types of termination in OEM quantities.

NEW MODEL K06D
Switches 6A @ 250 VDC

LOAD CURRENT VS TEMPERATURE



SOLID STATE RELAYS — SERIES CV
PC MOUNTED —



INPUT DATA			OUTPUT DATA	
	CV1	CV2		CV1 & CV2
Nominal Voltage	5.5VDC	28VDC	Current	3A RMS
Voltage Range	4-10VDC	10-32VDC	Surge Current	80A Peak
Must Operate	4VDC	10VDC	Minimum Current	50mA
Must Release	.4VDC	.4VDC	Off State Leakage	8mA
Impedance	1000Ω	4000Ω	Voltage	24 to 240VAC
Isolation (Input to Output)	1500V	1500V		@ 47 to 63 Hz
Capacitance	15pF	15pF	Voltage Drop	2.0VAC
			Offstate dv/dt	100V/μsec.
			Turn On Time	8.3msec.
			Turn Off Time	16 msec.

INPUT DATA			OUTPUT DATA	
	CV3	CV6		CV3 & CV6
Nominal Voltage	5.5VDC	28VDC	Maximum Current	3A DC
Voltage Range	4-10VDC	10-32VDC	Voltage Range	4-55VDC
Must Operate	4VDC	10VDC	Voltage Drop	1.6VDC
Must Release	.4VDC	.4VDC	Off State Leakage	.10mA DC
Impedance	1000Ω	4000Ω	Turn On Time	500μsec.
			Turn Off Time	1.5msec.

INPUT DATA			OUTPUT DATA	
	CV4	CV5		CV4 & CV5
Voltage Range	10-55VDC	90-130VAC	Voltage	30VDC
Current	10mA	10mA	Current	16mA Max.
Must Not Operate	3mADC	.8mA RMS	Leakage	100μA
Isolation	1500V	1500V	Voltage Drop	.4VDC
Capacitance	10pF	10pF	Logic Supply Volt.	4-5-6VDC
Impedance	—	40KΩ	Logic Supply Cur.	10mA @ 6VDC

MODELS CV-1 & CV-2

CSA CERTIFIED

3 Amp output @ 120/240 VAC
Zero crossover, Opto-isolation
Dim. A — 2.00″ Max, B — .650″ Max.

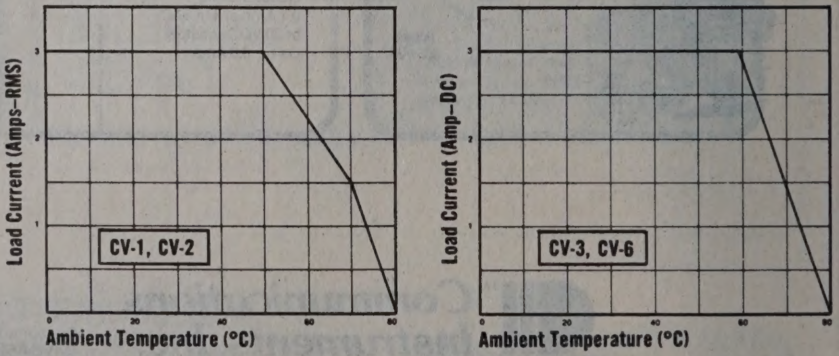
MODELS CV-3 & CV-6

3 Amp output @ 4 to 55 Volts DC
Opto-isolation
Dim. A — 2.00″, B — .75″

MODELS CV-4 & CV-5

Convert 10-55 VDC (CV-4)
Convert 90-130 VAC (CV-5)
to Logic Level outputs
Opto-isolation
Dim. A — 1.25″, B — .50″

LOAD CURRENT VS TEMPERATURE



AC Output CV-1 & CV-2 U/L Recognized, File E60556, C.C.NMFT2
CSA File LR34149

DOUGLAS RANDALL SOLID STATE COMPONENTS

Division of Kidde, Inc.
KIDDE

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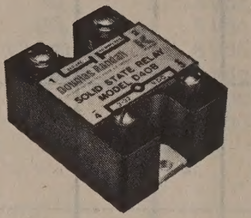
SOLID STATE RELAYS
RATINGS TO 40 AMPS
AC OUTPUT / DC OR AC CONTROL
UL RECOGNIZED / FILE NO. E60556 / CSA FILE LR34149



Douglas Randall's line of solid state AC output relays are UL recognized for resistive, lamp and motor loads. Featuring opto-isolation and zero-voltage switching models are available to handle up to 40 Amp. DC or AC control signals can be specified and Form A or B output.

OUTPUT DATA (AC OUTPUT)

Maximum Current	4A	8A	12A	25A	40A
One Cycle Surge Current	75A	100A	150A	250A	400A
Overload (1 sec., RMS)	20A	30A	50A	40A	75A
Minimum Holding Current	50mA Typ.	50mA Typ.	50mA Typ.	50mA Typ.	50mA Typ.

AC Line Voltage: 90/140V or 200/280V[1] @ 47-63 Hz
Voltage Drop @ Rated Current: 1.6V Max.
Typical Turn-on Voltage: 5V
Response Time (DC Signal): ½ Cycle Max.
dv/dt[6] Off State: 100V/µsec.
Commutating: 5V/µsec.

Off State Leakage Current:
90/140VAC — 4.5mA Typ.
200/280VAC — 5.5mA Typ.
400/480VAC — 1.5mA Typ.
Isolation Output to Base: 1500V, $10^{10}\Omega$ DC[3]
Contact Form: SPST (NO)[4]
SPST (NC) Optional

SPECIAL DESIGNS

Douglas Randall has designed many special solid state relays, such as a polarized, latching, SPDT unit which will switch 12A at 28VDC. We also have the capability of making special package sizes and terminal arrangements for our solid state relays at moderate tool cost. Your inquiries will be reviewed promptly.

INPUT SIGNAL DATA (AC OR DC)

	DC	AC
Range	3-32V[5]	90-240VAC (80-140VDC)
Must Operate	3VDC	90VAC (80VDC)
Must Release	1VDC	10VAC (10VDC)
Input Impedance	1000Ω Min., 40KΩ Min.	
Isolation		
Signal to Load	1500V, $10^{10}\Omega$ DC	
Signal to Base	1500V, $10^{10}\Omega$ DC	
Capacitance	15 pF Signal to Load	
Temperature Range	−30°C to +80°C	

MODEL NUMBERS (NOTE 4)

Output Rating	Current	DC Signal	AC Signal
90-140VAC	4A	D04A	A04A
	8A	D08A	A08A
	12A	D12A	A12A
	25A	D25A	A25A
	40A	D40A	A40A
200-280VAC	4A	D04B	A04B
	8A	D08B	A08B
	12A	D12B	A12B
	25A	D25B	A25B
	40A	D40B	A40B
400-480VAC*	12A	D12D	A12D

* Not U/L Recognized
No Internal Snubber

PROPORTIONAL CONTROLS
SERIES R RESISTOR CONTROL*

NEW 40 Amp Controls

Douglas Randall

Douglas Randall Proportional Control Modules provide a variable AC output voltage to loads up to 40 Amps. They are solid state, full wave phase angle control units, which offer a reliable, compact method of controlling motors, heaters, incandescent lamps, and other AC devices. STANDARD MODELS VARY THE OUTPUT FROM 0% TO 99%.

INPUT*
Variable Resistor (150,000Ω, 1 watt) — For 120VAC
Variable Resistor (1 Megohm, ½ watt) — For 240VAC, 277VAC or 480VAC

Output Voltage		CURRENT 5A	10A	15A	25A	40A
90-130 VAC	Models	R05A	R10A	R15A	R25A	R40A
200-240 VAC	Models	R05B	R10B	R15B	R25B	R40B
250-300 VAC	Models	R05C	R10C	R15C	R25C	R40C
400-480 VAC	Models*	R05D	R10D	R15D	R25D	R40D

OUTPUT DATA

Maximum Current	5A	10A	15A	25A	40A
One Cycle Surge Current	75A	100A	150A	225A	400A
Overload (1 Sec., RMS)	20A	30A	50A	70A	150A
Minimum Holding Current	.05A	.05A	.07A	.08A	.09A
AC Line: 90/130 VAC, 200/240 VAC, 250/300 VAC or 400/480 VAC					
Typical Leakage: 90/130 VAC — 10 mA; 200-240 VAC — 7 mA; 250-300 VAC — 6 mA; 400-480 VAC — 3 mA*					

* Models R05D, R10D, R15D, R25D and R40D have no snubbers.

SERIES RD / LOGIC INPUT CONTROL

Series RD provide full control from 0% to 99% when energized by 0-10 VDC or 0-15m ADC signals.

MODEL RD04A AND MODEL RD04B

INPUT SIGNAL	0-10 VDC or 0-15 ma DC(2)	
OUTPUT DATA	**RD04A**	**RD04B**
Maximum Current	4A	4A
One Cycle Surge Current	100A	100A
One Second Overload Current	40A	40A
Minimum Holding Current	.05A	.05A
AC Line Voltage	90-130 VAC @ 47-63 Hz	200-240 VAC
Off State Leakage	.01A (typical)	.01A (typical)
Response Time	150 m sec @ 10 VDC (typical)	300 m sec @ 10 VDC
Isolation (Input to Output)	500 VRMS	500 VRMS

Notes: 1. All data is measured at 25°C.
2. The input is not polarity sensitive, but must be protected against voltages above 10 VDC.

INPUT MODULES RDA, RDB & RDD

These modules accept 0-10 VDC signals. Their output is connected to the input terminals of Series R – Resistor Modules, which in turn controls loads up to 40Amp @ 480 VAC. See Fig. 1

PERCENT OUTPUT VOLTAGE VS INPUT VOLTAGE

Models RDA, RDB, RDD, RD04A, RD04B

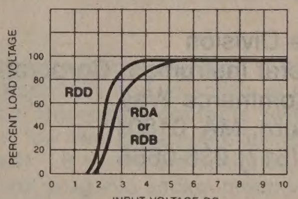


Fig. 1

NOMINAL PERCENTAGE OUTPUT VS INPUT RESISTANCE @ 25° C

Models R05 to R40A

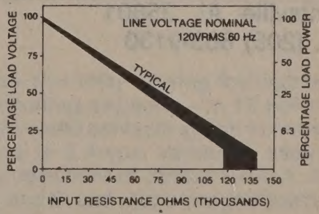


Fig. 2

Models R05 to R40B, R05 to R40D

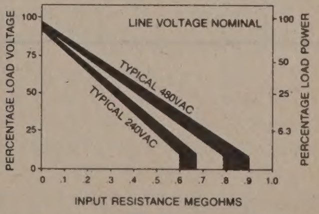


Fig. 3

For More Information. Circle No. 371

CLARE Dry Reed Relays

GENERAL INSTRUMENT

RELAY TYPE	TERMINAL TYPE/GRID	CONTACT FORMS AVAILABLE	NOMINAL VOLTAGE	DESCRIPTION
GI Clare DSS31A05 **DSS3**	.7 x .10	1A	5 Vdc 12 Vdc 24 Vdc	Low profile, fully sealed with an insulated metal cover for electromagnetic shielding. RF shield and electrostatic shield options. Low dielectric absorption. Life at low to signal loads: 250 million operations minimum.
DSS4 GI Clare DSS41A05 **DSS4**	SIP, .2 x .2 x .2	1A	5 Vdc 12 Vdc 15 Vdc 24 Vdc	Molded, single in-line. Diode option. High isolation input to output. Life at low to signal loads: 250 million operations.
No Photo. Available **CUP (1), CUP (V)**	Staggered	1A–5A 1B 2B 1AB 1A1B 2AB 1A Latch 2A Latch	5 Vdc 6 Vdc 12 Vdc 24 Vdc 48 Vdc	Open, plastic and metal cover types available. Fully sealed versions available upon request. Staggered pin-out. Life at low to signal loads: 100 million operations. CUP (V) version offers 2000 VRMS Breakdown contact to coil and has British standards approvals.
No Photo. Available **MRBS**	1 x .10	1A	4 Vdc 5 Vdc 12 Vdc	Can be driven directly from CMOS circuits. A line loop version which allows a permanent and direct loop-control without the need of being disconnected from the circuit is also available. Life at low to signal loads: 20 million operations.

Sales Office Listing

United States

Clare Division
General Instrument Corporation
36 Commerce Way
Woburn, MA 01801
Tel. (617) 938-0666

Clare Division
General Instrument Corporation
3322 S. Memorial Pkwy.
Huntsville, AL 35801
Tel. (205) 883-9130

Clare Division
General Instrument Corporation
2355 S. Arlington Heights Rd.
Arlington Heights, IL 60005
Tel. (312) 981-0630

Clare Division
General Instrument Corporation
1944 W. North Lane
Phoenix, AZ 85021
Tel. (602) 997-7448

GENERAL INSTRUMENT

Clare Division
General Instrument Corporation
3101 W. Pratt Ave.
Chicago, IL 60645
1-312-262-7700
TELEX: 25-3775

We Help You Compete®

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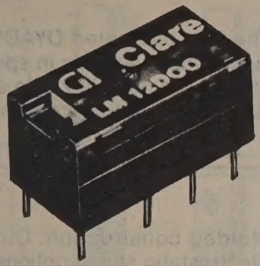
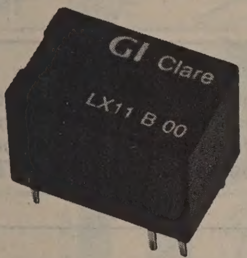
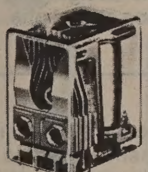
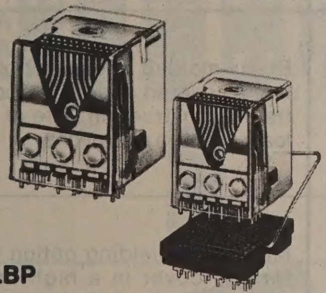
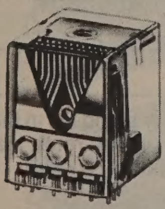
CLARE Electromechanical Relays

GENERAL INSTRUMENT

RELAY TYPE	TERMINAL TYPE/GRID	CONTACT FORMS AVAILABLE	NOMINAL VOLTAGE	DESCRIPTION
 **LM**	Dual-in-line Package (DIP)	1C 2C 1C Latch 2C Latch	3 Vdc 5 Vdc 6 Vdc 12 Vdc 24 Vdc 48 Vdc	Miniature dual-in-line package. Epoxy sealed. Bifurcated contacts for more reliable switching 1 and 2 coil latching versions available. Life at low to signal level loads: 10 million operations.
 **LX**	Dual-in-line Package (DIP)	1 Form C	3 Vdc 5 Vdc 6 Vdc 12 Vdc 24 Vdc	Subminiature "sugar cube" relay. Epoxy sealed. Contact rating: 1 Amp. Life at full rated load: 100,000 operations.
 **LA**	.100 in-Line	4 Form C	6 Vdc 12 Vdc 24 Vdc 30 Vdc 48 Vdc	Low-cost miniature relays offer high switching capacity and versatility for their size. Bifurcated contacts switch from low level to 2 ampere full rated loads. Life at rated load: 100 thousand operations.
 **LB, LBP**	.100 in-Line	6 Form C	6 Vdc 12 Vdc 15 Vdc 18 Vdc 24 Vdc 30 Vdc 36 Vdc 48 Vdc	Miniature relays offer high switching capacity and versatility at low cost. Bifurcated contacts switch from low level to 2 ampere full rated loads. LB series are designed for direct plug into socket mounting. Life at rated load: 100 thousand operations.
 **LC**	.10 in-Line	12A 6A6C 6B6C 6A6D 6B6D 6A4C2D	As Required	Low-cost relay offering the highest switching capacity—to 12 poles. Bifurcated contacts switch from low level to 2 Amps. Versatility allows combinations of contact forms A, B, C, and D. Life at low to signal loads: 10 million operations.

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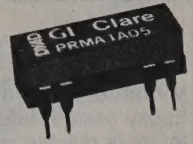
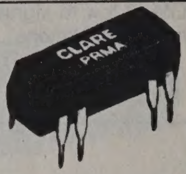
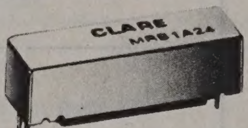
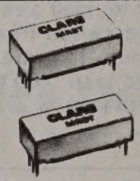
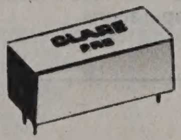
CLARE Dry Reed Relays

GENERAL INSTRUMENT

RELAY TYPE	TERMINAL TYPE/GRID	CONTACT FORMS AVAILABLE	NOMINAL VOLTAGE	DESCRIPTION
 **DYAD PRMA**	.300 x .100 Dual-in-line Package (DIP)	Form A (1 & 2) Form B (1 only)	5 Vdc 12 Vdc 24Vdc	The new bifurcated DYAD® series yields improvements in speed and contact life reliability. Life at signal load: 250 million operations.
 **PRMA**	.300 x .100 Dual-in-line Package (DIP)	Form A (1 & 2) Form B (1 only) Form C (1 only)	5 Vdc 12Vdc 24Vcd	Molded construction. Diode and electrostatic shield options. Life at rated load: 5 million operations.
PRME	.300 x .100 Dual-in-line Package (DIP)	Form A (1 only)	5 Vdc 12 Vdc 24 Vdc	Low profile molded construction. Available with diode and/or shield. Life at rated load: 5 million operations.
 **MRB/922**	1.00 x .100 1.00 x .150	Form A (1 to 6) Form B (1 & 2) Form A/B (1 & 2) Form C (1 to 4) Form AL (1 & 2)	5 Vdc 6 Vdc 12 Vdc 24 Vdc	Industry standard in "microreed" size reed relays. Metal cover and versatile design. Life at rated load: 10 million operations.
 **MRBT**	1.00 x 0.10	Form A (2 & 3)	5 Vdc 12 Vdc 15 Vdc	Microreed relay designed to minimize thermal voltage errors in low-level circuits. Life at rated load: 10 million operations.
951	1.00 x .100	Form A (1, 2 & 4) 3-pole and 5-pole available	5 Vdc 12 Vdc 24 Vdc	Epoxy molded equivalent of MRB metal covered relay. Rugged lead frame construction. Life at rated load: 5 million operations.
 **PRB**	.700 x .100	Form A (1 & 2) Form B (1 only)	5 Vdc 6 Vdc 12 Vdc 24 Vdc	Magnetic shielding option with a ferrous cover in a high density package design. Life at rated load: 5 million operations.
CLARE CRETH-1012 CLAREED RELAY **CRTN**	2.50 x .218	Form A (1 to 6) 7 to 12 poles available Form B (1 & 2) Form A/B (1 & 2) Form AL (1 & 2)	6 Vdc 12 Vdc 24 Vdc 48 Vdc	Industry standard in large size reed relays. Life at rated load: 20 million operations.

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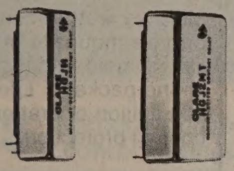
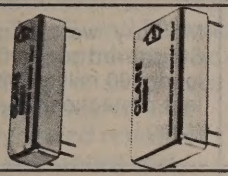
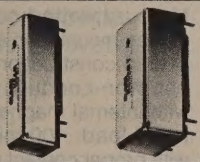
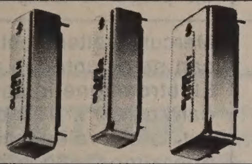
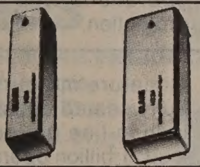
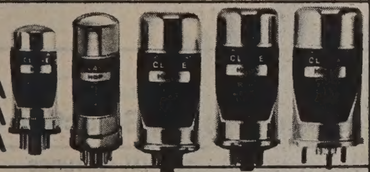
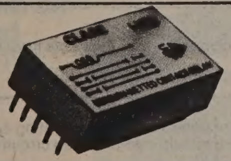
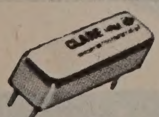
CLARE Mercury-Wetted Contact Relays

GENERAL INSTRUMENT

RELAY TYPE	TERMINAL TYPE/GRID	CONTACT FORMS AVAILABLE	NOMINAL VOLTAGE	DESCRIPTION
 **HGJM** **HGJ2MT**	1.400/1.200 x .100 staggered	1C 2C (Break-Before-Make)	5 Vdc 12 Vdc 24 Vdc 48 Vdc	Highest speed mercury-wetted contact relay. Life at 2A, 100VA rated load: 20 billion operations with contact protection. Low noise, high repetition rate. Stable at 200 Hz.
 **HGWM** **HGW2MT**	1.20 x .100	1C 2C	5 Vdc 12 Vdc 24 Vdc 48 Vdc	Compact package mercury-wetted relay. Life at rated load: 20 billion operations. Same characteristics as HGJM
 **HGSM** **HGS2MT**	1.800/1.500 x .200 staggered	1C 1D 2C 2D	5 Vdc 12 Vdc 24 Vdc 48 Vdc	Sensitive mercury-wetted relay. Life at 2A rated load: 20 billion operations with contact protection. 120 Hz repetition rate.
 **HGRM** **HGR2MT** **HGSR**	1.400/1.200 x .100 staggered	1C 1D 2C 2D	5 Vdc 12 Vdc 24 Vdc 48 Vdc	Small mercury-wetted relay. Life at rated load: 20 billion operations with contact protection. Same contact characteristics of HGSM.
 **HGM** **HG2M**	3.000/2.400 x .200 staggered	1D 2D (Make-Before-Break)	12 Vdc 24 Vdc 48 Vdc	High current (5.0A, 250VA) mercury-wetted module. Life at rated load: 20 billion operations with contact protection. 80 Hz maximum repetition rate.
 **HG** **HGP** **HG2A** **HG3A** **HG4A**	8, 11 and 14 Pin Plugs	1D 2D 3D 4D	As Required	Heavy duty (5.0A, 250VA) mercury-wetted plug-in relays. Life at rated load: 20 billion operations with contact protection.
HGS	8 Pin Octal Plug	1C 1D	As Required	Sensitive mercury-wetted plug-in relay. Life at rated load: 20 billion operations with contact protection. 2A, 100VA contact rating.
CLARE 851A12B1A MERCURY WETTED CONTACT RELAY **851**	1.300 x .100	1A 2A 4A (Normally Open)	5 Vdc 12 Vdc 24 Vdc	Mercury-wetted reed, epoxy molded. End lead construction. Life at rated load: 1 billion operations. .5A, 50VA contact rating.
 **HRB**	1.00 x .150	1A thru 5A	5 Vdc 12 Vdc 24 Vdc	Mercury-wetted reed, metal cover. Standard grid spacing. Life at rated load: 1 billion operations. .5A, 50VA contact rating.
 **HRM**	.800 x .150	1A	5 Vdc 12 Vdc 24 Vdc	Subminiature form A module for PCB mounting. Life at rated load: 1 billion operations with contact protection. .5A, 50VA contact rating.

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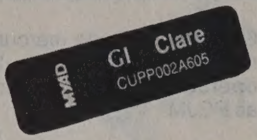
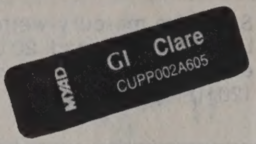
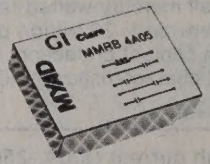
CLARE Mercury-Wetted Contact Relays

GENERAL INSTRUMENT

RELAY TYPE	TERMINAL TYPE/GRID	CONTACT FORMS AVAILABLE	NOMINAL VOLTAGE	DESCRIPTION
MSS2	DIP, .3 x .10	1A	5 Vdc 12 Vdc 24 Vdc	Mercury wetted contact relay that can be mounted in any position. Epoxy molded construction, dual-in-line package. Life at rated load: 100 million operations with proper contact protection.
 **CUP (5)**	Staggered	1A–5A 1B 2B	5 Vdc 12 Vdc 24 Vdc 48 Vdc	Mercury wetted contact relay. Staggered pin-out. Life at rated load: 100 million with proper contact protection. 2A, 30VA contact rating.
 **CUP (6)**	Staggered	1A–5A 1B 2B	5 Vdc 12 Vdc 24 Vdc 48 Vdc	Mercury wetted contact relay that can be mounted in any position. Fully sealed construction, staggered pin-out. Non-conductive plastic cover with internal magnetic shield. Life at rated load: 100 million operations with proper contact protection.
 **MMRB**	1 x .1, 1 x .15	1A–6A	5 Vdc 12 Vdc 24 Vdc	Mercury wetted contact relay that can be mounted in any position. Electromagnetic shielding standard on a 1 x .10 inch in-line pin-out. Life at rated load: 100 million operations with proper contact protection.
MHC	1 x .10	1C 2C	5 Vdc 12 Vdc 24 Vdc 48 Vdc	Miniature mercury Form C relay. Fully sealed construction, 1 x .10 inch in-line pin-out. Life at rated load: 1 billion operations. 1A, 50VA contact rating.

CLARE CIRCUIT PROTECTION

Surge Arrester Selection Guide

PRODUCT	VOLTAGE RATINGS	APPROXIMATE SIZE AND MOUNTING METHOD	PHYSICAL CONSTRUCTION	SPECIAL FEATURES
Comgap (CG)	75V–1000VDC	.265" L x .380" Dia. Solder Leads .892" L P/C Mtg. Mtg. Clips for Units w/o Leads	Ceramic/Metal	Small Size Rugged Ceramic Construction Low Capacitance < 1.5 pF High Peak Current Capability > 10 kA
Uni-Imp® (UBD, UGT, UBT)	550V–20kVDC	2.20" L x .560" Dia. Solder Lugs	Glass/Metal	Ultra Fast Protection No Overshoot (DC to 200kV/µS) Life Thousands of Operations
Spark Gaps (SB & SG)	400V–40kVDC	3.562" L x 1.202" Dia. Solder Lugs Ferruled Ends for Clip Mtg.	Glass/Metal	Sub-Microsecond Response Time Electrical Energy Transfer DC Overvoltage Protection
Triggered Spark Gaps (TA & TB)	1.0kV–2kVDC	3/4" H x 21/22" Dia. Solder Lugs 2.10" H x 2.82" Dia. Stud Screw Mtg.	Ceramic/Metal	Command Energy Switching DC Overvoltage Protection Rugged Construction
ESP1	Plasma surge arresters in a dual-in-line, automatically insertable package. Epoxy molded construction. Available in voltages from 90 to 470 volts. Printed circuit board mountable.			
ESP2	Dual-in-line signal line protector that combines the high current capability of the surge arrester with the fast operating speed and low voltage capability of the "superzorb." Available in voltage 5 to 150 volts. Epoxy molded construction. Printed circuit board mountable.			

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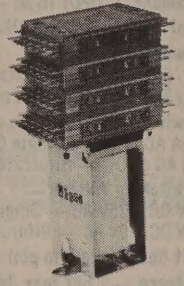
For More Information. Circle No. 372

Tbar THE SOURCE FOR MULTI-CONTACT RELAYS AND SWITCHES

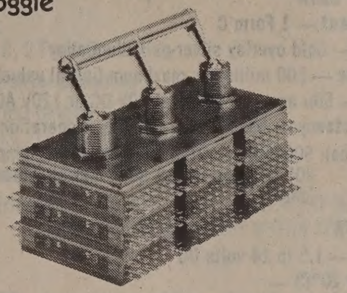
RELAYS

General purpose 800-series, with contact ratings to 5A, and 900-series with low-level to 1A ratings. Both available with 12, 24, 36, 48, and 52 poles form C (D.T.) Operation from continuous ac or dc power, pulsed power (latching), or solid-state logic. Environmentally sealed and hermetically sealed relays for aerospace, shipboard and ground support hostile environments are available.



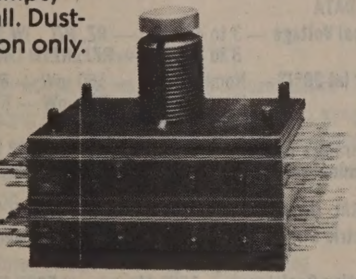
TOGGLE SWITCHES

Same 800-series and 900-series as relays. Available with 4 to 144 poles in form A and C, maintained action. Typical life in excess of 50,000 operations. Normally dust-tight, T-Bar toggle switches are also available in an environmentally sealed version.



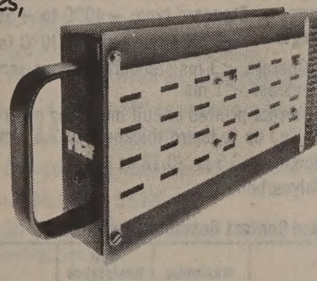
PUSHBUTTON SWITCHES

Momentary pushbutton switches, 800-series only are available with 12 to 36 poles, form C. Typical applications include press-to-test for control panel lamps, reset, and all-call. Dust-tight construction only.



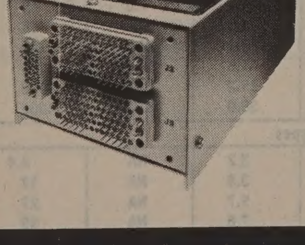
PLUGGABLE MODULES

Pluggable modules use standard T-Bar multi-contact relays in either a one relay configuration or two relays independently controlled with no common failure mode. Plugged into T-Bar printed circuit card cages, any desired switching configuration can be established by backplane wiring.



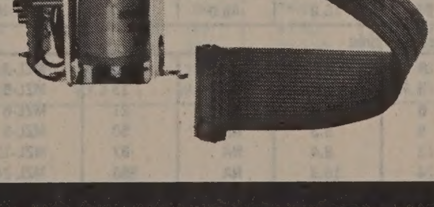
SELECTOR UNITS

Standard T-Bar relays, 800 or 900-series, are packaged as an automatic selector unit to random or sequential circuit selection and addressed through binary weighted coils. Available as Treeselect (all unaddressed lines remain open) or Norselect (all unaddressed lines connected to a bus), selector units can be provided with 16 to 128 positions.



CONNECTORS

T-Bar plug-on connectors are available for all relays and switches. Each connector provides wiring to one-half of a wafer deck (6 poles; A, B, or C). A 36-pole device, for example, requires 6 connectors. Two connector versions are available. One accommodates individual wiring with crimp-on connectors; the other is used to mass-terminate ribbon cable.



Tbar INCORPORATED
Switching Components Division

141 Danbury Road, PO Box T, Wilton, CT 06897
Telephone (203) 834-8368, TWX 710 479-3216

For More Information. Circle No. 373

ITT Components
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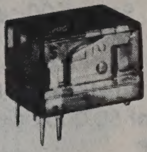
Sub Miniature Printed Circuit Board Relays

MZ RELAY



1 Amp SPDT
L — 0.606″,
W — 0.449,
H — 0.433″

CONTACT DATA

Arrangement — 1 Form C
Material — Gold overlay silver-palladium alloy
Resistance — 100 milliohms maximum (initial value)
Ratings — 50μ amps to 1 amp at 30V DC or 120V AC, resistive
Life Expectancy — Mechanical: 20 million operations
Electrical: 500,000 operations minimum at 1 amp 24V DC resistive load
200,000 operations minimum at 0.5 amps 120V AC resistive load

COIL DATA

Voltages — 1.5 to 24 volts DC
Power (at 20°C) —
Standard type: Operate—0.22 watt, Nominal—0.45 watt, Maximum—1 watt
High sensitive type: Operate—0.1 watt, Nominal—0.2 watt, Maximum—1 watt
Operate (at 20°C) — 70% of nominal voltage
Duty — Continuous

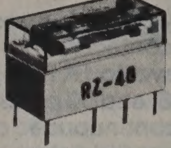
GENERAL DATA

Insulation Resistance — 100 megohms minimum at 500V DC
Dielectric Strength — 500V AC (50/60 Hz), between all insulated elements
Temperature Range — Standard type: −40°C to +55°C
(at nominal voltage) High sensitive type: −30°C to +75°C
Time Values — Operate <3 ms standard, <6 ms sensitive; release <1 ms
Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2.5 mm (0.98 in.)
Approximate Weight — 3.5 gr. (0.12 oz.)
Enclosure — Polycarbonate

Standard Coil and Contact Combination (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Standard Types					
1.5	1.05	2.0	5	MZ-1.5HG	$1.95
3	2.1	4.1	20	MZ-3HG	$1.95
5	3.5	6.8	56	MZ-5HG	$1.95
6	4.2	8.1	80	MZ-6HG	$1.95
9	6.3	12.2	180	MZ-9HG	$1.95
12	8.4	16.2	320	MZ-12HG	$1.95
24	16.8	32.4	1280	MZ-24HG	$1.95
High Sensitive Type					
1.5	1.05	3.0	12	MZ-1.5HS	$2.15
3	2.1	6.0	45	MZ-3HS	$2.15
5	3.5	10.0	120	MZ-5HS	$2.15
6	4.2	12.0	180	MZ-6HS	$2.15
9	6.3	18.0	400	MZ-9HS	$2.15
12	8.4	24.0	700	MZ-12HS	$2.15
24	16.8	48.0	2800	MZ-24HS	$2.15
Latching Types					
3	2.1	NA	5.7	MZL-3	$2.75
5	3.5	NA	15	MZL-5	$2.75
6	4.2	NA	21	MZL-6	$2.75
9	6.3	NA	50	MZL-9	$2.75
12	8.4	NA	87	MZL-12	$2.75
24	16.8	NA	350	MZL-24	$2.75

RZ/RZL RELAYS



1 Amp DPDT
L — 0.795″,
W — 0.386″,
H — 0.457″

CONTACT DATA

Arrangement — DPDT (B-M) — RZ, RZ( )W Type
Material — Gold overlaid silver-palladium alloy
Max. Switching Power —
30W/50VA — Single Contact
17W/30VA — Bifurcated contact at resistive load
Max. Switching Current —
1.25A AC or DC — Single Contact
0.7A AC or DC — Bifurcated contact at resistive load
Max. Switching Voltage —
150V DC/125V AC — Single Contact
100V DC/90V AC — Bifurcated contact at resistive load
Contact Resistance (Pin-pin) — 100mΩ Max.
Capacitance — 1.5PF max. between open contact
0.5PF max. between adjacent change-over contact
Life Expectancy —
Mechanical: 20 million operations — Single Contact
15 million operations — Bifurcated contact
Electrical: 0.5 million operations at 1.25A 24V DC or 0.4A 125V AC at resistive load — Single contact
0.5 million operations at 0.7A 24V DC or 0.25A 125V AC at resistive load — Bifurcated contact

COIL DATA

Nominal Voltage — 3 to 48 V DC — RZ, RZ( )W Type,
3 to 24V DC — RZ1, RZ1( )W Type
Power (at 20°C) — Nominal: 515 ~ 560 mW — RZ, RZ( )W Type,
Operate: 200 ~ 324 mW — RZ, RZ( )W Type
Max: 1050 mV
Temperature Range — −40°C ~ +65°C — RZ RZ( )W Type
(at nominal voltage) −40°C ~ +75°C — RZ1 RZ1( ) Type

GENERAL DATA

Dielectric Strength — 500V AC (50/60 Hz) between open contacts, 1000V AC contact-coil
Insulation Resistance — 1000 MΩ min. at 500V DC
Timing — Operate <4 ms, release <2
Bounce Time — Approx. 1 ms on operate
Approx. 4 ms on release
Vibration Resistance — 10 to 60 Hz amplitude 1.5 mm (10G)
Shock Resistance — Destruction shock: 100G (11 ms ±1 ms)
Unerror shock: 10G (11 ms ± 1 ms)
Surge Strength — 1500V AC between all conductors

Standard Coil and Contact Combinations (20°C

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Standard types					
5	3.2	7.0	45	RZ-5	$3.00
6	3.8	8.4	66	RZ-6	$3.00
9	5.1	12.6	140	RZ-9	$3.00
12	7.6	16.8	280	RZ-12	$3.00
24	15.2	33.6	1070	RZ-24	$3.00
48	36.0	67.2	4000	RZ-48	$3.55
Latching types					
5	3.2	NA	8.4	RZL-5	$4.00
6	3.8	NA	12	RZL-6	$4.00
9	5.7	NA	27	RZL-9	$4.00
12	7.6	NA	52	RZL-12	$4.00
24	15.2	NA	192	RZL-24	$4.00
48	36.0	NA	820	RZL-48	$4.30

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For More Information. Circle No. 374

ITT Components
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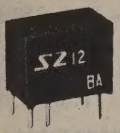
Sub Miniature Printed Circuit Board Relays

SY/SZ RELAYS

1 Amp SPDT
L — 0.492",
W — 0.291",
H — 0.374"



CONTACT DATA

Arrangement — 1 Form C

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial value)

Ratings — 0.5A, 120V AC or 1A, 24V DC (resistive)

Life Expectancy — Mechanical: Min. 5 million operations
Electrical: SZ Min. 200,000 operations at rated load
SY Min. 150,000 operations at rated load

COIL DATA

Voltages — 1.5 to 24V DC

Power (at 20°C) —
SZ Operate — 0.15 watt (0.16 watt for 18V coil, 0.18 watt for 24V coil)
Nominal — 0.3 watt (0.32 watt for 18V coil, 0.36 watt for 24V coil)
SY Operate — 0.075 watt
Nominal — 0.15 watt

Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 100 MΩ minimum at 500V DC

Dielectric Strength — 500V AC (50, 60 Hz), between all conductors

Temperature Range -- −40°C to +70°C (18V coil: −30°C to +65°C, 25V coil: −30°C to +60°C) (at nominal voltage)

Time Values (approx.) — Operate 1.5 mS, Release 1 mS (at nominal voltage)

Vibration Resistance — 20G (10 ∼ 300 Hz) amplitude 3 mm

Shock Resistance — 50G

Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.)

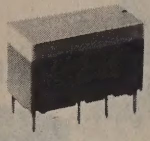
Approximate Weight — 1.7 gr (0.06 oz.)

Enclosure — Polybutylene terephthalate (PBT)

Nominal Coil Voltage	Coil Resistance	Operate Voltage	Type No.	List Price
3	30	2.1	SZ-3	$2.25
5	83	3.5	SZ-5	$2.25
6	100	3.9	SZ-6	$2.25
9	270	6.3	SZ-9	$2.25
12	480	8.4	SZ-12	$2.25
18	1000	12.6	SZ-18	$2.25
24	1600	16.8	SZ-24	$2.25
5	167	3.5	SY-5	$2.50
6	240	4.2	SY-6	$2.50
9	540	6.3	SY-9	$2.50
12	960	8.4	SY-12	$2.50

RY RELAY

1 Amp DPDT
L — 0.795",
W — 0.386",
H — 0.472"



CONTACT DATA

Arrangement — 2 Form C, 2 Form D

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial)

Ratings — 0.5A 120V AC or 1A 24V DC (resistive)

Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 1A 24V DC
Min. 200,000 operations at 0.5A 120V AC

COIL DATA

Voltages — 4.5 to 48V DC

Power (at 20°C) —
Operate — 0.075 watt (0.098 watt for 18V, 24V coil, 0.138 watt for 48V coil)
Nominal — 0.15 watt (0.2 watt for 18V, 24V coil, 0.3 watt for 48V coil)

Operate (at 20°C) — 68 ∼ 71% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ min. at 500V DC

Dielectric Strength — 500V AC between open contact
1000V AC between all other conductors

Temperature Range — −40°C ∼ +80° at nominal voltage

Surge Strength — 1500V between all conductors

Time Values (max.) — Operate 6 ms, Release 3 ms at nominal voltage

Vibration Resistance — 10G (10 ∼ 55 Hz)

Shock Resistance — 10G 11 ±1 ms) — Unerror, 100G (6 ±1 ms) — Destruction

Enclosure — Polybutylene terephthalate (PBT)

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
B-M (2 form C)					
5	3.6	12.5	167	RY-5W	$3.80
6	4.3	15.0	240	RY-6W	$3.80
9	6.4	22.5	540	RY-9W	$3.80
12	8.5	30.0	960	RY-12W	$3.80
24	16.8	51.6	2880	RY-24W	$3.80
48	32.6	84.0	7680	RY-48W	$4.30
M-B (2 form D)					
5	3.3	7.1	55	RY-5D	$4.00
6	4.0	8.5	80	RY-60	$4.00
9	5.9	12.8	180	RY-9D	$4.00
12	7.9	17.0	320	RY-12D	$4.00
24	15.8	34.1	1280	RY-24D	$4.00
48	31.8	65.8	4800	RY-48D	$4.65

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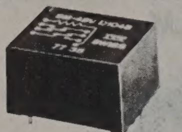
Miniature Printed Circuit Board Relays



SM RELAYS

0.5 Amps DPDT, SPDT

L — 0.618", 0.618"
W — 0.504", 0.394"
H — 0.390", 0.390"

CONTACT DATA

Arrangement — 2 Form C, 1 Form C, bifurcated crossbar
Material — Gold-silver nickel, bifurcated crossbar
Load — Maximum switched power: 30VA, resistive
Maximum switched current: 0.5A, resistive
Maximum switched voltage: 100V, resistive
Life — Mechanical: 200 million operations minimum
Electrical: 0.5 x 10^6 operations minimum at rated load
Timing — Operate: < 3.5ms
Release: < 2ms
Bounce: < 0.7ms on operate, < 5ms on release

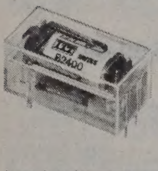
COIL DATA (@ 20°C)

Operate power — 100mW — DPDT, 85mW — SPDT
Nominal power — 200mW — DPDT, 170mW — SPDT
Maximum power — 1.0W — DPDT or SPDT

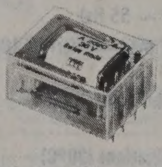
Standard Coil and Contact Combinations (20°C)

	Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
SPDT	5	3.6	12.1	148	SM1-D1101	$6.60
	12	8.6	29.0	852	SM1-D1102	$6.60
	24	17.1	57.6	3350	SM1-D1103	$6.60
	48	34.1	117	13,830	SM1-D1104	$7.10
DPDT	5	3.6	12.6	135	SM2-D1005	$8.65
	12	8.6	29.3	724	SM2-D1012	$8.65
	24	17.1	57.1	2760	SM2-D1024	$8.65
	48	34.1	114.6	11,100	SM2-D1048	$9.80

PZ & PZM RELAYS



L — 1.142",
W — 0.677",
H — 0.591"



L — 1.142",
W — 0.977",
H — 0.630"

L — 1.181",
W — 1.386",
H — 0.866" PZ-6,

1 Amp DPDT, 4PDT, 6PDT, DPST

CONTACT DATA

Arrangement — 2 Form C, 4 Form C, 6 Form C, 2 Form A
Material — Silver-palladium, bifurcated crossbar
Gold overlay silver palladium, bifurcated crossbar
Load — Maximum switched power: 30VA, resistive
Maximum switched current: 1A, resistive
Maximum switched voltage: 100V, resistive
Life — Mechanical: PZ types: 2 x 10^8 operations minimum
PZM types: 5 x 10^6 operations minimum
Electrical: AgPd types: 3 x 10^6 operations at rated load, minimum
AuAg types: 5 x 10^5 operations at rated load, minimum
Timing — Operate: PZ-2: < 10ms, PZ-4: < 9ms, PZ-6: < 13ms,
PZ-2A: < 12ms
Release: PZ-2, 4: < 3ms, PZ-6: < 4 ms, PZ-2A: < 2.5ms,
PZM-2: < 8ms
PZM-4: < 18ms, PZM-6 (1 winding): < 19ms, PZM-6 (2 windings): < 3.5ms
Bounce: 4ms on operate
PZ(M)-2: < 1.5ms, PZ(M)-4: < 6 ms, PZ-6 < 4ms,
PZM-6: < 6ms

COIL DATA (@ 20°C)

Operate power — PZ-2: 0.5W, PZ-4: 0.5W, PZ-6: 0.4W, PZ-2A: 0.3W
PZM-2: 1.1W, PZM-4: 1W, PZM-6 (1 winding): 1W
Nominal Power — PZ-2: 0.6-0.8W, PZ4: 0.6-0.9W, PZ-6: 0.5-0.7W, PZ-2A: 0.35-0.45W
PZM-2: 1.3W, PZM-4: 1.2W, PZM-6 (1 winding): 1.2W
Maximum power — PZ-2:1W, PZ-4: 2W, PZ-6: 2.8W, PZ-2A: 1W
PZM-2: 1.1W, PZM-4: 1W, PZM-6 (1 winding): 1W

Coil Data — Standard Relays

DC Nominal Voltage	Coil Resistance ±10%, Ohms	Ordering Code		List Price	
		Ag/Pd Contacts*	AgPd/Au Contacts†	Ag/Pd	AgPd/Au
PZ-2					
6	60	A 2400	A 2406	$5.60	$7.75
12	210	A 2410	A 2416	$5.60	$7.75
18	500	A 2412	A 2419	$5.60	$7.75
24	850	A 2420	A 2426	$5.60	$7.75
36	1600	A 2430	A 2436	$5.60	$7.75
48	3000	A 2440	A 2446	$5.60	$7.75
PZ-2A					
6	90	B 70100	B 70106	$5.60	$7.75
12	360	B 70110	B 70116	$5.60	$7.75
18	780	B 70112	B 70119	$5.60	$7.75
24	1350	B 70120	B 70126	$5.60	$7.75
36	3000	B 70130	B 70136	$5.60	$7.75
48	5500	B 70140	B 70146	$5.60	$7.75
PZ-4					
6	40	A 2640	A 2646	$6.90	$10.70
12	210	A 2600	A 2606	$6.90	$10.70
18	450	A 2611	A 2619	$6.90	$10.70
24	850	A 2610	A 2616	$6.90	$10.70
36	1600	A 2620	A 2626	$6.90	$10.70
48	3000	A 2630	A 2636	$6.90	$10.70
60	4800	A 2650	A 2656	$6.90	$10.70
PZ-6					
6	66	A 2800	A 2806	$9.95	$15.20
12	230	A 2810	A 2816	$9.95	$15.20
18	520	A 2812	A 2819	$9.95	$15.20
24	900	A 2820	A 2826	$9.95	$15.20
36	1900	A 2830	A 2836	$9.95	$15.20
48	3600	A 2840	A 2846	$9.95	$15.20
60	6100	A 2850	A 2856	$9.95	$15.20

* Silver Palladium alloy, 70% Silver, 30% Palladium
† Gold/Silver alloy, 80% Gold, 20% Silver

Coil Data — Latching Relays††

DC Nominal Voltage	Coil Resistance ±10%, Ohms	Ordering Code		List Price	
		Ag/Pd Contacts*	AgPd/Au Contacts†	Ag/Pd	AgPd/Au
PZM-2					
6	26	B 2400	B 2406	$8.30	$10.05
12	120	B 2410	B 2416	$8.30	$10.05
18	240	B 2420	B 2426	$8.30	$10.05
24	480	B 2430	B 2436	$8.30	$10.05
36	930	B 2440	B 2446	$8.30	$10.05
48	1980	B 2450	B 2456	$8.30	$10.05
PZM-4					
6	26	B 2500	B 2506	$9.50	$13.05
12	120	B 2510	B 2516	$9.50	$13.05
18	240	B 2520	B 2526	$9.50	$13.05
24	460	B 2530	B 2536	$9.50	$13.05
36	1260	B 2540	B 2546	$9.50	$13.05
48	1840	B 2550	B 2556	$9.50	$13.05
60	2900	B 2560	B 2566	$9.50	$13.05
PZM-6, 1 WINDING					
6	27	B 2700	B 2706	$11.25	$16.10
12	120	B 2710	B 2716	$11.25	$16.10
18	260	B 2720	B 2726	$11.25	$16.10
24	560	B 2730	B 2736	$11.25	$16.10
36	1090	B 2740	B 2746	$11.25	$16.10
48	2080	B 2750	B 2756	$11.25	$16.10
60	3300	B 2760	B 2766	$11.25	$16.10
PZM-6, 2 WINDINGS					
6/6	60/19	B 2600	B 2606	$13.30	$18.05
12/12	240/110	B 2610	B 2616	$13.30	$18.05
24/24	900/360	B 2630	B 2636	$13.30	$18.05
48/48	1460/1400	B 2650	B 2656	$13.30	$18.05

†† Remanant latch — designed for pulse operation. For additional technical information contact factory.

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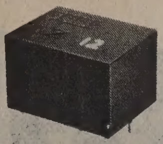
Miniature General Purpose Relays

LZ RELAY



5 Amp SPDT
L — 0.843″
W — 0.646″
H — 0.583″

CONTACT DATA

Arrangement — 1 Form C

Material — 5A type: Gold overlay silver-nickel alloy (single)
3A type: Gold overlay silver (single)
1A type: Gold overlay silver-palladium alloy (bifurcated)

Load — 5A type: 5A @ 30V DC or 120V AC, 4A @ 240V AC resistive. ⅛ HP
3A type: 3A @ 30V DC or 120V AC, 2.5A @ 240V AC resistive, $^{1}/_{10}$ HP
1A type: 1A @ 30V DC or 120V AC, resistive

Life — Mechanical: 20 million operations minimum
Electrical: 0.1 x 10^6 operations minimum at rated load

Timing — Operate: < 5ms (standard type), < 6ms (high sensitive type)
Release: < 2ms

COIL DATA (@ 20°C)

Operate power — 210mW (standard type), 150mW (high sensitive type)

Nominal power — 450mW (standard type), 330mW (high sensitive type)

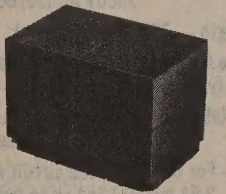
Maximum power — 1.4W

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10, Ohms	Ordering Code 5A*	Ordering Code 3A	List Price
Standard types						
5	3.25	8.3	56	LZ-5H	LZ-5	$2.20
6	3.90	9.9	80	LZ-6H	LZ-6	$2.20
9	5.85	14.9	180	LZ-9H	LZ-9	$2.20
12	7.80	19.8	320	LZ-12H	LZ-12	$2.20
24	15.6	39.6	1280	LZ-24H	LZ-24	$2.20
48	28.8	79.2	3800	LZ-48H	LZ-48	$2.35
High sensitive types						
5	3.25	9.8	80	—	LZ-5S	$2.35
6	3.90	11.7	110	—	LZ-6S	$2.35
9	5.85	17.6	250	—	LZ-9S	$2.35
12	7.80	23.4	440	—	LZ-12S	$2.35
24	15.6	45.6	1780	—	LZ-24S	$2.35

* Add $0.05 to List Price

GZ RELAY



5 Amp DPDT
L — 1.098″
W — 0.728″
H — 0.866″

CONTACT DATA

Arrangement — 2 Form C

Material — Heavy duty type: Gold overlay silver-nickel alloy (single)
Standard type: Gold overlay silver-nickel alloy (single)
Low level type: Gold overlay silver-palladium (bifurcated)

Life — Mechanical: 10 million operations minimum
Electrical: 0.1 x 10^6 operations minimum at rated load

Timing — Operate: < 10ms
Release: < 5ms

COIL DATA (@ 20°C)

Operate power — 270mW

Nominal power — 650mW

Maximum power — 1W

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Heavy duty type 6 Amp					
6	3.8	9.0	55	GZ-6H	$4.95
12	7.6	18.0	220	GZ-12H	$4.95
24	15.2	36.0	880	GZ-24H	$4.95
48	27.8	63.4	2700	GZ-48H	$4.95
Standard types 3 Amp					
6	3.8	9.0	55	GZ-6	$4.80
12	7.6	18.0	220	GZ-12	$4.80
24	15.2	36.0	880	GZ-24	$4.80
48	27.8	63.4	2700	GZ-48	$4.80
Low level types 1 Amp					
6	3.8	9.0	55	GZ-6W	$5.40
12	7.6	18.0	220	GZ-12W	$5.40
24	15.2	36.0	880	GZ-24W	$5.40
48	27.8	63.4	2700	GZ-48W	$5.40

ITT-2R ITT-2H RELAY

10 Amps DPDT
L — 1.098″
W — 0.843″
H — 1.362″

CONTACT DATA

Arrangement — 2 Form C

Materials — Gold flashed silver, button

Load — 10A type: 10A @ 30V DC/120V AC, resistive, ¼ HP
5A type: 5A @ 30V DC/120V AC, resistive, ⅛ HP

Life — Mechanical: 50 million operations minimum
Electrical: 10A type: 0.1 x 10^6 operations minimum at rated load
5A type: 0.5 x 10^6 operations minimum at rated load

Timing — Operate: < 20ms
Release: < 20ms (AC relays), < 10ms (DC relays)

COIL DATA (@ 20°C)

Operate power — 500-575mW (DC relays), 2.0-2.3VA (AC relays)

Nominal power — 900mW (DC relays), 1.2VA (AC relays)

Maximum power — 2.2W (DC relays), 2.7VA (AC relays)

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10% DC, Ohms ±15% AC	Ordering Code Printed Ciruit	Ordering Code Standard	List Price
5A types, DC Coils						
6	4.5	9.3	40	ITT-2BAR	ITT-2AR	$4.85
12	9	18.6	160	ITT-2BBR	ITT-2BR	$4.85
24	18	37.2	650	ITT-2BCR	ITT-2CR	$4.85
5A types, AC Coils						
24	19.2	30.6	180	ITT-2ZBCR	ITT-2ZCR	$5.05
115	92	146.6	4270	ITT-2ZBFR	ITT-2ZFR	$5.50
10A types, DC Coils						
6	4.8	9.3	40	ITT-2BAH	ITT-2FAH	$6.50
12	9.6	18.6	160	ITT-2BBH	ITT-2FBH	$6.50
24	19.2	37.2	650	ITT-2BCH	ITT-2FCH	$6.50
10A types, AC Coils						
24	20.4	30.6	180	ITT-2ZBCH	ITT-2ZFCH	$6.80
115	97.8	146.6	4270	ITT-2ZBFH	ITT-2ZFFH	$7.15

ITT-4 RELAYS

5 Amp 4PDT
L — 1.098″
W — 0.843″
H — 1.362″

CONTACT DATA

Arrangement — 4 Form C

Material — 5A type: Gold-flashed silver-cadmium-oxide, button
3A type: Gold-flashed silver, button
1A type: Gold-silver alloy, cross-bar

Load — 5A type: 5A @ 30V DC/120V AC, resistive, ⅛ HP
3A type: 3A @ 30V DC/120V AC, resistive, $^{1}/_{10}$ HP
1A type: 1A @ 30V DC/120V AC, resistive

Life — Mechanical: 5A and 3A types: 50 million operations minimum
1A type: 20 million (DC relays), 10 million (AC relays) operations minimum
Electrical: 0.2 x 10^6 operations minimum at rated load

Timing — Operate: < 20ms
Release: < 20ms (AC relays), < 10ms (DC relays)

COIL DATA (@ 20°C)

Operate power — 500mW (DC relays), 2.0VA (AC relays)

Nominal power — 900mW (DC relays), 1.2VA (AC relays)

Maximum power — 2.2W (DC relays), 2.7W (AC relays)

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10% DC, ±15% AC Ohms	Ordering Code Printed Circuit	Ordering Code Standard	List Price
3A types, DC Coils						
6	4.5	9.3	40	ITT-4BAR	ITT-4AR	$5.30
12	9	18.6	160	ITT-4BBR	ITT-4BR	$5.30
24	18	37.2	650	ITT-4BCR	ITT-4CR	$5.30
3A types, AC Coils						
24	19.2	30.6	180	ITT-4ZBCR	ITT-4ZCR	$5.60
115	92	146.6	4270	ITT-4ZBFR	ITT-4ZFR	$5.85
5A types, DC Coils						
6	4.5	9.3	40	ITT-4BAH	ITT-4AH	$5.65
12	9	18.6	160	ITT-4BBH	ITT-4BH	$5.65
24	18	37.2	650	ITT-4BCH	ITT-4CH	$5.65
5A types, AC Coils						
24	19.2	30.6	180	ITT-4ZBCH	ITT-4ZCH	$5.95
115	92	146.6	4270	ITT-4ZBFH	ITT-4ZFH	$6.25

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For More Information. Circle No. 374

ITT Components
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Sub Miniature Printed Circuit Board Relays

VG RELAY

L — 0.925",
W — 0.386",
H — 0.984"

CONTACT DATA

Arrangement — 1 Form C (SPDT)

Material & Rating —
VG-( )H, — Silver alloy 5A 24V DC or 120V AC resistive
VG-( ), VG-( )S — Silver alloy 3A 30V DC or 120V AC resistive
VG-( )L, VG-( )LS — Gold overlaid silver alloy 1A 30V DC or 120V AC resistive

Life Expectancy — Mechanical: 10 million operations
Electrical: 100,000 operations at rated load
30,000 operations at TV Rating

COIL DATA

Voltage — 5 to 48V DC (High sensitive type — to 24V DC)

Power (at 20°C) — Standard type: operate 0.18 ~ 0.2W
nominal 0.36 ~ 0.4W
High sensitive type: operate 0.1 ~ 0.13W
nominal 0.2 ~ 0.26W

Max. Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — Min. 1000 MΩ at 500V DC

Dielectric Strength — 750V AC (50/60 Hz) between open contacts
4000V AC (50/60 Hz) between coil and contacts

Surge Strength — 7000V (1 × 40 μs)

Temperature Range (at Nominal voltage) —
Standard type −40°C to +75°C } Non-carrying condition of contacts
High sensitive type −40°C to +85°C }

Time Value (at Nominal voltage) — Operate Max. 8 ms
Release Max. 5 ms

Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2 mm (0.08 in.)

Weight — 12 gr (Approx.)

Coil Data			Ordering Code Gold Overlaid Silver Alloy					
Nom. Coil Voltage	Coil Resist. in Ohm ±10% at 20°C	Must operate Voltage at 20°C	5A 1 Form C	List Price	3A 1 Form C	List Price	1A 1 Form C	List Price
Standard Type								
5	69	3.5	VG- 5H	$2.75	VG- 5	$2.65	VG- 5L	$2.85
6	100	4.2	VG- 6H	$2.75	VG- 6	$2.65	VG- 6L	$2.85
9	225	6.3	VG- 9H	$2.75	VG- 9	$2.65	VG- 9L	$2.85
12	400	8.4	VG-12H	$2.75	VG-12	$2.65	VG-12L	$2.85
18	870	12.6	VG-18H	$2.75	VG-18	$2.65	VG-18L	$2.85
24	1450	16.8	VG-24H	$2.75	VG124	$2.65	VG-24L	$2.85
48	6000	33.6	VG-48H	$2.85	VG-48	$2.75	VG-48L	$2.95
High Sensitive Type								
5	120	3.5			VG- 5S	$2.80	VG- 5LS	$3.00
6	150	4.2			VG- 6S	$2.80	VG- 6LS	$3.00
9	325	6.3			VG- 9S	$2.80	VG- 9LS	$3.00
12	575	8.4			VG-12S	$2.80	VG-12LS	$3.00
18	1400	12.6			VG-18S	$2.80	VG-18LS	$3.00
24	2230	16.8			VG-24S	$2.80	VG-24LS	$3.00

LZG RELAY

L — 0.862",
W — 0.685",
H — 0.634"

CONTACT DATA

Arrangement — [LZG-( )VM — SPST (N-O) only]

Material & Rating — Silver tin oxide alloy
[LZG-( )VM]: 10A at 24V DC or 120V AC resistive

Resistance — (Initial value) Silver tin oxide alloy — Max. 100 mΩ (at 6V, 1A)

Life Expectancy — Mechanical: 20 million operations
Electrical: 100,000 operations

COIL DATA

Voltage — 1.5 to 24V DC

Power (at 20°C) — Standard type: operate 0.19W
nominal 0.45W
maximum 1.4W

Operate (at 20°C) — 65% of nominal voltage

Duty — Continuous

GENERAL

Insulation Resistance — Min. 250 MΩ at 500 VDC

Dielectric Strength — 750V AC (50/60 Hz) between open contacts
2500V AC (50/60 Hz) between all other conductors

Surge Strength — 7000V (1 × 40 μs)

Temperature Range (at Nominal voltage) —
Standard type: −40°C to +70°C — Non-carrying condition of contacts

Time Value (at Nominal voltage) — Operate Max. 7 ms
Release Max. 4 ms

Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2.5 mm (0.098 in.)

Weight — 9.2 gr (Approx.)

Coil Data				
Nominal Coil Voltage	Coil Resistance in Ohms ±10% at 20°C	Must Operate Voltage at 20°C	Ordering Code 10A	List Price
Standard Type				
1.5	5	0.97	LZG 1.5VM	$2.70
3	20	1.95	LZG 3VM	$2.70
5	56	3.25	LZG 5VM	$2.70
6	80	3.90	LZG 6VM	$2.70
9	180	5.85	LZG 9VM	$2.70
12	320	7.80	LZG 12VM	$2.70
18	720	11.70	LZG 18VM	$2.70
24	1280	15.60	LZG 24VM	$2.70

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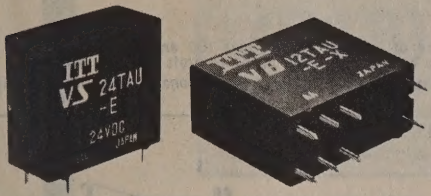
Miniature Power Relays

VB/VS RELAY

L — 1.150″
W — 0.508″
H — 0.996″



CONTACT DATA

Arrangement — 1 Form A, B or C 10 Amp (VS)
2 Form A, B or C 5 Amp (VB)

Material — Silver Nickel (Standard)

Rating — 5 or 10 Amp at 24V DC or 240V AC
⅙ or ⅓ HP 120V AC motor load

Inrush Current — 51 or 78A at 120 V AC

Max. Carrying Current — SPDT 14A, DPDT 7A

Life Expectancy — Mechanical 5 million operations
Electrical: 100,000 operations at 5 or 10A 24V DC or 240V AC
200,000 operations at 5 or 10A 120V AC resistive
3.5 or 7A 24V DC or 240V AC
30,000 operations at ⅙ or ⅓ 120V AC motor load

COIL DATA

Nominal Voltage — 3 to 60V DC

Power (at 20°C) — Nominal: 0.72W Standard Type
0.53W High Sensitive Type
Operate: 0.35W Standard Type
0.26W High Sensitive Type
Maximum: 1.4W

GENERAL

Dielectric Strength — Min. 1000V AC between open contact
Min. 5000V AC between all other conductors

Insulation Resistance — Min. 1000MΩ at 500V DC between conductors

Surge Strength — 10,000V

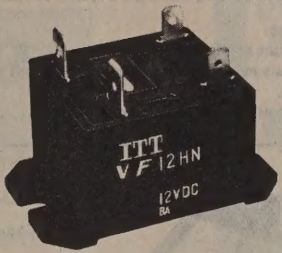
Temperature Range — (TV types) −40°C to +50°C
Standard types) −40°C to +65°C
(Sensitive types) −40°C to +75°C

Standard Coil and Contact Combinations

Type	Nominal Voltage DC (V)	Coil Resistance —10% at 20°C (V)	Must Operate Voltage at 20°C (V)	Ordering Code	List Price
Standard Types					
SPDT	5	36	3.5	VS- 5TBU-E	$3.25
	6	50	4.2	VS- 6TBU-E	$3.25
	12	200	8.4	VS-12TBU-E	$3.25
	24	820	16.8	VS-24TBU-E	$3.25
DPDT	5	36	3.5	VB- 5TBU-E	$3.80
	6	50	4.2	VB- 6TBU-E	$3.80
	12	200	8.4	VB-12TBU-E	$3.80
	24	820	16.8	VB-24TBU-E	$3.80
High Sensitive Type					
SPDT	5	47	3.5	VS- 5STBU-E	$3.35
	6	68	4.2	VS- 6STBU-E	$3.35
	12	270	8.4	VS-12STBU-E	$3.35
	24	1100	16.8	VS-24STBU-E	$3.35
DPDT	5	47	3.5	VB- 5STBU-E	$3.90
	6	68	4.2	VB- 6STBU-E	$3.90
	12	270	8.4	VB-12STBU-E	$3.90
	24	1100	16.8	VB-24STBU-E	$3.90

VF RELAY

L — 1.968″
W — 1.268″
H — 0.949″



CONTACT DATA

Arrangement — 1 Form A

Material — Silver Alloy

Rating:

Classification	Rating		Maximum Inrush Current
	Resistive	Motor Load	
H	30A 250V AC	2HP 25A 250V AC	70A 200V AC
M	25A 250V AC	1.5HP 20A 250V AC	60A 200V AC
L	20A 250V AC	1HP 15A 250V AC	55A 100V AC

Maximum Carry Current — 30A

Life Expectancy — Mechanical: 5 million operations
Electrical: 200,000 operations at motor load
100,000 operations at resistive load

COIL DATA

Nominal Voltage — 3 to 60V DC

Power (at 20°C) — Nominal: 1.2W
Operate: 0.59W
Maximum: 3.0W

GENERAL DATA

Dielectric Strength — 1200V AC between open contacts
4000V AC between all other conductors

Insulation Resistance — 1000MΩ (min.) at 500V DC

Surge Voltage — 10,000V

Timing (approx.) — Operate: 15ms at nominal
Release: 3ms at nominal

Weight — 55 gr

Vibration — 10 - 55Hz

Shock — 20G

Standard Coil and Contact Combinations

Coil Data at 20°C			Ordering Code		List Price
Nominal Coil Voltage	Coil Resistance in Ohms ±10%	Must Operate Voltage	Quick Connect Terminals	PCB Coil Terminals	
6	30	4.2	VF- 6HU	VFB- 6HU	$5.70
12	120	8.4	VF-12HU	VFB-12HU	$5.70
24	480	16.8	VF-24HU	VFB-24HU	$5.70
48	1920	33.6	VF-48HU	VFB-48HU	$5.70
6	30	4.2	VF- 6MU	VFB- 6MU	$5.20
12	120	8.4	VF-12MU	VFB-12MU	$5.20
24	480	16.8	VF-24MU	VFB-24MU	$5.20
48	1920	33.6	VF-48MU	VFB-48MU	$5.20
6	30	4.2	VF- 6LU	VFB- 6LU	$4.85
12	120	8.4	VF-12LU	VFB-12LU	$4.85
24	480	16.8	VF-24LU	VFB-24LU	$4.85
48	1920	33.6	VF-48LU	VFB-48LU	$4.85

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Solid-State Relays

ITT Components offers a full line of Solid-State Relays to cover a wide range of switching and isolation applications where long life, environmental ruggedness, low RFI, no contact bouncing and logic circuitry compatibility are prime requisites.

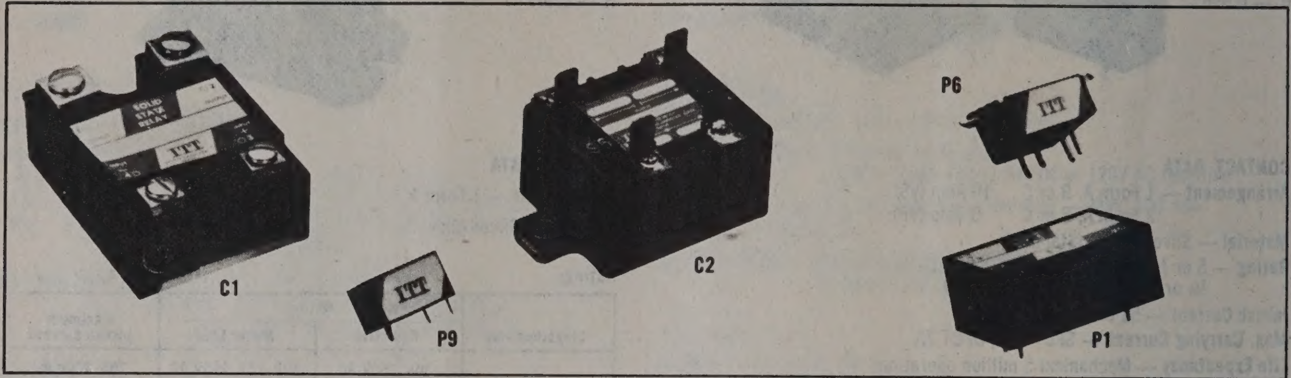
These SSRs feature:

Photo-transistor or reed relay coupling.
Various chassis mounting or printed circuit board mounting housings.
AC switching.
Zero-crossing or random switching.

AC output models can switch:

Voltages of 120, 240, 330, 480V AC.
Currents of 0.5, 2, 3, 7, 10, 25 or 30A AC.

A full line of input-output modules (DC and AC input as well as DC and AC output) to fit microprocessor based controls is also available.
Do not hesitate to call us for any additional information you might need.



INPUT				OUTPUT		
PACKAGE	VOLTAGE	TYPE	COUPLING	VOLTAGE	TYPE OF SWITCHING	CURRENT
C1	5	D	RC	120	R	10

CHASSIS MOUNT
C1
C2

3(3-32)
5
12
24 } D → DC

PRINTED CIRCUIT MOUNT
P1
P6
P9

120
240 } A → AC

PC- PHOTO TRANSISTOR COUPLED

RC- REED RELAY COUPLED

12
120
240
330
480 } V AC

X- ZERO CROSSING SWITCHING

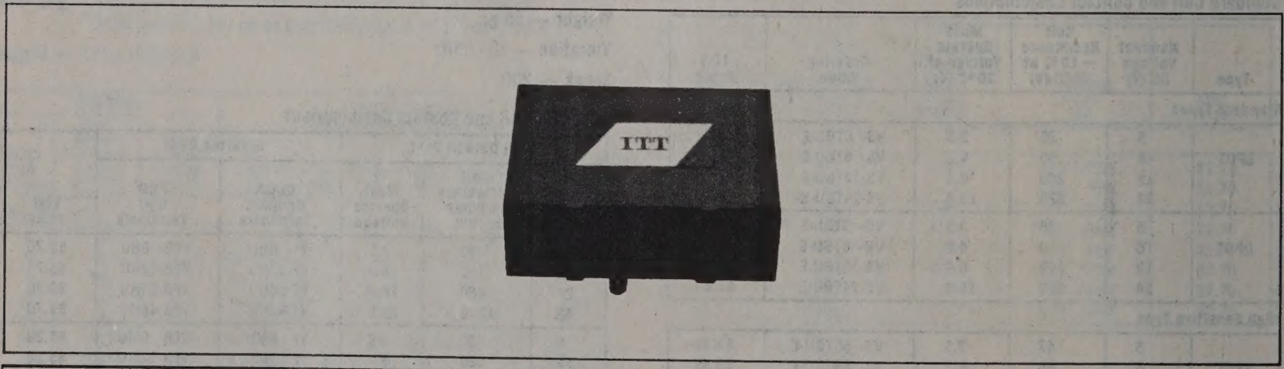
R- RANDOM CROSSING SWITCHING

0.5
1
2
3
7
10
25
30 } A-AC

Example: C1-3D-PC-240X10

A Chassis mount, "hockey-puck" housing, the input circuit is driven with 3-32V DC, and it switches a 240V, 10A output triac. The relay features photo-transistor coupling, and zero cross-over switching.

I-O MODULES



Input	Housing	Logic Supply Voltage	Input Voltage
I	P7	5D/15D/24D	10D/120A/240A

Output	Housing	Signal Pick-Up Voltage	Output Voltage	Output Current
0	P7	5D/15D/24D	60D/120A/240A	3

NOT ANY COMBINATION OF THE ABOVE PARAMETERS IS POSSIBLE. PLEASE CONSULT US FOR ANY OTHER COMBINATION OF VOLTAGE, CURRENT, PACKAGE, ETC.

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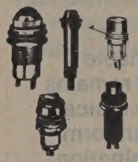
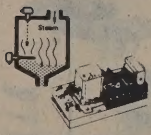
TOGGLES

LAMPS & LEDS


INDICATOR LIGHTS

RELAYS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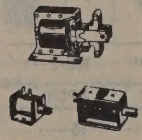
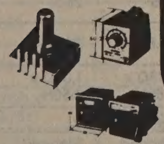

SOLENOIDS

TERMINAL BLOCKS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- Industrial Timer
- Intermatic
- Magnecraft
- Master Electronics
- Midtex
- National Controls
- Omnetics
- Omron
- Potter & Brumfield
- SSAC
- Sigma
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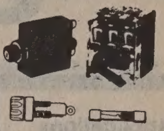
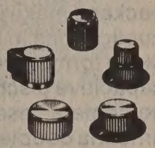
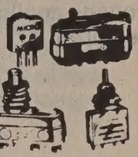
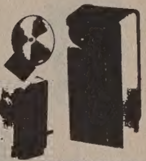
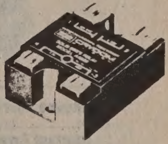

CIRCUIT BREAKERS FUSES & FUSEHOLDERS

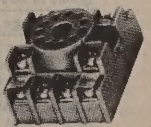

INSTRUMENT KNOBS

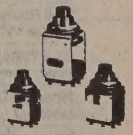

SWITCHES

RELAYS

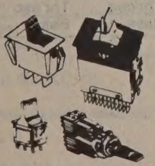

PHOTOELECTRICS


SOLID STATE RELAYS

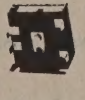

SOCKETS


PUSHBUTTON SWITCHES

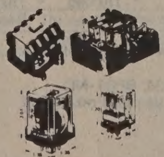
PROXIMITY CONTROLS


PADDLE SWITCHES

TRANSFORMERS


TIMERS

COUNTERS


RELAYS

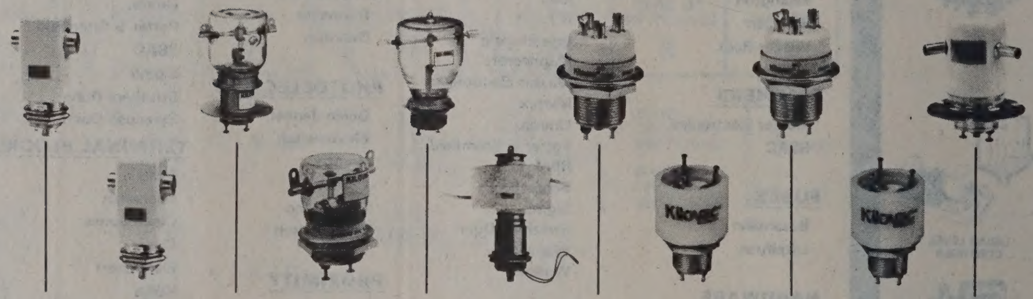
For More Information. Circle No. 375

High Voltage Relays

Applications
The capability to rapidly switch high voltages in a small package makes Kilovac® relays especially well suited for applications in ECM, communications, sonar and radar pulse forming networks, heart defibrillators and other capacitive discharge circuits, electrostatic coating equipment, laser and x-ray power supplies, digital antenna couplers (tuners), automatic dielectric-strength test equipment, and other high voltage equipment, or low voltage applications where extreme reliability is required.

Vacuum as a Dielectric
Since most high voltage arcs are initiated by ionization of the insulating medium, absence of any such medium (i.e., a hard vacuum) produces the greatest possible isolation between contact electrodes. In a vacuum of 10^{-8}mm of mercury, dielectric strengths can be achieved on the order of 2000 V/mil. A vacuum dielectric has the additional advantage of providing an inert (i.e., nonoxidizing) atmosphere in which high voltage contacts operate.

Low Contact Resistance
In conventional relays, contact resistance is variable from cycle to cycle. In Kilovac vacuum relays, it remains low and stable over the life of a relay (.015 ohms typical). Stability and low resistance are attributable to uniform cleanliness of parts, lack of oxidation or contamination, and use of only pure metals in the contact areas. Contact maintenance is never required.



Kilovac Part No.	**KC-20**	**KC-22**(1)	**H-9**	**H-11**	**H-23 H-24**	**K52C**	**HC-1**	**HC-2**	**HC-3**(1)	**HC-4**(1)	**KC-2**
Contact Arrangement	SPST-NO	SPST-NO	SPST-NC	SPST-NO	SPST(2)	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT
Rated Operating Voltage (kVdc or 60 Hz peak)	28	25	15	9	30	100 (4)	3.5	8	3.5	8	15
Test Voltage (kVdc)	30	28	20	12	35	110 (4)	5	10	5	10	18
Continuous Current contacts closed, max (amps dc or 60 Hz peak)	110	65	15	15	30	1	25	25	18	15	50
Contact Resistance, max (ohms)	.005	.005	.015	.015	.015	2	.010	.010	.020	.020	.012
Operate Time, max (ms)	30	30	15	18	30	30	6	6	6	6	18
Coil Resistance (ohms ±10% @ 20° C)	120	120	265	250	120	28	335	335	335	335	250
Coil Voltage (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	1.31 Sq x 4.00H	1.31 Sq x 4.00H	1.3D x 2.75H	1D x 1.67H	2D x 3.62H	3.56D x 6.25H	.75D x 1.50H	1.13D x 1.88H	.75D x 1.50H	1.13D x 1.88H	1.00D x 2.50H
Nominal Weight (oz)	10	10	3	2	7	24	1	1.25	1	1.25	3
Mounting Style	Thr'ded Base	Thr'ded Base	Solder Flange	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Flange(3) Base

(1) Suitable for power switching applications. Consult factory for details. Also available: P/N KC-28 for pulsed power.
(2) H-23: SPST-NC; H-24: SPST-NO.
(3) For threaded base, use part no. KC-11.
(4) In oil.

Send for Kilovac catalog

Kilovac Corporation
P.O. Box 4422G Santa Barbara, CA 93103 USA
(805) 684-4560 • TWX 910-336-1141

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For More Information. Circle No. 376

High Voltage Relays

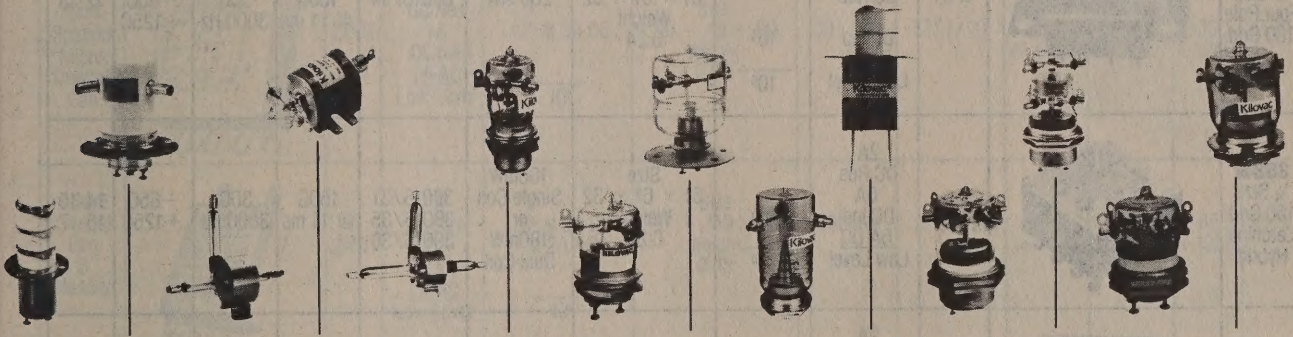
Small Size and Weight
The small contact gap and short contact travel possible with a vacuum dielectric result in minimal package size and weight.

Safety
Because contacts are sealed within the high voltage envelope, switching may be safely accomplished in explosive atmospheres.

Fast Switching Time
10 ms typical, due to small contact gap and short armature travel.

Electronegative Gas as a Dielectric
Kilovac gas-filled relays are pressurized with an electronegative gas mixture. This insulating medium offers several advantages, including high voltage isolation capability in a compact package. The primary advantage is its ability to suppress arcing in heart defibrillator and other capacitive discharge circuits.

Kilovac Medical Relays
Since 1964 Kilovac has produced and delivered thousands of high voltage relays especially designed for heart defibrillators. Kilovac produces several models of patient relays, safety discharge relays, and ECG relays, as well as a multifunction relay capable of performing all of these switching functions in a defibrillator.



KC-3	KC-8	HVS-1	H-4	H-35	H-8	H-12	H-17	H-25/	K42A332 (6)	H-14	H-16	H-18	H-19
SPDT	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT	SPST-NO	DPDT	DPDT	DPDT	DPDT
8	12	17	5	35	15	8	25	50	5	12	12	8	20
11	15	22	7.5	40	20	12	30	60	7	15	15	10	25
25	30	7	10	10	15	15	30	30	15	30	30	10	30
.015	.025	.015	.02	.015	.015	.015	.015	.015	.020	.015	.030	.020	.015
18	18	25	10	30	15	18	25	60	10	20	20	15	30
220	180	128	250	50	265	250	120	120	680	120	120	250	225
26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
.75D x 2.75H	1D x 2.50H	4.75L x 5H	1.88L x .75H	8.25L x 5.75H	1D x 3H	1D x 2.0H	2.38D x 3.57H	3D x 7.5H	.75D x 1.72 H	1.29D x 2.77H	1.03D x 3.26H	1.03D x 1.97H	1.80D x 3.25H
2.5	3	15	1	15	3	2	5	30	1	8	5	4	7
Flange Base	Flange (5) Base	Foot Bracket	Foot Bracket	Foot Bracket	Thr'ded Base	Thr'ded Base	Flange Base	Thr'ded Base	Flange Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base

(5) For threaded base, use part No. KC-12.
(6) K42B332:SPST-NC.
(7) First in a series of low-cost stacked ceramic relays. Contact factory for further details and alternate configurations.

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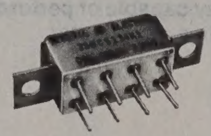
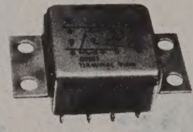
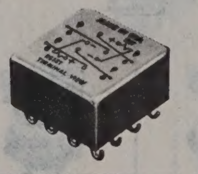
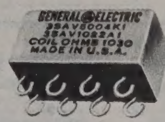
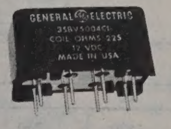
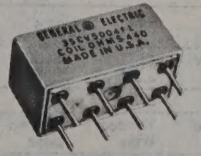
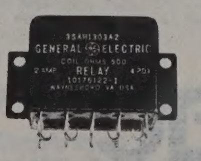
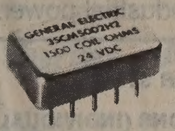
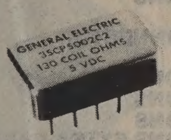
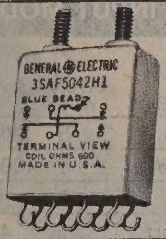
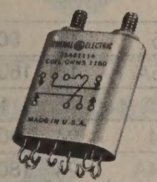
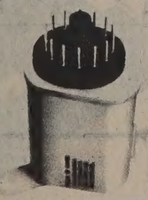
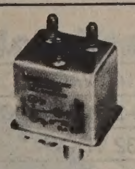
SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L"×W"×H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE	CATALOG GEA6628 PAGE NO.
3SBS Transistor Size Relay		2PDT	1A DC Res .2A DC Ind Low Level	10^5 10^6	Size .37 × .37 × .275 Weight 0.09	120 mW	39016/9 39016/15 39016/20	100G @ 11ms	30G 55-3000 Hz	−65C +125C	6-7
3SBC ¼ Size Two Pole 150 Grid Hybrid		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 10^6	Size .61 × .31 × .32 Weight 0.13	135 mW	39016/13 39016/37 39016/38	100G @ 11 ms	30G 55-3000 Hz	−65C +125C	8-9 10-11
3SBH ¼ Size Four Pole 150 Grid		4PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 10^6	Size .61 × .61 × .32 Weight 0.24	250 mW	39016/14	100G @ 11 ms	30G 3000 Hz	−65C +125C	12-13
3SBM ¼ Size 150 Grid Latching Hybrid		4PDT	2A DC Res .5A DC Ind .5A-DC Low Level	10^5 10^6	Size .61 × .61 × .32 Weight 0.28	100mW Single Coil or 180mW Dual Coil	39016/31 39016/35 39016/36	150G @ 11 ms	30G 3000 Hz	−65C +125C	14-15 16-17
3SAV Half-Size Sensitive R.F.		2PDT	2A DC Res .5A DC Ind .75 A-AC Low Level	10^5 10^6	Size .80 × .40 × .40 Weight 0.30	100mW to 260mW	39016/6 39016/22 39016/33 39016/44	100G @ 11ms	30G 3000 Hz	−65C +125C	18-19 22-23 24-25
3SBV Industrial Half-Size		2PDT	2A DC Res .5A-AC Low Level	10^5 10^6	Size .88 × .48 × .49 Weight 0.30	285 mW				−45C +71C	20
3SCV Long Life Half-Size		2PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 100×10^6	Size .80 × .40 × .40 Weight .30	340mW				−55C +125C	21
3SAH Four Pole Grid		4PDT	2A DC Res .5A DC Ind 1A-AC Low Level	4×10^5 at 1A DC at 0.5A ac 2×10^5 at 2A dc at 1A DC 2×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW	39016/39	50G @ 11ms	30G 55-3000 Hz	−65C +125C	26-27

***Single-phase load, case not grounded**

For More Information. Circle No. 377

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L"×W"×H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE	DCP OR CATALOG PAGE NO.
3SCM DeciGrid® Mag-Latch 1/10 Size	 GENERAL ELECTRIC 3SCM5007H2 1500 COIL OHMS 24 VDC	2PDT	0.5A DC Res Low Level	10^5 5×10^5	Size .350 × .575 × .17 Weight 2. Grams	105 mW	39016/47	100G @ 6ms	50G-3000 Hz	−65C +125C	DCP 1358
3SCP DeciGrid® Mono-stable 1/10 Size	 GENERAL ELECTRIC 3SCP5002C2 130 COIL OHMS 5 VDC	2PDT	0.5A DC Res Low Level	10^5 5×10^5	Size .350 × .575 × .17 Weight 2. Grams	68 mW	39016/48	100G @ 6ms	50G-3000 Hz	−65C +125C	DCP 1359
3SAM Mag-Latch Grid-Space	GENERAL ELECTRIC 3SAM6135M2 COIL OHMS 915	2PDT	2A DC Res .5A DC Ind 1A-AC Low Level	10^5 at 2A DC at 1A AC 10^6	Size .80 × .40 × .90 Weight 0.60	50mW Single Coil 75mW Dual Coil	39016/32	150G @ 11ms	30G 3000 Hz	−65C +125C	28-29
3SAF Grid Spaced Micro Crystal Can	 GENERAL ELECTRIC 3SAF5042H1 BLUE BEAD TERMINAL VIEW COIL OHMS 600 MADE IN U.S.A.	2PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC 10^6	Size .80 × .40 × .90 Weight 0.50	300 mW	5757/10	100G @ 11 ms	30G 55-2000 Hz	−65C +125C	30-31
3SAE Crystal Can "S" Header	 GENERAL ELECTRIC MADE IN U.S.A.	2PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × .875 Weight 0.45	330mW	5757/10	100G @ 11ms	20G 55-2000 Hz	−65C +125C	32-33
3SCA Miniature Industrial Relays		2PDT 4PDT 6NO	5A DC Res 2A DC Ind 5A-AC Low Level	10^5 at 5A DC 10^6	1.67 × 1.48 × 2.1 Weight 4.5	600mW				0C +71C	34-35 and DCP 1003
3SBW RF Relay		1PDT	15 Watts RF	2×10^5 at RF	1.150 × .950 × .840 Weight 1.0	250mW			10G 500 Hz	−65C +85C	36-37

*Single-phase load, case not grounded

For additional publications and product information contact:
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Waynesboro, VA 22980, 1-703-949-1471

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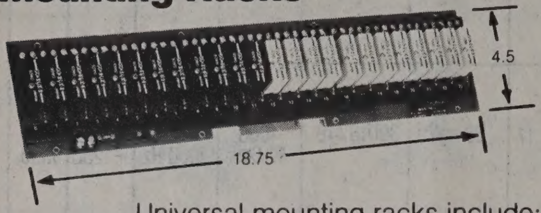
Power I/O Systems

The most versatile I/O system available – also the most complete; Choices of 4, 8, 16, 24 or 32 module mounting racks; three logic voltages; 120 VAC, 240 VAC, 60 VDC, or 200 VDC load voltages; allow maximum flexibility in system design. The first true plug-in system per NEMA ICS2-230.02 simplifies maintenance, installation and modification. Provides power interface & optical isolation between the μP (or other logic) & industrial power.

Mounting Racks



Universal mounting racks include:

- ☐ LED status indicator
- ☐ Plug connection for logic signals
- ☐ UL Recognized, CSA Certified

Instant Delivery From Stock

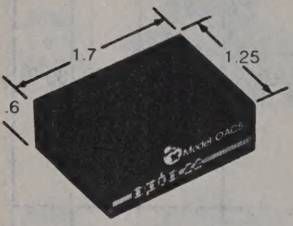
CONTROL VIA BARIER STRIP

PB4	**4 MODULE POSITIONS (INDIVIDUAL**
PB4R	**4 MODULE POSITIONS CONTROL)**
PB16T	**16 MODULE POSITIONS**

CONTROL VIA EDGE CONNECTOR

PB4A	**4 MODULE POSITIONS**
PB8	**8 MODULE POSITIONS**
PB16A	**16 MODULE POSITIONS**
PB16C	**16 MODULE POSITIONS-EXTRA BARRIER STRIP**
PB24	**24 MODULE POSITIONS**
PB24Q	**24 MODULE POSITIONS**
PB32DEC	**32 MODULE POSITIONS-CONNECTS TO DEC LSI 11**

I/O Modules



- ☐ 4000 V Optical Isolation
- ☐ Built-in Snubbers on AC output
- ☐ Zero Cross Switching on AC output
- ☐ UL Recognized, CSA Certified
- ☐ High Transient Immunity

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OUTPUT MODULES

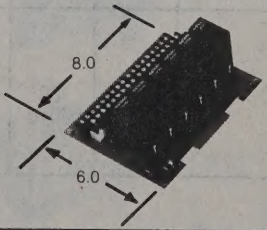
MODEL	DC Logic Voltage	Power Voltage	Power Current Rating Amps	1 Cycle Surge Rating Amps Peak
OAC5	5	12-140 VAC	3	80
OAC5A	5	24-280 VAC	3	80
ODC5	5	2-60 VDC	3	5
ODC5A	5	2-200 VDC	1	5
OAC5A5*	5	24-280 VAC	3	80
OAC15	15	12-140 VAC	3	80
OAC15A	15	24-280 VAC	3	80
ODC15	15	2-60 VDC	3	5
ODC15A	15	2-200VDC	1	5
OAC24	24	12-140 VAC	3	80
OAC24A	24	24-280 VAC	3	80
ODC24	24	2-60 VDC	3	5
ODC24A	24	2-200 VDC	1	5

*Normally closed

INPUT MODULES

MODEL	DC Logic Voltage	Power Voltage
IAC5	5	90-140 VAC/DC
IAC5A	5	180-280 VAC/DC
IDC5	5	10-32 VDC/AC
IDC5B	5	4-16 VDC HIGH SPEED
IAC15	15	90-140 VAC/DC
IAC15A	15	180-280 VAC/DC
IDC15	15	10-32 VDC/AC
IAC24	24	90-140 VAC/DC
IAC24A	24	180-280 VAC/DC
IDC24	24	10-32 VDC/AC

Quad Pak™ High Density Power I/O Modules



Instant Delivery From Stock

MODEL	Power Voltage	Power Current Rating Amps	1 Cycle Surge Rating Amps Peak
OAC5Q	12-280 VAC	3	80
ODC5Q	2-60 VDC	3	5

Note: All Quad Pak® input & output modules operate with 5 VDC logic.

MODEL	Power Voltage
IAC5Q	90-140 VAC/DC
IAC5AQ	180-280 VAC/DC
IDC5Q	10-32 VDC/AC
IDC5BQ	4-16 VDC HIGH SPEED

The OPTO 22 Direct Connection to Commonly Used Host Computers and Buses

OPTO 22 offers cables and/or adapter boards to facilitate connection to a wide variety of host computers and buses.

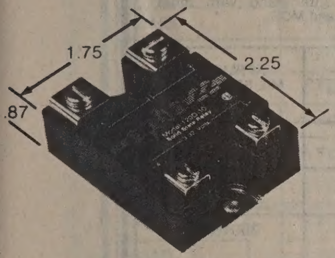
CIMBUS
EXORBUS
IEEE 488
MULTIBUS
STD BUS
S-100 BUS
Q BUS
UNIBUS
VME BUS
APPLE II
DEC FALCON
IBM PC/SERIES 1
RCA MICROBOARD
ROCKWELL AIM/SBC
TI 990 SERIES

For More Information. Circle No. 378

Optically Isolated SSRs

- ☐ TTL Compatible Control
- ☐ 4000 V Optical Isolation
- ☐ UL Recognized, CSA Certified
- ☐ Zero Cross Switching for low noise
- ☐ Intergal snubber–tested twice at Rated & Surge Current for both resistive load & 0.5 power factor inductive load.

Power Series–AC Load†



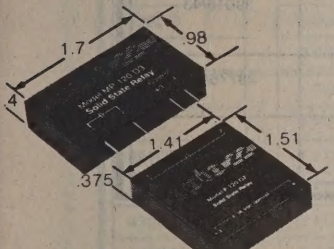
Chassis mount, heavy duty power relays utilizing two SCRs & the most advanced heat transfer design.

Instant Delivery From Stock

Output Current Rating Amps	Output Voltage Rating* 120 VAC	240 VAC	1 Cycle Surge (Amps) Peak	Control Voltage
3	120D3	240D3	55	3-32 VDC
10	120D10	240D10	110	3-32 VDC
25*	120D25	240D25	250	3-32 VDC
45*	120D45	240D45	650	3-32 VDC
10	120A10	240A10	110	85-280 VAC
25*	120A25	240A25	250	85-280 VAC
45*	120A45	240A45	650	85-280 VAC

*Also available with 380 VAC rating

PC Board Series–AC Load†

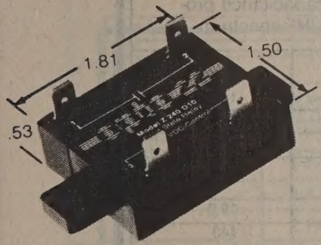


Two optimized configurations–the thin P series for edge stacked cards and the MP series where a small footprint is required.

Instant Delivery From Stock

Output Current Rating Amps	Output Voltage Rating 120 VAC	240 VAC	1 Cycle Surge (Amps) Peak	Control Voltage
2	MP120D2	MP240D2	20	3-24 VDC
4	MP120D4	MP240D4	85	3-24 VDC
2	P120D2	P240D2	20	3-32 VDC
4	P120D4	P240D4	85	3-32 VDC

Liberator Z Series



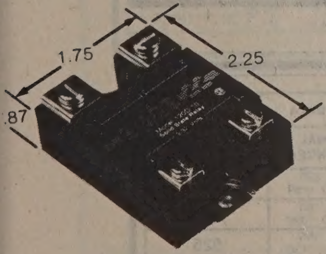
Designed for high volume the best buy in solid state relays.

Proof that quality does not have to cost more.

Instant Delivery From Stock

Output Current Rating Amps	Output Voltage Rating 120 VAC	240 VAC	1 Cycle Surge (Amps) Peak	Control Voltage
10	Z120D10	Z240D10	110	3-32 VDC

480 Volt Transient Proof High Voltage Power Series



Advanced design provides transient immunity to 2000 volts!

Instant Delivery From Stock

Current Rating Amps	Output Voltage Rating 480 VAC	1 Cycle Surge (Amps) Peak	Control Voltage
10	480D10-12	110	3-32 VDC
15	480D15-12	150	3-32 VDC
10	480A10-12	110	85-280 VAC

†DC Load Relays - Also Available

opto 22

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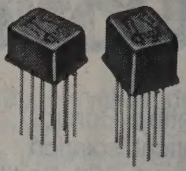
For More Information. Circle No. 378

TELEDYNE RELAYS

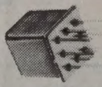


Centigrid® Military Relays

- **General purpose 114 Series**
- **Sensitive 134 Series**
- **CMOS compatible 116C/136C Series**

The centigrid series relays are subminiature, hermetically sealed relays featuring, low profile, .275" (6.99mm) high by .370" (9.4mm) square, with .100" grid spaced terminals. Sensitive versions, 134 and 136C are .375" (9.5mm) high and feature ultra-low coil power dissipation. All-welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low inter-contact capacitance provide RF switching capability well into the UHF spectrum. Teledyne 114 Series and 134 Series are qualified to L, M and P levels of MIL-R-39016. The 116 C and 136C Series are qualified to L and M levels of MIL-R-28776 and incorporate an N-channel enhancement mode MOSFET chip which enables direct relay interfacing with most Microprocessor and IC logic families (CMOS, TTL and MOS).

SERIES*	CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL.-R-
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE	NOMINAL RESISTANCE	NOMINAL OPERATING POWER (MW) AT RATED VDC	
114	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/17
114D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/18
114DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	39016/19
134	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200	39016/41
134D	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200	39016/42
134DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200	39016/43
116C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	28776/6
136C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200	200	28776/7



Low Cost 172 Series
Centigrid® Commercial/Industrial Relays

Low cost commercial versions of the DPDT MIL qualified centrigrid® relays. Hermetic sealing, all welded construction, and gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum.

	GENERIC PART NUMBERS	172-5 172D-5	172-12 172D-12	172-26 172D-26
Coil Voltage (VDC)	Nom.	5.0	12.0	26.5
	Max.	5.8	16.0	32.0
Coil Resistance (ohms ± 20%)		62	400	1600
Pick-up Voltage (VDC, Max.) Pulse Operation		4.0	9.4	19.0
Coil Operating Power at Nominal Voltage (Milliwatts)		405	360	440
Diode P.I.V. (VDC, min.) 172D		100		
Negative coil transient (VDC, max.) 172D		2.0		

High Environmental Military TO-5 Relays

Designed to withstand severe environmental conditions of shock, vibration, or elevated temperature in excess of normal military specification levels. The following versions are available, all of which meet other requirements of MIL-R-39016:

412H Series-High Temperature (200°C)
412K Series-High Shock (4000 g's/0.5ms)
412V Series-High Vibration (100 g's to 2000 Hz)

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING* (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (MW) AT RATED VDC
412H	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
412K	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 80, 160, 300, 600, 1350	500
412V	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 70, 155, 235, 610, 1130	525

TELEDYNE RELAYS

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TELEDYNE RELAYS

Military TO-5 Relays

SERIES		CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL.-R-
		ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (MW) AT RATED VDC	
411		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	39016/7
411D		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	39016/23
411DD		1 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 2000	300	39016/24
411T		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	28776/5
412		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/9
412D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/15
412DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	39016/20
412T		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	28776/1
431	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	39016/10
431D		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	39016/25
431DD		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	100, 200, 630, 1025, 2300, 4000, 6500, 11000	150	39016/26
431T		1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	28776/4
432		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	39016/11
432D		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	39016/16
432DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 850, 1600, 3300, 6500, 11000	200	39016/21
432T		2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	28776/3
421	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/8
421D		1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/27
421DD		1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290	39016/28
420/422		2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/12
420D/422D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/29
420DD/422DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290	39016/30

Commercial/Industrial TO-5 Relays

SERIES		CONTACT DATA		COIL DATA		
		ARRANGEMENT	MAX. RATING** (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (MW) AT RATED VDC
712		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712TN		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
732	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732TN		2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
720/722	MAG LATCH	2 FORM C MAGLATCH	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
720D/722D		2 FORM C MAGLATCH	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

TELEDYNE RELAYS

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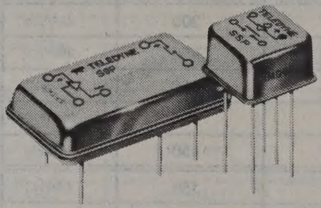
TELEDYNE SOLID STATE PRODUCTS

Military Solid State Switching Hybrids

Note: All military solid state switching hybrids are available to the screening and testing requirements of MIL-R-28750, MIL-STD-883 and MIL-M-38510.

M85F/M90F Series — Power FET AC/DC Hybrids — Optically Isolated Short Circuit Protected — Radiation Tested — High Speed

- **TTL/CMOS Compatible**
- **3.8 to 32 VDC Input Control Range**



- **Meet MIL-STD-704 Power Requirements**
- **MIL-HDBK-217D MTBF: Up to 4.1 × 10^6 hrs.**

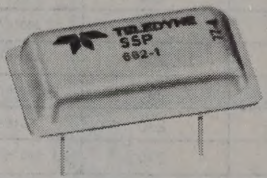
Patent Pending

TELEDYNE PART NO.	MAXIMUM OUTPUT VOLTAGE	ON RESISTANCE TYP. (OHMS)	MAXIMUM LOAD CURRENT (25°C)
M90F-1	80 Volts DC	0.60	0.56 DC Amps
M90F-2	80 Volts DC	0.30	1.00 DC Amps
M91F-1	±80 Volts Peak	1.2	0.40 Amp (RMS)
M91F-2	±80 Volts Peak	0.60	0.70 Amp (RMS)
M85F-1	80 Volts DC	0.60	0.75 DC Amps
M85F-2	80 Volts DC	0.30	1.35 DC Amps
M86F-1	±80 Volts Peak	1.2	0.54 Amp (RMS)
M86F-2	±80 Volts Peak	0.60	0.95 Amp (RMS)
M93F-1	100 Volts DC	4.0	0.35 DC Amps
M93F-2	400 Volts DC	25.0	0.135 DC Amps
M92F-1	±400 Volts Peak	50.0	0.09 Amp (RMS)
M92F-2	±200 Volts Peak	20.0	0.18 Amp (RMS)
M92F-3	±100 Volts Peak	8.0	0.24 Amp (RMS)
M85VF-1	80 Volts DC	0.60	0.75 DC Amps
M85VF-2	80 Volts DC	0.30	1.35 DC Amps

Contact factory for models available with short circuit protection.

680 Series — Bipolar AC and DC Solid State DIP Hybrids — Optically Isolated — Radiation Tested

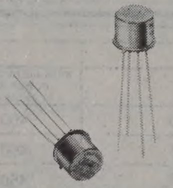
QPL Qualified to MIL-R-28750



- **TTL Compatible Input**
- **MIL-HDBK-217D MTBF: 5.2 × 10^6 hrs.**

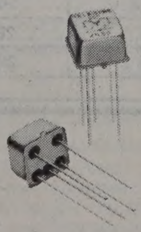
PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT RATING	APPLICABLE MIL SPEC
682-1 (M28250/9)	3.8-32 VDC	1A/250VAC (45-440Hz)	MIL-R-28750/9-001
683-1	3-15 VDC	600mA/50VDC	MIL-R-28750/8

M640 Series — QPL Qualified to MIL-R-28750 Radiation Tested — Fast Switching Speed



MILITARY PART NUMBER	TELEDYNE PART NUMBER	OUTPUT RATING (@ MAX. INPUT VOLTAGE)
M28750/5-001	M640-1W	40V/50MA Peak (bipolar, AC or DC)
M28750/6-001	M643-1W	40 VDC/250 MA
M28750/7-001	M643-2W	250 VDC/100 MA

4N50 Military OPTO-Isolator Radiation Tested



PERFORMANCE FEATURES	
Isolation	1500 VRMS
Transfer Ratio	140%
Output Voltage	40V min.

Packaged in a low profile hermetically sealed case, .275″ (6.98mm) high by .370″ (9.4mm) square, with pin-out on .100″ grid centers for ease of pc board layout. Employing unique construction techniques developed for Teledyne hybrids. The miniature 4N50 provides the highest input/output isolation available in a military style optical isolator.

Meets DOD Radiation Requirements for Avionics and Ground Systems Applications

TELEDYNE SOLID STATE PRODUCTS

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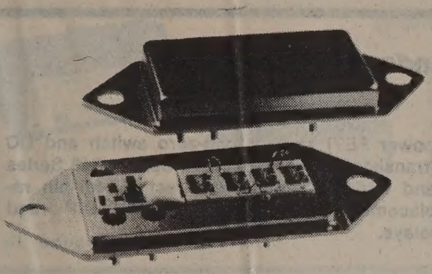
TELEDYNE SOLID STATE PRODUCTS

Military Power Modules

M33/M33S Series — 5 Amp, 80 VDC Power Hybrid Short Circuit Protected — Optically Isolated



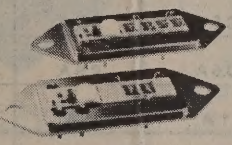
- TTL compatible input
- Meets MIL-STD-704 power requirements
- Low profile 22-pin military DIP

The M33 is a military style high power DC switching hybrid, packaged in a low profile hermetically sealed case. The input and output are optically isolated to protect TTL compatible input logic circuits from output voltage transients.

SHORT CIRCUIT PROTECTION

Teledyne Solid State Products has developed a revolutionary technique to provide the M33S with integrated short-circuit protection. This short-circuit protection is provided whether switching into a dead short or shorting the relay while under load. In either case, the unit will sense the short-circuit condition and shut down. The M33S will then block the short-circuit condition indefinitely until the short is removed and the unit is reset by cycling the input control.

M30/M31 Series — Single Pole Double Throw AC/DC Power FET Output — Optically Isolated



- SPDT break-before-make
- Low on-resistance (0.15 Ω)

The M30 & M31 are military style SPDT high power AC/DC switching hybrids, packaged in a 22-pin low profile hermetic case.

The hybrids are optically isolated to protect delicate input logic circuits from output voltage transients. The logic input is a CMOS gate which is directly compatible with CMOS logic and TTL logic.

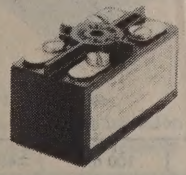
Teledyne Part No.	Maximum Output Voltage	Maximum Load Current (25°C)
M30-1	± 80 VAC	4.1 Amps AC
M30-2	±180 VAC	2.6 Amps AC
M30-4	±380 VAC	1.3 Amps AC
M31-1	80 VDC	4.8 Amps DC
M31-2	180 VDC	3.0 Amps DC
M31-4	380 VDC	1.5 Amps DC
M31-1A	80 VDC	8.2 Amps DC
M31-2A	180 VDC	5.2 Amps DC
M31-4A	380 VDC	2.6 Amps DC

602-1 10 Amp/220 VAC

Optically Isolated

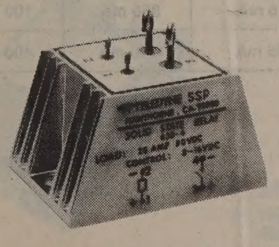
- TTL Compatible Input
- Zero-Voltage Turn on

Radiation Tested



INPUT (CONTROL) VOLTAGE RANGE	OUTPUT CURRENT RATING	OUTPUT VOLTAGE RATING 45-440 Hz	
		CONTINUOUS VAC (RMS)	TRANSIENT PEAK
3.8-32 VDC	10 AMP	220	460

652 Series — 25 Amp/250 VAC — QPL'D — M28750/10
653 Series — DC Power FET Output — 35 Amps



652 Series: Patent #4,339,670

The Series 652 and 653 are military style power relays packaged in a hermetically sealed thermally efficient aluminum case, which withstands military and aerospace environments. Both units are S.P.S.T. normally open. They feature Logic Compatible drive circuits, zero voltage switching (652), snap-action turn on (653), and utilize Inverse/Parallel SCRs (652), Darlington Transistors (653-1), and power MOSFET devices (653-4 and 653-5) for output switching. The power MOSFET 653 Series provides on-resistances as low as 0.03 ohms for minimum power dissipation and voltage drop.

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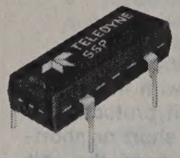
TELEDYNE SOLID STATE PRODUCTS

SERENDIP® Commercial/Industrial DIP Solid State Relays

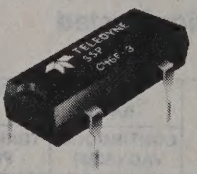
Subminiature Solid State Relays in Standard DIP Packages



Features all solid state circuitry with hybrid microcircuit construction, and high input/output isolation (up to 2500 Volts/10⁹ Ohms). Fourteen models available providing choice of output. Bidirectional (AC or DC), AC (thyristor/power FET) zero or non-zero switch and DC (transistor/power FET). 640 Series, 643 Series and C46/47 Series are direct pin-for-pin replacements for standard T0-116 DIP reed relays.

	INPUT DATA		COUPLING		OUTPUT (LOAD) RATINGS*		
					CURRENT		
PART NUMBER	VOLTAGE (VDC)	MAX. CURRENT (MADC @ 5V)	TRANS-FORMER OPTICAL	AC/DC	@ MAX. INPUT VOLTAGE	@ 5V INPUT	VOLTAGE
640-1	4-10	22	Trans	BIDIRECTIONAL (AC or DC)	±80 mA	±40 mA	±50 V PEAK
641-1	4-10	16	Trans	AC	0.5 A	0.5 A	140 VRMS/ 200 V PEAK
641-2	4-10	16	Trans	AC	0.5 A	0.5 A	250 VRMS/ 400 V PEAK
645-1/645V-1	3.8-32	12/15	Opto	AC (Z. SW)	1 A	1 A	140 VRMS/ 200 V PEAK
645-2/645V-2	3.8-32	12/15	Opto	AC (Z. SW)	1 A	1 A	250 VRMS/ 400 V PEAK
645-2H/645V-2H	3.8-32	12/15	Opto	AC (Z. SW)	1 A	1 A	250 VRMS/ 550 V PEAK
643-1	3.8-10	15	Trans	DC	400 mA	200 mA	60 VDC
643-2	3.8-10	15	Trans	DC	100 mA	50 mA	250 VDC
643-3	3.8-10	15	Trans	DC	600 mA	250 mA	130 VDC

*Output current ratings without heat sink



Serendip Power FET Relays

C46F-3	3.8-16	12	Opto	AC or DC	90 mA	100 mA	±400 V PEAK
C46F-2	3.8-16	12	Opto	AC or DC	180 mA	200 mA	±200 V PEAK
C46F-1	3.8-16	12	Opto	AC or DC	225 mA	250 mA	±100 V PEAK
C47F-1	3.8-16	12	Opto	DC	315 mA	350 mA	100 VDC
C47F-2	3.8-16	12	Opto	DC	125 mA	140 mA	400 VDC

Notes:

1. 641 and 645 Series, UL recognized — File #E55197.
2. 645V models meet VDE creepage and dielectric strength requirements.
3. 645 Series meets VDE and FCC Class A conducted emission limits.
4. 645 Series, Patent #4,339,670.
5. C46/C47 Series, Patent #3,791,025.

TELEDYNE SOLID STATE PRODUCTS

12525 Daphne Ave., Hawthorne, California 90250 • Telephone (213) 777-0077

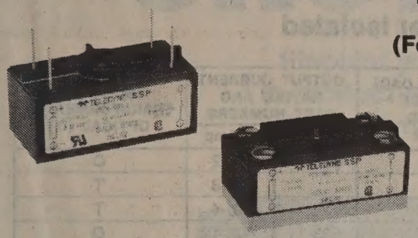
Detailed specifications on any of our products or a complete catalog are available on request.

For More Information. Circle No. 379

TELEDYNE SOLID STATE PRODUCTS

Solid State Commercial/Industrial AC Power Relays

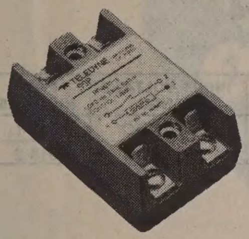
601 Series — Optically Isolated, Zero Voltage Turn-On 5 and 10 Amps (Formerly 601 - 1401 thru -1404)



UL Recognized — File #59547

INPUT (CONTROL) VOLTAGE	OUTPUT VOLTAGE RATING		OUTPUT (LOAD) CURRENT RATING & PART NUMBERS	
	CONTINUOUS VAC (RMS)	TRANSIENT VAC (PEAK)	5 AMP	10 AMP
3.8-32 VDC	250	500	601-1	601-2
	250	650	601-1H	601-2H

611 Series — Optically Isolated, Zero Voltage Turn-On 10 to 40 Amps

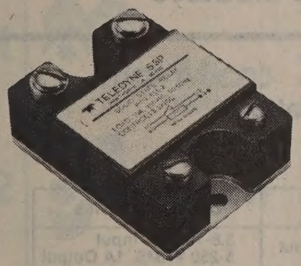


UL Recognized — File #E55197
CSA Certified — File #31043

INPUT (CONTROL) VOLTAGE	OUTPUT VOLTAGE RATING		OUTPUT CURRENT RATING AND PART NUMBERS			
	CONTINUOUS (RMS)	TRANSIENT (PEAK)	10 AMP	15 AMP	25 AMP	40 AMP
3-28 VDC	140	250	611-7*	611-3	611-1	611-5
	250	500	611-8*	611-4	611-2	611-6
	250	650	611-8H*	611-4H	611-2H	611-6H
90-250 VAC (47-70 Hz)	140	250	611-17	611-13	611-11	611-15
	250	500	611-18	611-14	611-12	611-16
	250	650	611-18H	611-14H	611-12H	611-16H

*Available in N/C (Form B) configuration, with "B" suffix (e.g., 611B-7).

C15, 615, 615 V Series — Optically Isolated, Zero Voltage Turn-On 10, 25, and 40 Amps



615 Series

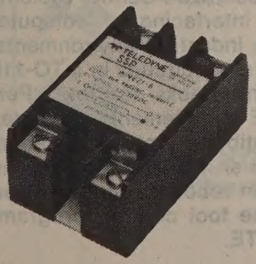
CSA Certified
File #LR31043-11
#LR31043-8
UL Recognized
File #E55197

- **TTL Compatible**
- **High Dielectric Isolation**
- **VDC Versions Available**

Control	OUTPUT (LOAD) CURRENT RATING & PART NUMBER			OUTPUT VOLTAGE RATING (VAC)	
	10 AMP	25 AMP	40 AMP	Continuous (RMS)	Transient (PEAK)
3-32 VDC (615) 3.8-32 VDC (615 V)	615-1	615-3	615-5	140	250
	615-2*	615-4*	615-6*	250	400
	615-2H*	615-4H*	615-6H*	250	600
3.8-32 VDC	C15DS-V-AR44-25 (25 AMPS)			440	800
	C15DS-V-AR44-40 (40 AMPS)			440	800

*615V models meet VDE creepage and dielectric strength requirements.

621 Series — High Voltage, Optically Isolated, Zero Voltage Turn-On



- **CSA Certified File #LR31043-10**
- **UL Recognized File #E55197**
- **3750 VRMS Isolation**
- **High Voltage Output 480 VRMS, 800 V Peak**

Designed to meet safety requirements of UL, CSA, VDE and IEC and dielectric requirements of VDE.

INPUT VOLTAGE RANGE	OUTPUT (LOAD) CURRENT RATING & PART NUMBERS		
	15 AMP	25 AMP	40 AMP
3-14 VDC	621-1*	621-3*	621-5*
12-32 VDC	621-2*	621-4*	621-6*
90-250 VAC (45-70 Hz)	621-11	621-13	621-15

TELEDYNE SOLID STATE PRODUCTS

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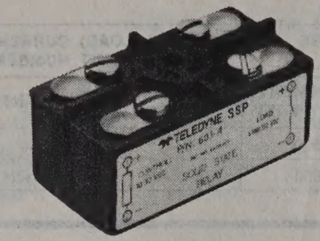
TELEDYNE SOLID STATE PRODUCTS

Solid State Commercial/Industrial DC Power Relays

603 Series — Optically/Transformer Isolated


TELEDYNE SSP
P/N 603-4
SOLID STATE RELAY
LOAD

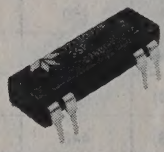
INPUT VOLTAGE RANGE	OUTPUT (LOAD) VOLTAGE RATING (VDC)	OUTPUT CURRENT RATING AND PART NUMBERS		ISOLATION TRANSFORMER (T) OPTICAL (O)
		2 Amp	5 Amp	
3-32 VDC	50	603-1	603-2	O
4-10 VDC	250		603-3	T
10-32 VDC	250		603-4	T
90-250 VAC	50	603-11	603-12	O
3-32 VDC	50	603-21	603-22	O
		WITH CONTROLLED RISE AND FALL TIME		

613 Series — High Current, Transformer Isolated

OUTPUT VOLTAGE	OUTPUT CURRENT RATING	INPUT VOLTAGE RANGE	PART NUMBERS
50 VDC	20 Amps	4-10 VDC	613-1
		10-32 VDC	613-2

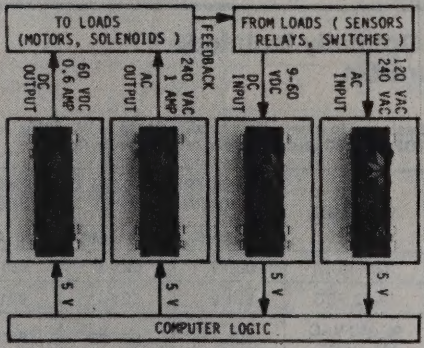
Solid State Computer Input/Output Interface Modules

C76 Hybrid DIP I/O™ System
Optically Isolated — CMOS and TTL Compatible



- **Enable Function on Inputs**
- **High Noise Immunity**
- **Meets VDE Voltage and Spacing Requirements**
- **TO-116 DIP Package (16 pin)**

PART NUMBER	TYPE	CHARACTERISTICS
C76AO-1	AC Output	3.8-16 VDC Input 5-250 VRMS, 1A Output
C76AI-1	AC Input	90-135 VRMS and 180-250 VRMS Inputs
C76DO-1	DC Output	3.8-16 VDC Input 3-16 VDC, 0.6A Output
C76DI-1	DC Input	9-60 VDC Input


TO LOADS (MOTORS, SOLENOIDS)
FEEDBACK
FROM LOADS (SENSORS RELAYS, SWITCHES)
DC OUTPUT
60 VDC 0.6 AMP
AC OUTPUT
240 VAC 1 AMP
DC INPUT
9-60 VDC
AC INPUT
120 VAC 240 VAC
5 V
5 V
5 V
5 V
COMPUTER LOGIC

Teledyne Solid State C76 DIP I/O™ Modules are designed for use in computerized Control systems for noise-free isolated interfacing of computer logic elements to harsh industrial environments. Modules employ custom microcircuits in a TO-116 DIP. Eliminates mounting tracks for low "Per-point" cost. Meets VDE requirements. Features CMOS and TTL compatibility, optical isolation, high noise immunity and an ENABLE function on input modules. For use in robotics, computerized process control, machine tool control, programmable controllers and ATE.

TELEDYNE SOLID STATE PRODUCTS

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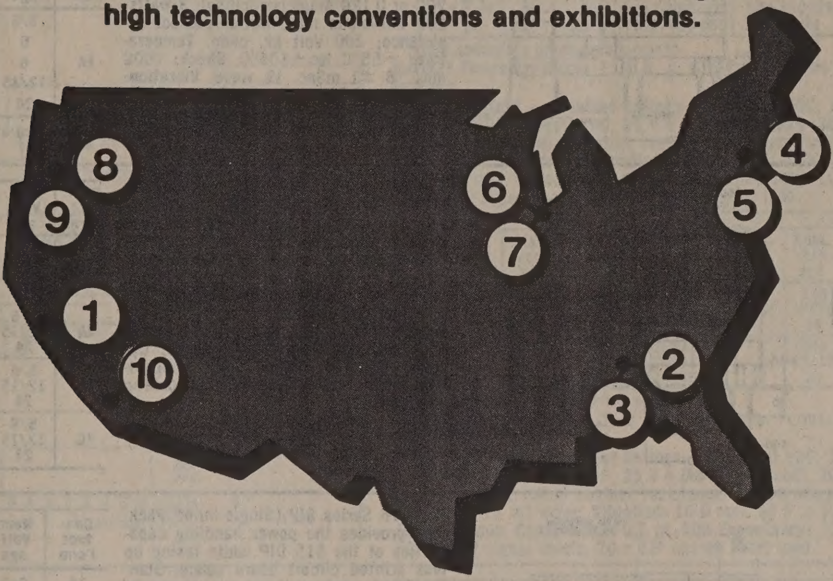

1 **Mini/Micro West** — February 5, 6, 7, 1985
Anaheim Hilton Exposition Center
Anaheim, California

2 **Southcon** — March 5, 6, 7, 1985
Georgia World Congress Center
Atlanta, Georgia

3 **Mini/Micro Southeast** — March 5, 6, 7, 1985
Georgia World Congress Center
Atlanta, Georgia

4 **Electro** — April 23, 24, 25, 1985
New York Coliseum
New York

5 **Mini/Micro Northeast** — April 23, 24, 25, 1985
Albert Hall,
New York

6 **Midcon** — September 10, 11, 12, 1985
Rosemont Exposition Center
Chicago, Illinois

7 **Mini/Micro Midwest** — September 10, 11, 12, 1985
Rosemont Exposition Center
Chicago, Illinois

8 **Northcon** — October 22, 23, 24, 1985
Portland Memorial Coliseum
Portland, Oregon

9 **Mini/Micro Northwest** — October 22, 23, 24, 1985
Portland Memorial Coliseum
Portland, Oregon

10 **Wescon** — November 19, 20, 21, 22, 1985
Anaheim Convention Center
Anaheim, California

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Telephone: 213/772-2965 • Telex: 181350

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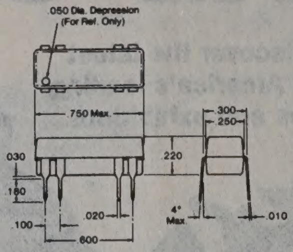
WABASH RELAY & ELECTRONICS DIVISION

DIP PACKAGE DRY REED RELAYS 814 SERIES


.050 Dia. Depression (For Ref. Only)
.750 Max.
.300
.250
.220
.030
.180
.100
.020
.600
4° Max
.010

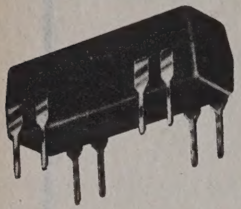
The 814 Series offers dry reed reliability and total isolation in a low profile IC type package, with DTL/TTL compatible coil drive available in most configurations.

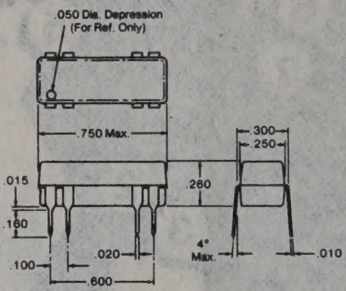
SPECIFICATIONS — Contact Rating: 28 VDC or 0.110 Amps (switching); 3 watts; 200 milliohms max. initial contact resistance; 200 Volt pk. bkdn. **Temperature:** −55°C to +105°C. **Shock:** 100G max., 8 ±1 mSec. ½ wave. **Vibration:** 20G @ 10-5000 Hz. **Insulation Resistance:** 10^{10} Ohms min. **Capacitance:** 0.2 pf. **Operate Time (Typical):** to 0.5 mSec. **Release Time (Typical):** 0.1 mSec. **Life Expectancy:** 50 x 10^6 operations at signal level; 1 x 10^6 operations at rated load.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	16	365	814-101-01
	5	19	500	814-102-01
	6	19	500	814-103-01
	12/15	24	800	814-104-01
	24	30	1250	814-105-01

▲ Measured at 25°C.

815 SERIES

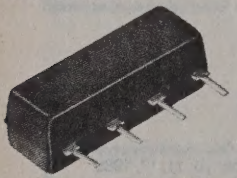


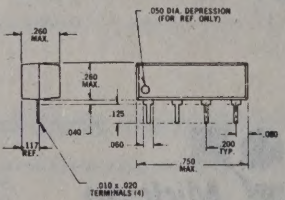

.050 Dia. Depression (For Ref. Only)
.750 Max.
.300
.250
.015
.260
.180
.100
.020
.600
4° Max.
.010

The 815 Series, with a profile slightly higher than the 814, offers increased versatility while maintaining the DIP package approach to hi-density printed circuit applications. Standard part numbers listed are subject to specifications shown for the 814 Series, however, the 815 has the capacity to offer dry reed switches to ½ Amp rating plus up to a 200 VDC max. switching voltage. Optional features include diode suppression, magnetic shielding and electrostatic shielding.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	14	200	815-101-01
	5/6	19	500	815-102-01
	12/15	19	500	815-103-01
	24	40	2150	815-104-01
2A	5/6	14	200	815-201-01
	12/15	19	500	815-202-01
	24	38	2000	815-203-01
1B	5/6	7	200	815-221-01
	12/15	16	500	815-222-01
	24	32	2000	815-223-01
1C	5/6	8	80	815-241-01
	12/15	19	500	815-242-01
	24	38	2000	815-243-01

816 SERIES

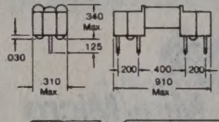


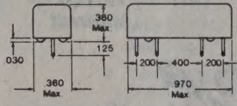

.050 DIA. DEPRESSION (FOR REF. ONLY)
.260 MAX.
.260 MAX.
.125
.040
.060
.117 REF.
.080
.200 TYP.
.750 MAX.
.010 x .020 TERMINALS (4)

The 816 Series SIP (Single-Inline Package) provides the power handling capabilities of the 815 DIP while taking up less printed circuit board space. Standard part numbers listed are subject to specifications shown for the 814 Series; however, the 816 has the capacity to offer dry reed switches with ratings to 0.5 amps and 200 VDC. Optional features include diode suppression and magnetic shielding.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A SPST NO	5/6	14	200	816-101
	5/6	19	500	816-102
	12/15	19	500	816-103
	24	40	2150	816-104
1B SPST NC	5/6	7	200	816-221
	12/15	16	500	816-222
	24	32	2000	816-223

802/803 SERIES

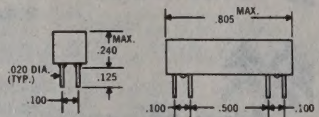

.340 Max
.125
.030
.310 Max
.200
.400
.200
.910 Max

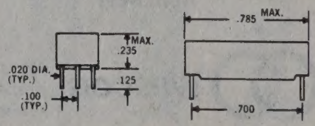

.360 Max
.125
.030
.360 Max
.200
.400
.200
.970 Max

The 802 and 803 are sub-miniature reed relays in a Single-Inline package. They are both available in a 1 Form A configuration and are P.C. mountable. Contact ratings of 200 volts DC with total power handling of 10 watts is standard.

Contact Form	Nominal Voltage	Coil Resistance ±10%▲	Part Number
1A	5/6	500	802-101
	12/15	500	802-102
	24	2000	802-103
	5/6	125	802-104
Enclosed 1A	5/6	500	803-101
	12/15	500	803-102
	24	2000	803-103
	5/6	125	803-104

SUB-MINIATURE RR 804/806 SERIES


.805 MAX.
MAX. .240
.125
.020 DIA. (TYP.)
.100
.100
.500
.100

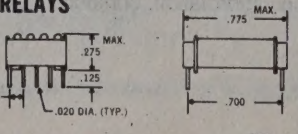

.785 MAX.
MAX. .235
.125
.020 DIA. (TYP.)
.100 (TYP.)
.700

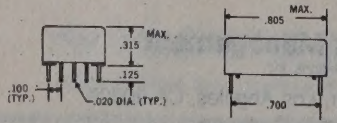
The 804 and 806 sub-miniature reed relays come in a 1 Form A configuration. Both relays are P.C. mountable and are completely enclosed for environmental protection, extended life and easy cleaning. Call Wabash Relay & Electronics for complete details.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 0.5 Amp (switching), 1.0 Amp (carry), 10 Watts DC, 15 V-A (AC suppressed), 250 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^{10} ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 operations at dry ckt.; 50 x 10^6 operations at signal levels; 20 x 10^6 operations at rated load.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	8	60	804-101
	12/15	18	370	804-102
	24	27	950	804-103
1A	5/6	12	500	806-101
	12/15	24	1200	806-102
	24	38	2000	806-103

SUB-MINIATURE DRY REED RELAYS 807/808 SERIES


.775 MAX.
MAX. .275
.125
.100 (TYP.)
.020 DIA. (TYP.)
.700


.805 MAX.
MAX. .315
.125
.100 (TYP.)
.020 DIA. (TYP.)
.700

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1B†	5/6	8	200	807/808-211	1A	5/6	13	350	807/808-101
	12/15	16	800	807/808-212		12/15	24	1200	807/808-102
	24	32	2000	807/808-213		24	39	3200	807/808-103
1C† *	5/6	8	125	807/808-316	2A	5/6	10	200	807/808-201
	12/15	16	500	807/808-317		12/15	20	800	807/808-202
	24	32	2000	807/808-318		24	32	2000	807/808-203

* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3 Pole. Forms A, B, & C.

For More Information. Circle No. 380

wabash

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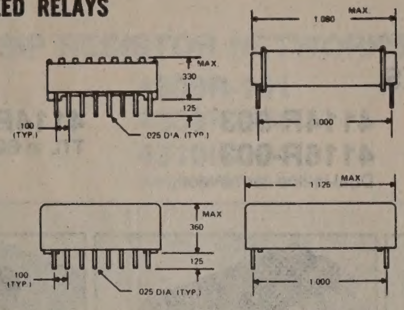
WABASH RELAY & ELECTRONICS DIVISION

MINIATURE DRY REED RELAYS 827/828 SERIES



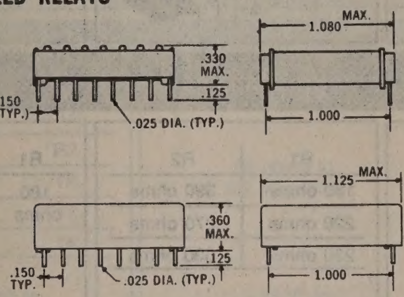
Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	500	827/828-101	1B†	5/6	8	200	827/828-211
	12/15	28	800	827/828-102		12/15	16	800	827/828-212
	24	44	2000	827/828-103		24	32	2000	827/828-213
2A	5/6	14	200	827/828-201	1C† *	5/6	8	60	827/828-316
	12/15	29	800	827/828-202		12/15	16	240	827/828-317
	24	46	2000	827/828-203		24	32	960	827/828-318

* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3, 4, & 6 Poles. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

MINIATURE DRY REED RELAYS 837/838



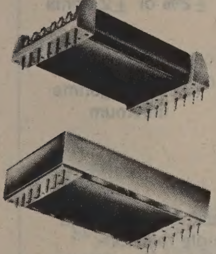
Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	500	837/838-101	1B†	5/6	8	200	837/838-211
	12/15	28	800	837/838-102		12/15	16	800	837/838-212
	24	44	2000	837/838-103		24	32	2000	837/838-213
2A	5/6	14	200	837/838-201	1C† *	5/6	8	60	837/838-342
	12/15	29	800	837/838-202		12/15	16	240	837/838-343
	24	46	2000	837/838-203		24	32	960	837/838-344

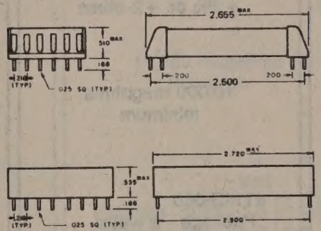
* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3, 4, & 6 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

STANDARD REED RELAYS 842/843 SERIES





Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	150	842/843-101	1B†	5/6	9	100	842/843-209
	12/15	45	600	842/843-102		12/15	18	400	842/843-211
	24	90	2400	842/843-103		24	36	1600	842/843-213
	48	175	9000	842/843-104		48	72	6400	842/843-215
2A	5/6	20	100	842/843-201	1C† *	6	9	100	842/843-311
	12/15	41	400	842/843-202		12	18	400	842/843-315
	24	82	1600	842/843-203		24	36	1600	842/843-319
	48	165	6400	842/843-204		48	72	6400	842/843-323

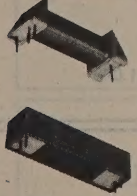
* (1A1B guarantee break-before-make)

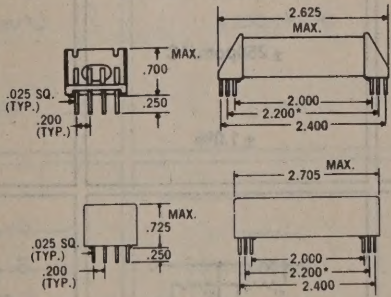
Contact Forms Available: 1, 2, 3, 4, 5, 6, 8, & 12 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: 400 VDC, 250 VAC, 1.5 Amp (switching) 6 Amp (carry), 25 Watts, 40 V-A (AC suppressed) 50 milliohm max. initial contact resistance 500 volts peak breakdown. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max.@ 0-1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 1.5 pf. **Life Expectancy:** Dry ckt., 100 x 10^6 ops; signal level, 50 x 10^6 ops; rated power, 20 x 10^6 ops.

Available to 12 form A. True form C also available.

846/847 SERIES





* Spacing not available in 1 pole package.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	150	846/847-101	1B†	5/6	9	100	846/847-209
	12/15	45	600	846/847-102		12/15	18	400	846/847-211
	24	90	2400	846/847-103		24	36	1600	846/847-213
2A	5/6	20	100	846/847-201					
	12/15	41	400	846/847-202					
	24	82	1600	846/847-203					

Contact Forms Available: 1 & 2 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: 400 VDC, 250 VAC, 1.5 Amp (switching) 6 Amp (carry), 25 Watts, 40 V-A (AC suppressed) 75 milliohm max. initial contact resistance 500 volts peak breakdown. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0-1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 1.5 pf. **Life Expectancy:** Dry ckt., 100 x 10^6 ops; signal level, 50 x 10^6 ops; rated power, 20 x 10^6 ops.

True form C also available.

The relays shown here are just a sampling of the many designs and configurations manufactured by Wabash Relay & Electronics as standard products. We also offer design assistance and custom designed relays through our fully staffed engineering department. Should you require a custom designed relay, here are some parameters to consider:

U.L. and C.S.A. Recognition

Several relay series are recognized under the Component Program of Underwriters' Laboratories. Most of these relays also have C.S.A. recognition. Regardless of which series you are interested in, Wabash Relay can help you obtain the U.L. or C.S.A. recognition your design requires.

Wabash Relay & Electronics Division
1st & Weber Streets, Wabash, Indiana 46992
(219) 563-2191 TWX: 810-290-2722

Prints and specifications, if available, are the best design tool. The minimum information required for Wabash Relay to design a relay is:

Mechanical Specifications

- Maximum length
- Maximum width
- Maximum height above P.C. board
- Pin configuration
- Open or covered
- Type of environment relay will be exposed to
- End Use

Electrical Specifications

- Switch configuration
- Nominal voltage
- Must operate voltage or current
- Must release voltage or current
- Coil resistance
- Switching current
- Contact resistance
- Carry current
- U.L. recognition required
- Special considerations (ESS, low thermal, high insulation resistance, etc.)

For More Information. Circle No. 380

BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

NETWORKS DIVISION, 1400 North 1000 West, Logan, UT 84321
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 • TEL (714) 781-5050

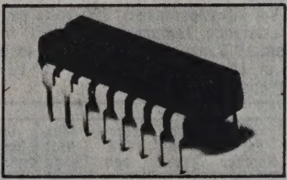
BOURNS® DIP RESISTOR NETWORKS

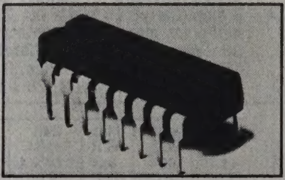
4114R-001
4116R-001
Dual-in-line isolated resistor circuits

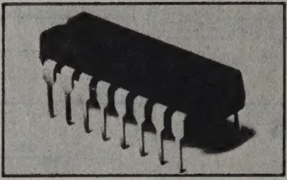
4114R-002
4116R-002
Dual-in-line bussed resistor circuits

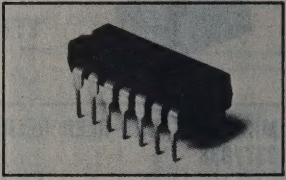
4114R-003
4116R-003
Dual-in-line terminator

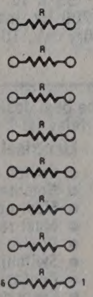
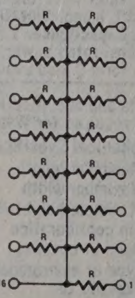
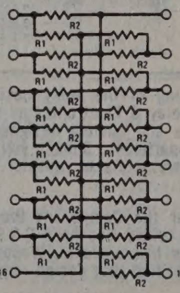
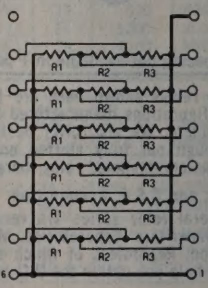
4114R-008
TTL to ECL translator







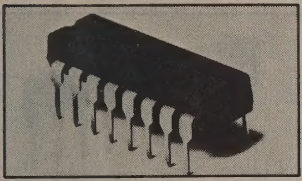
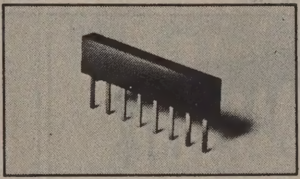
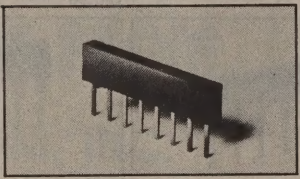
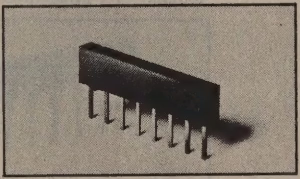
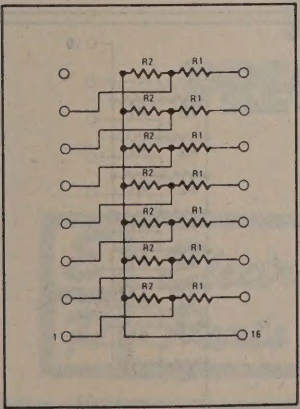
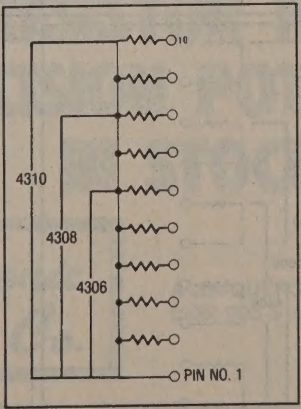
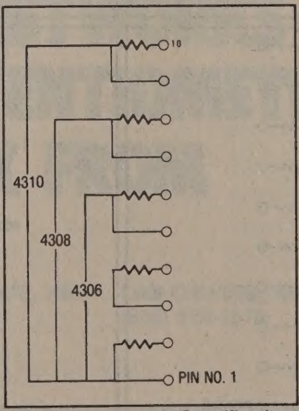
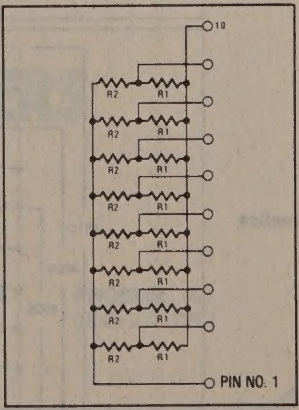


	4114R-001 4116R-001	4114R-002 4116R-002	4114R-003 4116R-003	4114R-008
Resistance Range	22 ohms to 2.2 megohms	22 ohms to 2.2 megohms	R1 / R2 180 ohms / 390 ohms 220 ohms / 270 ohms 220 ohms / 330 ohms	R1 / R2 / R3 180 ohms / 270 ohms / 820 ohms
Operating Temperature	−55°C to +125°C ambient	−55°C to +125°C ambient	−55°C to +125°C ambient	−55°C to +125°C ambient
Resistance Tolerance	±2% or ±2 ohms	±2% or ±2 ohms	±2% or ±2 ohms	±2% or ±2 ohms
Insulation Resistance	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum
Power Rating @ 75°C	(Derating curve) Package 14 pin - 2 watts 16 pin - 2.25 watts Single resistor - 0.25 watt	Package 14 pin - 2 watts 16 pin - 2.25 watts Single resistor - 0.125 watt	4114R-003 Package - 2 watts Resistor pair - .25 watt 4116R-003 Package - 2.25 watts Resistor pair - .25 watt	Package - 2.0 watts Single resistor - 0.125 watt
Temperature Coefficient	±250ppm/°C	±250ppm/°C	±250ppm/°C	±250ppm/°C
Standard Load Life	±1.0%	±1.0%	±1.0%	±1.0%
Schematic (Highest pin configurations shown)				

Custom Resistor Networks are available in both DIP and SIP configurations. Specifications subject to change without notice.

BOURNS INC
1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® SIP RESISTOR NETWORKS

4114R-064 **4116R-064** Logic memory network	**4306R-101** **4308R-101** **4310R-101** Single-in-line bussed	**4306R-102** **4308R-102** **4310R-102** Single-in-line isolated	**4306R-104** **4308R-104** **4310R-104** Single-in-line dual terminator
			
Pass Thru | Pull-Up *R1 | *R2 20 ohms | 1K 30 ohms | 1K 40 ohms | 1K	22 ohms to 2.2 megohms	22 ohms to 2.2 megohms	R1 | R2 180 ohms | 390 ohms 220 ohms | 270 ohms 220 ohms | 330 ohms 3000 ohms | 6200 ohms
−55°C to +125°C ambient	−55°C to +125°C ambient	−55°C to +125°C ambient	−55°C to +125°C ambient
±2% or ±2 ohms	±2% or ±2 ohms	±2% or ±2 ohms	±2% or ±2 ohms
10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum
Package 14 pin - 2 watts 16 pin - 2.25 watts Single resistor - 0.125 watt	6 | 8 | 10 watt Package 0.75 | 1.0 | 1.25 Single resistor 0.2 | 0.2 | 0.2	6 | 8 | 10 watt Package 0.75 | 1.0 | 1.25 Single resistor 0.3 | 0.3 | 0.3	6 | 8 | 10 watt Package 0.75 | 1.0 | 1.25 Resistor pair 0.25 | 0.25 | 0.25
±250ppm/°C	±250ppm/°C	±250ppm/°C	±250ppm/°C
±1.0%	±1.0%	±1.0%	±1.0%
			

*Other values available.

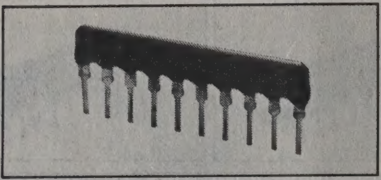
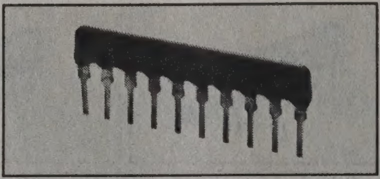
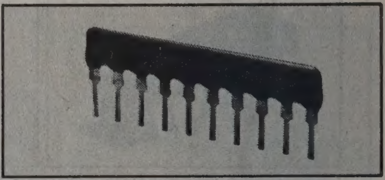
Specifications subject to change without notice.

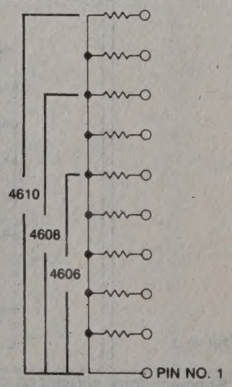
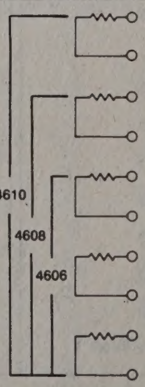
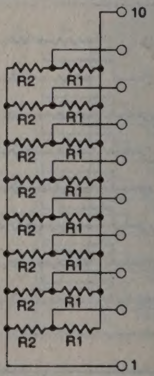
For More Information. Circle No. 381

BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® MODEL 4600 SERIES CONFORMAL COATED SIP NETWORKS

4606X-101 4608X-101 4610X-101 Single-in-line bussed	4606X-102 4608X-102 4610X-102 Single-in-line isolated	4606X-104-R1/R2 4608X-104-R1/R2 4610X-104-R1/R2 Single-in-line dual terminator
		

Resistance Range	22 ohms to 2.2 megohms	22 ohms to 2.2 megohms	R1 | R2 180 ohms | 390 ohms 220 ohms | 270 ohms 220 ohms | 330 ohms 3000 ohms | 6200 ohms
Operating Temperature	−55°C to +125°C ambient	−55°C to +125°C ambient	−55°C to +125°C ambient
Resistance Tolerance	±2% or ±1 ohm	±2% or ±1 ohm	±2% or ±1 ohm
Insulation Resistance	10,000 megohms minimum	10,000 megohms minimum	10,000 megohms minimum
Power Rating @75°C	6 / 8 / 10 watt Package 0.75 | 1.0 | 1.25 Single resistor 0.2 | 0.2 | 0.2	6 / 8 / 10 watt Package 0.75 | 1.0 | 1.25 Single resistor 0.3 | 0.3 | 0.3	6 / 8 / 10 watt Package 0.75 | 1.0 | 1.25 Resistor pair 0.25 | 0.25 | 0.25
Temperature Coefficient	±100ppm/C°	±100ppm/C°	±100ppm/C°
Standard Load Life	±1.0%	±1.0%	±1.0%
Schematics			

For More Information. Circle No. 381

BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

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RN, E Series (±25 ppm/°C.)	MIL-R-10509
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RLR Series (±100 ppm/°C.)	MIL-R-39017

Semi-precision Metal Film

RL Series (±100, ±200 ppm/°C.)	MIL-R-22684
C/CT Series (±100, ±200 ppm/°C.)	COMMERCIAL
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Low-OHM Metal Film

FL and LO Series	COMMERCIAL

Resistor Networks

Conformal SIP	COMMERCIAL
Custom Networks also available	CUSTOM

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CAN	Calgary, Alberta, Future Electronics	403-235-5325
CAN	Vancouver, British Columbia, Future Electronics	604-438-5545
CAN	Downsview, Ontario, Future Electronics	416-663-5563
CAN	Ottawa, Ontario, Future Electronics	613-820-8313
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FL	Fort Lauderdale, Hammond Electronics	305-973-7103
FL	Orlando, Hammond Electronics	305-849-6060
FL	Winter Park, Milgray Electronics	305-647-5747
FL	Altamonte Springs, Schweber Electronics	305-331-7555
FL	Hollywood, Schweber Electronics	305-927-0511
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NJ	Fairfield, Schweber Electronics	201-227-7880
NJ	Hanover, State Electronics Corp.	201-887-2550
NJ	Perth Amboy, Sterling Electronics	201-442-8000
NM	Albuquerque, Bell Industries	505-292-2700
NY	Bohemia, Justin Electronics, Inc.	516-598-4000
NY	Farmingdale, Milgray Elec., Inc.	516-391-3000
NY	Rochester, Schweber Electronics	716-424-2222
NY	Westbury, Schweber Electronics	516-334-7474
NC	Greensboro, Hammond Electronics	919-275-6391
NC	Raleigh, Resco	919-781-5700
NC	Raleigh, Schweber Electronics	919-876-0000
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Cleveland, Milgray Electronics	216-447-1520
OH	Beachwood, Schweber Electronics	216-464-2970
OH	Dayton, Schweber Electronics	513-439-1800
OK	Tulsa, Schweber Electronics	918-622-8000
OR	Lake Oswego, Bell Industries	503-241-4115
OR	Hillsboro, Wyle Distribution Group	503-640-6000
PA	Enola, Almo Electronics Corp.	717-732-3681
PA	Philadelphia, Almo Electronics Corp.	215-698-4000
PA	Pittsburgh, Almo Electronics Corp.	412-931-5990
PA	Philadelphia, Philadelphia Electronics, Inc.	215-568-7400
PA	Horsham, Schweber Electronics	215-441-0600
PA	Pittsburgh, Schweber Electronics	412-782-1600
SC	Greenville, Hammond Electronics, Inc.	803-233-4121
TN	Knoxville, Hammond Electronics, Inc.	615-691-3491
TX	Houston, Hamilton/Avnet Electronics	713-780-1771
TX	Austin, Schweber Electronics	512-458-8253
TX	Dallas, Schweber Electronics	214-661-5010
TX	Houston, Schweber Electronics	713-784-3600
TX	Irving, Force Electronics	214-438-5700
TX	Richardson Wyle Distribution Group	214-235-9953
UT	Salt Lake City, Bell Industries	801-972-6969
UT	Salt Lake City, Wyle Distribution Group	801-974-9953
VA	Richmond, Sterling Electronics	804-226-2190
VA	Charlottesville, Virginia Radio Supply	804-296-4184
WA	Bellevue, Bell Industries	206-747-1515
WA	Bellevue, Wyle Distribution Group	206-453-8300
WI	Waukesha, Bell Industries	414-547-8879
WI	Brookfield, Schweber Electronics	414-784-9020

Corning Electronics...All Systems "Go"!

For More Information. Circle No. 382

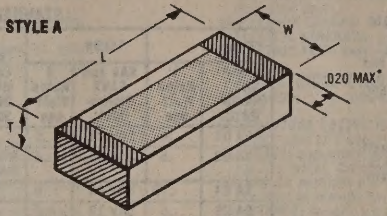
CAL-R® INC.

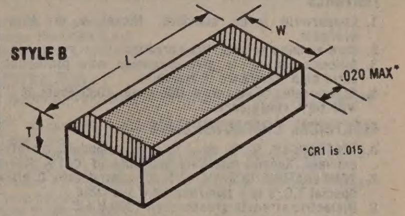
THICK FILM

CERMET CHIP RESISTORS

ELECTRICAL

Resistance Range: 10 ohms to 40 megohms
Tolerance: 1% (F), 2% (G), 5% (J), 10% (K) standard and 20% (M)
Power Rating: 100 Milliwatts CR1, 200 Milliwatts CR2, 250 Milliwatts CR3 and 300 Milliwatts CR4.
Short Time Overload: Less than 0.50%ΔR.
Temperature Coefficient of Resistance: ± 150 ppm standard thru 1 megohm; ± 350 ppm 1.1 megohm thru 10 megohms; ± 50 ppm available 10 ohms thru 100K megohm. All TCR ratings as measured from – 55°C to + 125°C with 25°C reference point.
Standard MIL Decade Values: 10 ohms thru 20 megohms.





*CR1 is .015

SIZE	LENGTH (L) ± .005	WIDTH (W) ± .005	THICKNESS (T) ± .003
CR1	.050	.040	.012
CR2	.075	.050	.016
CR3	.100	.050	.016
CR4	.150	.050	.016
CR5	.225	.075	.016
CR1010	.100	.100	.029
CR1025	.100	.025	.020
CR2010	.200	.100	.020
CR3535	.035	.035	.015
CR5025	.050	.030	.020
CR5050	.050	.050	.020

ENVIRONMENTAL

Operating Temperature: – 55°C to + 125°C.
Moisture Resistance: Less than 1% change when tested per method 106 of MIL-STD 202.
Life: Less than 1% change when tested per method 108D (+ 85°C) of MIL-STD 202.
MIL Specifications: Designed to meet MIL-R-55342 requirements.

CAL-R CHIP NUMBERING SYSTEM

SIZE	TERMINATION		VALUE* (OHMS)	TOLERANCE	TCR
	STYLE	MATERIAL			
CR1	A	A	1002	K	150

*The first two digits represent significant figures; the last digit specifies the number of zeros to follow.
Tolerance code: F –1%, G –2%, J –5%, K –10% & M –20%

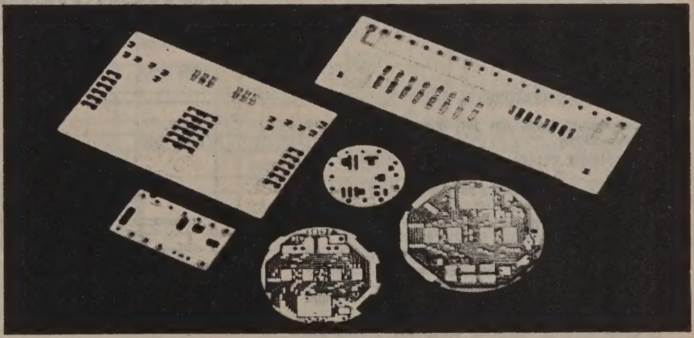
MECHANICAL

Construction: 96% Alumina substrate with proprietary Cermet resistance element and specified termination material.

Terminations: STYLES	MATERIAL	
A 3 sided wrap-around	A Platinum silver	D Platinum silver
B Top Termination	B Platinum gold	E Palladium gold
	C Gold	Solder termination available
		S1 — 60/40 $2 — SN62

PRECISION THICK FILM NETWORKS

Cal-R thick Film Passive Systems develops and produces, to customer requirements, packaged resistor networks including digital to analog A-D binary ladders (through 12 bits), BCD bipolar ladders and custom precision resistor networks.
Cal-R manufactures ceramic substrates for the Digital Watch market and custom R-C networks for hi-rel and commercial applications.
Cal-R thick film resistor compositions fused to a high purity 96% aluminum substrate insure low thermal gradients, high thermal stability and matched electrical characteristics.

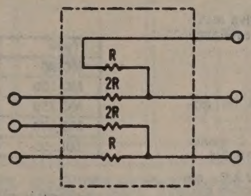


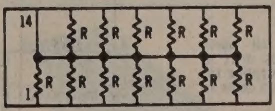
ELECTRICAL SPECIFICATIONS

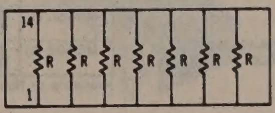
CHARACTERISTICS	DUAL and SINGLE IN-LINE AND FLATPACK RESISTOR NETWORKS	LADDER NETWORKS
Resistance Range	10 ohms to 1 megohm	10 ohms to 1 megohm
Temperature Coefficient	±150 PPM/°C STD ±50 PPM/°C Avail.	±150 PPM/°C STD ±50 PPM/°C Avail.
Tracking to:	15 PPM/°C	5 PPM/°C

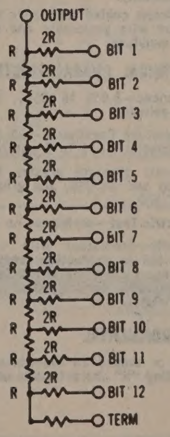
GENERAL SPECIFICATIONS

Operating Temperature Range: – 55 °C to + 125 °C
Storage Temperature Range: – 65 °C to + 150 °C
Stability To: 25 PPM/year
Setting To: 50 nSec.
Fast Rise Time
Minimum size for maximum efficiency and quality.
All networks are 100% inspected to applicable requirements (MIL-Specs or inhouse).
All resistance parameters meet or exceed the performance requirements of MIL-R-55342A when applicable.









CAL-R® INC.

1601 Olympic Blvd., Santa Monica, California 90404 • (213) 450-1761 • TWX 910-343-6966
WIREWOUND RESISTORS • THICK FILM • THERMISTORS

CAL-R INC. WIRE WOUND RESISTORS

PRECISION POWER RESISTORS

FEATURES

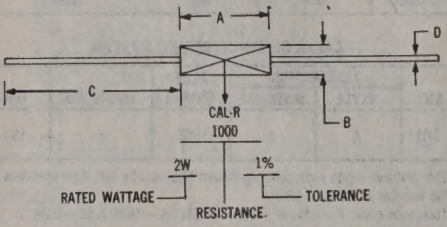
1. Copperweld leads standard. Nickel A or Alloy 180 available.
2. Core-alumina and steatite ceramics.
3. Silicone coating to give maximum wire protection and extra high resistance to moisture.
4. Failure rates of less than .006% per 1000 hours @ +25°C with 60% confidence.

ELECTRICAL CHARACTERISTICS

A. TOLERANCES: 5.0% to .01%. 1% standard for off-shelf delivery. Special matching available to .001% tolerance.
B. TEMPERATURE COEFFICIENT: 20 ppm/degree C standard. Special T.C.'s to 5 ppm/degree C available.
C. Dielectric strength greater than 1000 V.A.C.
D. Special configurations available on request.
E. SA (X) Types Thermal shock proof from 275°C to —55°C.
F. SAV (X) Types Thermal shock proof from 350°C to —55°C.
G. STABILITY: consistent with tolerances, all parts stabilized in production. Less than 0.1% drift in 2000 hours operation at full Cal-R wattage rating for 1% tolerance parts.
H. RESISTANCE RANGES: .05 ohms to 250K ohms.
I. INDUCTIVE TYPES: Single layer space wound with largest wire permissible.
J. Non-inductive Types feature dual balanced windings for minimum inductance.

ENVIRONMENTAL

Meet or exceed applicable paragraphs of MIL-R-26E and MIL-R-39007.



WHEN ORDERING SPECIFY: TYPE, WATTAGE, RESISTANCE AND TOLERANCE.

STANDARD RESISTANCE & TOLERANCE RANGES

*Type		*Type		MIL Equiv. MIL-R-26E & 39007	Dimensions				4 Tolerances & Max. Resistance Based on .0007 Min. Wire Dia.	
SA and SAX (Noninduct)	1 Rated Wattage	SAV and SAVX (Noninduct)	2 Rated Wattage		A ± .062	B ± .032 3	C ± .062	D ± .002	1% & Higher	.5%, .25% .1% & .05%
SA 01	.4	SAV 03	.5		.250	.078	1½	.020 24 Ga.	1.4KΩ	950Ω
SA 02	.5	SAV 06	.6	RW 81U RWR 81	.250	.085	1½	.020 24 Ga.	2KΩ	1.2KΩ
SA 04	.75	SAV 09	.9		.312	.078	1½	.020 24 Ga.	3KΩ	1.3KΩ
SA 05	.8	SAV 12	1.2		.312	.094	1½	.020 24 Ga.	4.9KΩ	2.4KΩ
SA 10	.9	SAV 22	2.2		.344	.094	1½	.020 24 Ga.	5KΩ	2.5KΩ
SA 15	1.0	SAV 25	2.5	RW 70U RW 80U RWR 80	.406	.094	1½	.020 24 Ga.	7KΩ	3.5KΩ
SA 17	1.0	SAV 26	2.6		.531	.094	1½	.020 24 Ga.	10KΩ	5KΩ
SA 20	2.0	SAV 33	3.0		.500	.156	1½	.032 20 Ga.	15KΩ	7.5KΩ
SA 30	2.5	SAV 41	4.1	RW 69V	.500	.188	2	.032 20 Ga.	20KΩ	10KΩ
SA 31	3.0	SAV 45	4.5	RWR 89 RW 79U	.560	.187	2	.032 20 Ga.	25KΩ	12KΩ
SA 32	2.0	SAV 46	4.6	RWR 71	.812	.188	2	.032 20 Ga.	40KΩ	20KΩ
SA 35	3.0	SAV 52	5.2		.625	.250	2	.040 18 Ga.	35KΩ	17KΩ
SA 50	5.0	SAV 74	7.4	RWR 74 RW 74U RWR 84	.875	.312	2	.040 18 Ga.	60KΩ	30KΩ
SA 55	5.5	SAV 82	8.2	RW 67V	1.00	.313	2	.040 18 Ga.	70KΩ	35KΩ
SA 70	7.0	SAV 96	9.6		1.219	.312	2	.040 18 Ga.	90KΩ	45KΩ
SA 95	9.5	SAV 106	11.0	RW 55V	1.375	.469	1½	.040 18 Ga.	160KΩ	80KΩ
SA 100	10.0	SAV 145	14.5	RWR 78 RW 78U RW 68V	1.781	.375	2	.040 18 Ga.	200KΩ	100KΩ
SA 125	12.5	SAV 150	15.0	RW 56V	2.000	.469	1½	.040 18 Ga.	250KΩ	140KΩ

*—Available in Noninductive (code symbol "X").

1 —Nominal, based on maximum 275°C. Hot spot at 25°C. Ambient. (char. U)
2 —Nominal, based on maximum 350°C. Hot spot at 25°C. Ambient. (char. V).
3 —Tolerance for noninductive types below 150Ω ±.062.
4 —Noninductive maximum resistances are one-half of listed values.

POWER RESISTORS

OUTSTANDING FEATURES

1. Copperweld leads hot tin dipped for maximum solderability.
2. Completely welded construction terminal to terminal.
3. High density extruded aluminum housing provides superior heat conduction.
4. Housing deep finned for maximum heat dissipation under natural and forced convection.
5. Windings—High uniformity single layer space wound, designed to give maximum core coverage for even heat dissipation. MCX (non-inductive) types have dual balanced windings for minimum inductance.
6. Core—Steatite ceramic, centerless ground for uniformity.
7. Silicone coated resistance element to give maximum wire protection and extra high resistance to moisture.

ELECTRICAL CHARACTERISTICS

Tolerances—5.0% to .05%, 1% standard for off-shelf delivery.

Temperature Coefficient—20 ppm/degree C standard. Special T.C.'s to 5 ppm/degree C available.

Dielectric strength greater than 1000 V.A.C. on MC-100 and MC-250, and greater than 2000 V.A.C. on MC-500.

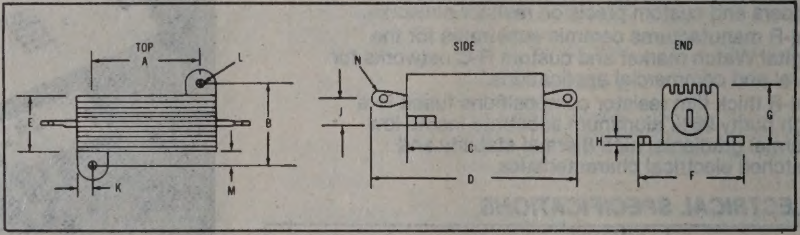
Dielectric Test—performed on 100% basis.

Stability—consistent with tolerances, all parts stabilized in production. Less than 0.5% drift in 1000 hours operation at full Cal-R wattage rating for 1% tolerance parts. Resistance ranges—.05 ohms to 210K ohms.

ENVIRONMENTAL

Meet or exceed all requirements of MIL-R-18546D, including "N" characteristic and MIL-R-39009.

FOUR STANDARD MC TYPE RESISTOR SPECIFICATIONS IN MIL-R SIZES



DIMENSIONS

Type	A	B	C	D	E	F	G	H	J	K	L	M	N
MC-80	.444	.490	.600	1.125	.334	.646	.317	.075	.139	.078	.093	.078	.050
MC-100	.562	.625	.750	1.375	.438	.873	.408	.094	.172	.093	.093	.094	.086
MC-250	.719	.781	1.063	1.938	.500	1.094	.531	.094	.219	.171	.125	.141	.086
MC-500	1.563	.844	1.969	2.781	.563	1.156	.625	.094	.281	.203	.125	.141	.086
TOL. ±	.005	.005	.016	.063	.031	.031	.031	.016	.031	.010	.005	.016	.015

STANDARD RESISTANCE & TOLERANCE RANGES

Type	Mil Equiv. Mil-R-18546C Mil-R-39009	Cal-R Watts Normal Rating	Watts Mil-R Rating	TOLERANCES AND MAXIMUM RESISTANCES*				
				1% Up	.5%	.25%	.1%	.05%
MC-80 (X)	RE 60 (N), RER 40, RER 60	8	5	.5 Ω to 20 K Ω	1 Ω to 10 K Ω	2.5 Ω to 10 K Ω	3 Ω to 10 K Ω	5 Ω to 10 K Ω
MC-100 (X)	RE 65 (N), RER 45, RER 65	10	10	.5 Ω to 25 K Ω	1 Ω to 10 K Ω	2.5 Ω to 10 K Ω	3 Ω to 10 K Ω	5 Ω to 10 K Ω
MC-250 (X)	RE 70 (N), RER 50, RER 70	25	20	.1 Ω to 70 K Ω	.2 Ω to 30 K Ω	.3 Ω to 30 K Ω	.5 Ω to 30 K Ω	1 Ω to 30 K Ω
MC-500 (X)	RE 75 (N), RER 55, RER 75	50	30	.1 Ω to 200 K Ω	.2 Ω to 80 K Ω	.3 Ω to 80 K Ω	.5 Ω to 80 K Ω	1 Ω to 80 K Ω

Available in Noninductive (code symbol "X"—Cal-R)
(code symbol "N"—Mil)

*Noninductive maximum resistances are one-half of listed values.

CAL-R INC.

1601 Olympic Blvd., Santa Monica, California 90404 • (213) 450-1761 • TWX 910-343-6966
WIREWOUND RESISTORS • THICK FILM • THERMISTORS

For More Information. Circle No. 383

CAL-R INC. WIRE WOUND RESISTORS

POWER RESISTORS . . . Cont'd.

T-5 (5 WATTS) OUTSTANDING FEATURES

1. Copperweld leads hot tin dipped — Gold plated DUMET or "A" nickel available.
2. High density extruded aluminum housing provides superior heat conduction.
3. Housing deep finned for maximum heat dissipation.
4. Windings — high uniformity single layer space wound, designed to give maximum core coverage for even heat dissipation. T5X (non-inductive) types have dual balanced windings for minimum inductance.
5. Core — Alumina ceramic, centerless ground for uniformity.

T-3 (3 WATTS) OUTSTANDING FEATURES

1. Windings — Reverse pie wound — all pies filled for maximum heat dissipation.
2. Unique recessed end cap designed to isolate winding termination from all lead stress.
3. Protective overcoating covering entire resistor before molding insures maximum protection and secures winding without introducing stress.
4. Resistor element encased in nonburning epoxy by transfer molding techniques.
5. Copperweld leads hot tin dipped standard — Gold plated DUMET or "A" nickel available.

STANDARD RESISTANCE & TOLERANCE RANGES

Type	Normal Rating	Weight	Tolerances and Maximum Resistances 1% UP	.5%	.25%	.1%	.05%
T5	5 WATTS	.8 gr	1Ω-5K	1Ω-5K	5Ω-3K	10Ω-2.5K	10Ω-2.5K
T3*	3 WATTS	.8 gr	3K-300K	3K-300K	3K-300K	3K-300K	3K-300K

*200 VAC MAX.

T-5 ELECTRICAL CHARACTERISTICS

TOLERANCES: 5.0% to .05%. 1% standard for off-shelf delivery.

TEMPERATURE COEFFICIENT: 30 ppm/°C standard. Special T.C.'s to 5 ppm/°C available.

STABILITY: consistent with tolerances, all parts stabilized in production. Less than 0.5% drift in 1000 hours operation at full CAL-R wattage rating for 1% tolerance parts.

RESISTANCE RANGES: .5 ohms to 3 K ohms.

DIELECTRIC STRENGTH: greater than 500 V.A.C.

DIELECTRIC TEST: performed on 100% basis.

T-3 ELECTRICAL CHARACTERISTICS

TOLERANCE: 1 to .005% absolute. To .002% matching tolerance for matched sets.

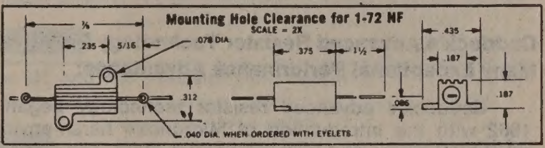
TEMPERATURE COEFFICIENT: 10 ppm/°C is standard. Special TCs in ranges from +6000 ppm to 2 ppm/°C available.

STABILITY: consistent with tolerances. All parts stabilized in production, including 1% parts. Components available with stability of .002% per year.

WINDINGS: multiple pie reversed type to minimized inductance. Special windings available to provide fast rise times.

RESISTANCE: Ranges 3 K ohms to 300 K ohms.

MAXIMUM WORKING VOLTAGE: 200V.


Mounting Hole Clearance for 1-72 NF
SCALE = 2X

PRECISION RESISTORS

OUTSTANDING FEATURES

1. All pies filled for maximum heat dissipation.
2. Unique recessed end cap designed to isolate winding termination from all lead stress.
3. Terminals welded to end cap for maximum strength — will withstand 15 lbs. linear pull.
4. Double slots tangent to mandrel to prevent shorting between pie windings eliminating space-wasting construction features or the need for insulating tape.
5. Protective overcoating covering entire resistor before molding insures maximum moisture protection and secures winding without introducing stress.
6. Standard leads — copperweld hot tin dipped or annealed Dumet gold plated.
7. Special matching available to .001% tolerance.

ELECTRICAL CHARACTERISTICS

TOLERANCE: 1 to .005% absolute. To .002% matching tolerance for matched sets.

TEMPERATURE COEFFICIENT: 10 ppm/°C is standard. Special TCs in ranges from +6000 ppm to 2 ppm/°C available.

STABILITY: consistent with tolerances. All parts stabilized in production, including 1% parts. Components available with stability of .002% per year.

WINDINGS: multiple pie reversed type to minimized inductance (except on Miniature Series). Special windings available to provide low rise times.

RESISTANCE: Ranges 1 ohm to 10 megohms.

PHYSICAL CHARACTERISTICS

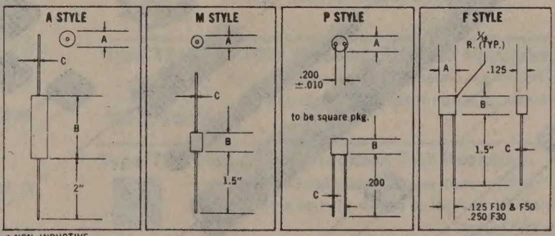
MATERIAL: Hi-Temp epoxy with matching coefficient of expansion between core and case. Leads are gold over Dumet.

ENVIRONMENTAL

Meet or exceed all requirements of MIL-R-93C and MIL-R-39005.

STANDARD RESISTANCE & TOLERANCE RANGES

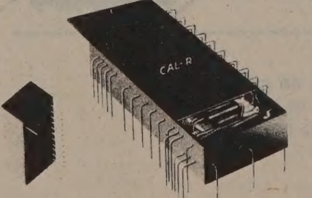
Dimensions CAL-R Part No.	"A" ±.010	"B" ±.010	"C"	Rated Wattage	MIL Equiv. MIL-R-93C MIL-R-39005	Tolerances and Maximum Resistances ±1%	±.5%	±.1%	±.05%	±.01%
M10	.080	.200	.016 #26 AWG	.05		100Ω100K	300Ω-80K	1K-80K	3K-50K	10K-25W
M20	.100	.200	.016 #26 AWG	.06		25Ω-150K	50Ω-100K	100Ω-100K	500Ω-80K	2.5K-50K
M30	.125	.250	.020 #24 AWG	.08		10Ω-250K	20Ω-250K	80Ω-250K	300Ω-200K	1.5K-150K
M40 M41*	.125	.375	.020 #24 AWG	.10		10Ω-400K	20Ω-400K	80Ω-400K	300Ω-300K	1.K-200K
A2525	.250	.250	.032 #20 AWG	.2	RBR75	10Ω-750K	20Ω-750K	50Ω750K	200Ω-650K	1.K-500K
A2535	.250	.350	.032	.25	RBR56	10Ω-1MEG	20Ω-1MEG	50Ω-1MEG	200Ω-1MEG	800Ω-800K
A2537	.250	.375	.032	.25	RB56	10Ω-1MEG	20Ω-1MEG	50Ω-1MEG	200Ω-1MEG	800Ω-800K
A2550	.250	.500	.032	.25	RB55 RBR55	10Ω-2.5MEG	20Ω-2.5M	50Ω-2.5M	100Ω-2.5M	500Ω-2.5M
A2575	.250	.750	.032	.35	RB54 RBR54	5Ω-3M	10Ω-3M	50Ω-3M	100Ω-3M	500Ω-3M
A25100 A3775	.250 .375	1.00 .750	.032 .032	.4 .5	RB53 RBR53	5Ω-3.5M 5Ω-4M	10Ω-3.5M 10Ω-4M	50Ω-3.5M 50Ω-4M	100Ω-3.5M 100Ω-4M	500Ω-3.5M 400Ω-3M
A37100	.375	1.00	.032	1.0	RB52 RBR52	2Ω-5.5M	4Ω-5.5M	20Ω-5.5M	50Ω-5.5M	300Ω-4.5M
A5050 A5062	.500 .500	.500 .625	.032 .032	.5 .5		10Ω-4M	20Ω-4M	50Ω-4M	100Ω-4M	400Ω-3M
A5070	.812	.312	.032	.5	RBR76	5Ω-5.5M	10Ω-5.5M	50Ω-5.5M	100Ω-5.5M	400Ω-4.5M
A50100	.500	1.00	.032	1.0	RB57 AFRT14	1Ω-7MEG	5Ω-7M	20Ω-7MEG	50Ω-7MEG	200Ω-5MEG
P2531	.250	.312	.025 #22 AWG	.12		10Ω-1MEG	20Ω-1M	50Ω-1M	100Ω-1M	800Ω-800K
P3750	.375	.500	.025	.35		5Ω-1.5M	10Ω-1.5M	30Ω-1.5M	100Ω-1.5M	800Ω-1.MEG
F10	.250	.250	.032 #20 AWG	.125		10Ω-750K	20Ω-750K	50Ω-750K	200Ω-650K	1.K-500K
F30	.500	.250	.032	.25		10Ω-1M	20Ω-1MEG	50Ω-1M	200Ω-1M	800Ω-800K
F50	.250	.500	.032	.25		5Ω-1.3M	10Ω-1.3M	20Ω-1.3M	100Ω-1.3M	200Ω-1.M

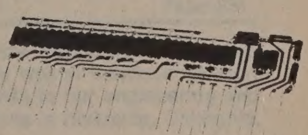


* NON INDUCTIVE

PRECISION RESISTOR NETWORKS

Cal-R engineers, specialists in advanced network design, offer precision assemblies, packaged to meet the most exacting specifications, allowing the circuit designer maximum freedom without costly packaging problems.





GENERAL SPECIFICATIONS

RESISTOR VALUES: From 1 ohm thru 5 megohms

FULL SCALE ACCURACY: to .005%

TEMPERATURE COEFFICIENT TRACKING: to 1 PPM/°C.

TEMPERATURE COEFFICIENT ABSOLUTE: to 2 PPM/°C.

AMBIENT TEMPERATURE RANGE: —55°C to +125°C.

STANDARD TEMPERATURE COEFFICIENT: 0 to ±10 PPM.

STABILITY: to 10 PPM per year.

FAST RECOVERY TIME: to within .02% of final value within 100 ns.

CAL-R INC.

1601 Olympic Blvd., Santa Monica, California 90404 • (213) 450-1761 • TWX 910-343-6966
WIREWOUND RESISTORS • THICK FILM • THERMISTORS

For More Information. Circle No. 383

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

High Performance Film Resistors

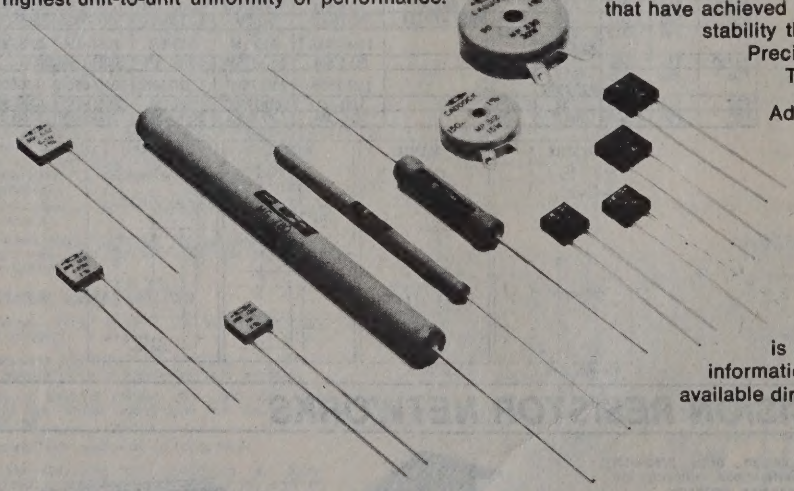
This 20th Edition of the Caddock Electronics General Catalog describes over 150 in-production models of precision discrete resistors and resistors networks that utilize Caddock's high-stability, extended-life Micronox® and Tetrinox™ resistance films. With 20 years of experience and an exceptional record of in-circuit performance and reliabilility, Caddock Electronics continues to lead the industry in the development, production and on-time delivery of high performance film resistors.

Caddock's Advanced Resistor Technology Provides Many Exceptional Performance Advantages:

Caddock's advanced resistor technology began in 1962 with the introduction of Micronox® harsh-environment high-power and high-voltage resistors. The Caddock technology was further extended in 1975 with the development of the Tetrinox™ resistance system that made possible the introduction of low TC, ultra-stable resistors and resistor networks.

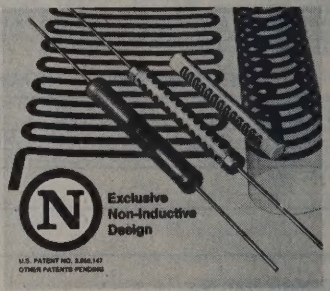
These technological advances have provided the electronics industry with a selection of precision resistor types that achieve many high-performance advantages:

- **Precision** — Tolerances as close as 0.01%.
- **Long-Term Stability** — Better than 0.005% per 1000 hours of operation under full load operating conditions.
- **Higher Power Ratings** — Up to five times higher than other resistor technologies.
- **High Operating Temperatures** — Up to +275°C.
- **Ultra-Low Temperature Coefficients** — Standard to less than 10 PPM/°C and custom values as low as 2 PPM/°C.
- **Unit-to-Unit Uniformity** — The inherent consistency of Caddock's film resistor technology assures the highest unit-to-unit uniformity of performance.



Caddock's Exclusive Non-Inductive Performance Is Available in Both High-Power and High-Voltage Micronox® Film Resistors.

For wide-band, high frequency applications, the advantages of Caddock's Exclusive Non-Inductive Design are available in most models of Micronox® resistors. This special serpentine pattern provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.



The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

The High-Performance Capabilities of Caddock Film Resistors Can Provide Improved Accuracy and Stability to Precision Circuitry:

Because of the special advantages of Caddock's resistance film technology, Caddock High Performance Film Resistors are often specified in the precision circuits that ultimately establish the overall accuracy and stability of the equipment.

Examples of such applications include many types of precision high-voltage supplies and voltage references that have achieved improved accuracy and extended-life stability through the use of Caddock Type MG Precision High-Voltage Resistors and Type T912 Precision Resistor Networks.

Additional examples of the application of this advanced resistor technology include the industry-wide use of Caddock Type 1776 and Type 1787 Precision Decade Divider Resistors in the signal input circuits of laboratory and bench-type digital voltage and current measuring instruments.

An introduction and index to these Caddock resistor technologies is provided on the next page. Additional information and technical assistance is also available directly from our technical staff.

We welcome your call.

CADDOCK
ELECTRONICS, INCORPORATED.

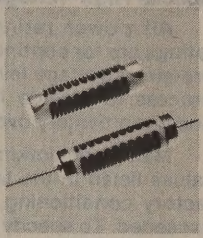
For More Information. Circle No. 384

High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Micronox® Resistance Films

For harsh environmental conditions, Caddock Micronox® resistors are truly unsurpassed. Produced by firing complex-oxide Micronox® resistance films onto ceramic core materials at temperatures above +1400°F, these precision resistors can withstand extremes of temperature, thermal shock, overvoltage and input power.



The result is a family of high voltage, high power precision resistors with an exceptional combination of performance advantages:

- **High Power Ratings** — to 30 watts.
- **High Voltage Ratings** — to 30,000 volts.
- **High Stability** — as close as 0.01% per 1000 hours in 50,000 hour extended life.
- **High Operating Temperatures** — up to +275°C.
- **A Wide Range of Resistance Values In Many Sizes** — from 30 ohms to 2000 Megohms.

These performance advantages make Caddock Micronox® film resistors ideal for use in many types of electronic circuitry, including —

- **Voltage Reference Circuits**
- **High Power Density Packaging**
- **Precision Feedback Circuits**
- **Matched TC Resistor Pairs**

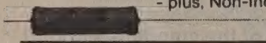
Type MG Precision High-Voltage Resistors

Highest stability at continuous operation to 30,000 volts in single-resistor values as high as 2000 Megohms.

Pages 818 and 819

Type MS and MR Power Film Resistors

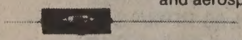
Power ratings to 15 watts at 6000 volts in a single axial-lead resistor - plus, Non-Inductive Performance is available.



Pages 820 and 821

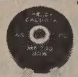
Type ML and MM Precision Film Resistors

Molded case encapsulation to meet high temperature industrial and aerospace requirements.



Pages 822

Type MP Chassis Mounted Power Film Resistors



High power density in both 15 and 30 watt ratings with center-screw chassis mounting.

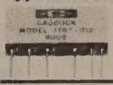
Pages 823

Type MK Low Cost Precision Film Resistors

.75 watt rating at +125° C. Resistance range from 30 ohms to 100 Megohms.

Pages 824 and 825

Type 1787 Current Shunt Resistor Networks

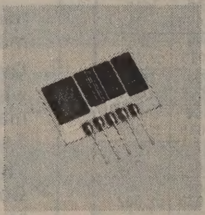


2-, 3- and 4-decade input networks for accurate current sensing in multi-range instrumentation.

Pages 826 and 827

Tetrinox™ Resistance Films

In high-accuracy instrumentation where outstanding circuit performance is required through variations of temperature and through long-term operation, Caddock Tetrinox™ resistance films are the answer.



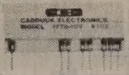
Constructed with advanced technology complex-oxide resistance films that are fired onto ceramic substrates, Caddock Tetrinox™ film resistors provide a unique combination of performance characteristics:

- **Ultra-Low Absolute and Ratio TC** — standard to less than 5 PPM/°C.
- **Ultra-Precision** — tolerances as tight as 0.01%.
- **High Resistance Range** — values to 10 Megohms in a miniature package.
- **Ultra-Stable in Loadlife** — ratio stability to within ±0.01% per 2000 hours.

This special combination of advantages make Caddock Tetrinox™ film resistors the optimum choice in many high stability applications, including —

- **Input Voltage Dividers in Precision Laboratory Instrumentation**
- **Precision Bridge Circuits**
- **Precision Voltage Reference Circuits.**
- **Ultra-Stable Voltage Dividers.**
- **Ultra-Low Power Precision Circuitry.**
- **Decade Resistance Networks.**

Type 1776 Precision Decade Resistor Voltage Dividers



33 models of decade voltage dividers for accurate voltage-division in multi-range digital instrumentation.

Pages 828 and 829

Type TF Low TC Ultra-Precision Film Resistors

The cost-effective replacement for precision high-value wire-wound resistors.

Pages 830

Type T912 and T914 Precision Resistor Networks

Resistor pairs and quads with ultra-precision ratio characteristics for analog circuits.

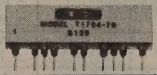
Pages 831

Type TK Temp-Stable Precision Film Resistors.

Temperature coefficients to less than 5 PPM/° C in single resistor values as high as 10 Megohms.

Pages 832 and 833

Type 1794 Custom Precision SIP Resistor Networks



Resistor networks with custom package size and custom performance.

Pages 834

If you should need additional information on any type of Caddock resistor, please call or write to our engineering and manufacturing offices in Riverside, California.

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ELECTRONICS, INCORPORATED
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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MG Precision High-Voltage Resistors

Highest Long-Term Stability Combined with Precision Tolerances and TC of 80 PPM/°C.

Caddock's Micronox® resistance films are the source of the Type MG Precision High Voltage Resistors' outstanding combination of performance features:

- Single-resistor values as high as 2000 Megohms.
- Maximum continuous operating voltages as high as 30,000 volts.
- Overvoltage capabilities of 150% of the standard working voltages for all models and values.
- Resistance Tolerances from ± 1.0% to ± 0.1%.
- Standard temperature coefficient of 80 PPM/°C in combination with resistance tolerances as tight as ±0.1%.

- plus

- Typical extended life stability of 0.02% per 1000 hours as demonstrated by reliability testing.

This exceptional performance has been proven through many years of use in equipment that demands the highest reliability and stability, including TWT amplifiers, X-ray systems, geophysical instruments and medical electronics.

Special High-Voltage Pulse Performance

All power ratings and maximum working voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

Maximum working voltages up to 60% higher than the values listed in the table can be achieved through special factory conditioning, provided the power ratings are not exceeded. To specify maximum working voltages above the values listed in the table, add a "-15" to the model number (Example: MG750-15) and identify the overvoltage value with the initial order. (Note that the standard overload and overvoltage ratings do not apply to the "-15" resistors.)

Non-Inductive Performance

Caddock's patented Exclusive Non-Inductive Design uses a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

Most models are available with Caddock's Patented Non-Inductive Design. To specify this performance, add an "N" to the standard model number. (Example: MG750N)

Model No.	Wattage	Max. Continuous Oper. Volt	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions		
						Min.	Max.	A	B	C
MG650	.5	600	225°C	750	80	200Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002
MG655	.5	600	225°C	750	80	200Ω	8 Meg	.313 ±.030	.109 ±.025	.025 ±.002
MG660	.6	1,000	225°C	750	80	400Ω	10 Meg	.500 ±.030	.094 ±.015	.025 ±.002
MG680	.8	2,000	225°C	750	80	600Ω	20 Meg	.750 ±.030	.094 ±.015	.025 ±.002
MG710	1.0	4,000	225°C	750	80	800Ω	50 Meg	1.000 ±.040	.094 ±.015	.025 ±.002
MG712	.6	1,000	225°C	750	80	800Ω	20 Meg	.400 ±.060	.140 ±.030	.025 ±.002
MG714	1.0	1,000	225°C	750	80	200Ω	20 Meg	.562 ±.060	.150 ±.030	.032 ±.002
MG715	1.0	2,000	225°C	750	80	400Ω	50 Meg	.750 ±.060	.140 ±.030	.025 ±.002
MG716	1.5	4,000	225°C	750	80	600Ω	75 Meg	1.000 ±.060	.140 ±.030	.025 ±.002
MG717	1.5	2,000	225°C	750	80	600Ω	75 Meg	.710 ±.050	.240 ±.030	.040 ±.002
MG721	2.0	4,000	225°C	750	80	200Ω	100 Meg	1.000 ±.050	.240 ±.030	.040 ±.002
MG730	3.0	6,000	225°C	1000	80	500Ω	250 Meg	1.500 ±.080	.240 ±.030	.040 ±.002
MG735	3.6	10,000	225°C	1000	80	750Ω	300 Meg	2.000 ±.080	.240 ±.030	.040 ±.002
MG745	5.0	15,000	225°C	1000	80	1K	500 Meg	3.000 ±.100	.240 ±.030	.040 ±.002
MG750	5.0	10,000	225°C	1000	80	400Ω	500 Meg	2.125 ±.060	.315 ±.030	.040 ±.002
MG780	7.5	15,000	225°C	1000	80	600Ω	750 Meg	3.125 ±.060	.315 ±.030	.040 ±.002
MG785	8.0	20,000	225°C	1000	80	800Ω	1000 Meg	4.000 ±.120	.315 ±.030	.040 ±.002
MG810	10.0	25,000	225°C	1000	80	1K	1250 Meg	5.000 ±.120	.315 ±.030	.040 ±.002
MG815	15.0	30,000	225°C	1000	80	1K	2000 Meg	6.000 ±.120	.350 ±.040	.040 ±.002

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Insulation Resistance: 100 megohms, minimum.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.8% max.

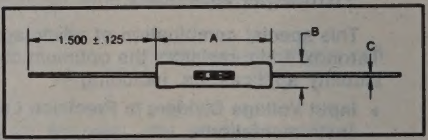
Thermal Shock: MIL-STD-202, Method 107, Cond. C, ΔR, 0.5% max.

Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.8% max.

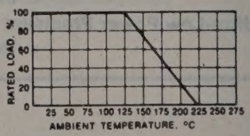
Loadlife: 1000 hours at rated power, ΔR 0.8% max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.



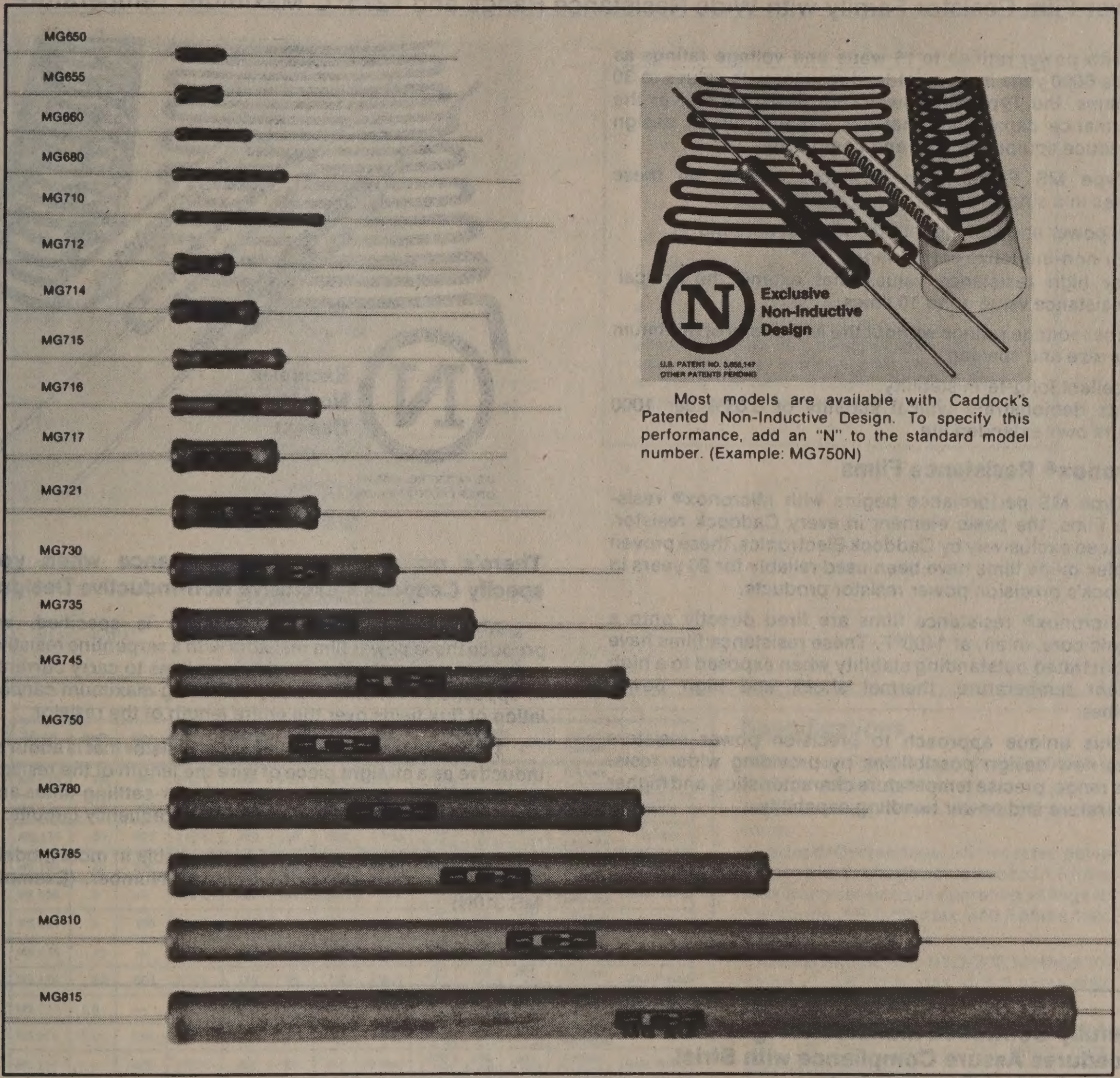
Derating Curve:



Type MG Precision High-Voltage Resistors

CADDOCK

HIGH PERFORMANCE FILM RESISTORS


MG650
MG655
MG660
MG680
MG710
MG712
MG714
MG715
MG716
MG717
MG721
MG730
MG735
MG745
MG750
MG780
MG785
MG810
MG815
N
Exclusive
Non-Inductive
Design
U.S. PATENT NO. [illegible]
OTHER PATENTS PENDING

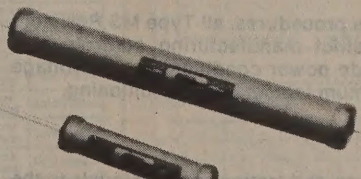
Most models are available with Caddock's Patented Non-Inductive Design. To specify this performance, add an "N" to the standard model number. (Example: MG750N)

Matched Type MG Resistor Sets with Tight Ratio Tolerances and Ratio TC Tracking.

The temperature coefficients of Caddock Micronox® resistance films can be controlled to provide matched sets of Type MG resistors with tight ratio TC from -55° C to +105° C.

For high voltage divider applications, ±2% ratio tolerance and 25 PPM/° C ratio tracking is available.

For low voltage, high resistance applications - such as electrometer circuits or high-gain amplifiers - ±0.1% ratio tolerance and 10 PPM/° C ratio tracking is available.



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MR & MS Power Film Resistors

Power Film Resistor Family with Wide Resistance Range and +275° C Maximum Temperature.

With power ratings to 15 watts and voltage ratings as high as 6000 volts in an axial-lead resistor with values to 30 Megohms, the Type MS Power Film Resistors deliver the performance capabilities that can simplify circuit design and reduce equipment cost and complexity.

Type MS Power Film Resistors provide all these features in a single resistor:

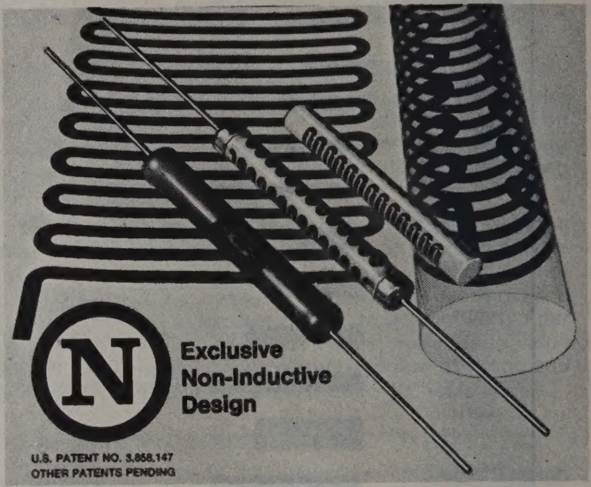
- Full power and voltage ratings, without derating —
  - for non-inductive performance.
  - for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability.
  Tests demonstrate typical stability of 0.05% per 1000 hours over extended life.

Micronox® Resistance Films

Type MS performance begins with Micronox® resistance films, the basic element in every Caddock resistor. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for 20 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core, in air, at 1400° F. These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This unique approach to precision power resistors opens new design possibilities by providing wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.



There's no derating of performance when you specify Caddock's Exclusive Non-Inductive Design.

When non-inductive performance is specified, we produce these power film resistors with a serpentine resistive pattern that provides for neighboring lines to carry currents in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

Non-inductive construction is available in most models. Specify by adding "N" suffix to Model Number. (Example: MS 310N)

Carefully Controlled Manufacturing and Test Procedures Assure Compliance with Strict Quality Control Requirements

Manufacturing Control

In addition to these procedures, all Type MS Resistors are produced under strict manufacturing controls with processes which include power conditioning, overvoltage conditioning and maximum temperature conditioning.

Quality Control

From the certification and testing of all materials to the supervision of manufacturing processes, all Caddock Type MS and MR Power Film Resistors are produced under procedures that have been approved for conformance to the requirements of NASA NHB5300.4(1C) and MIL-I-45208 in many recent surveys.

Reliability Verification

Type MS Resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration and Humidity are verified on a periodic basis. Data from MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG and MK represent an identical combination of materials —aluminum oxide substrate, Micronox® resistance film and silicone insulating coating.

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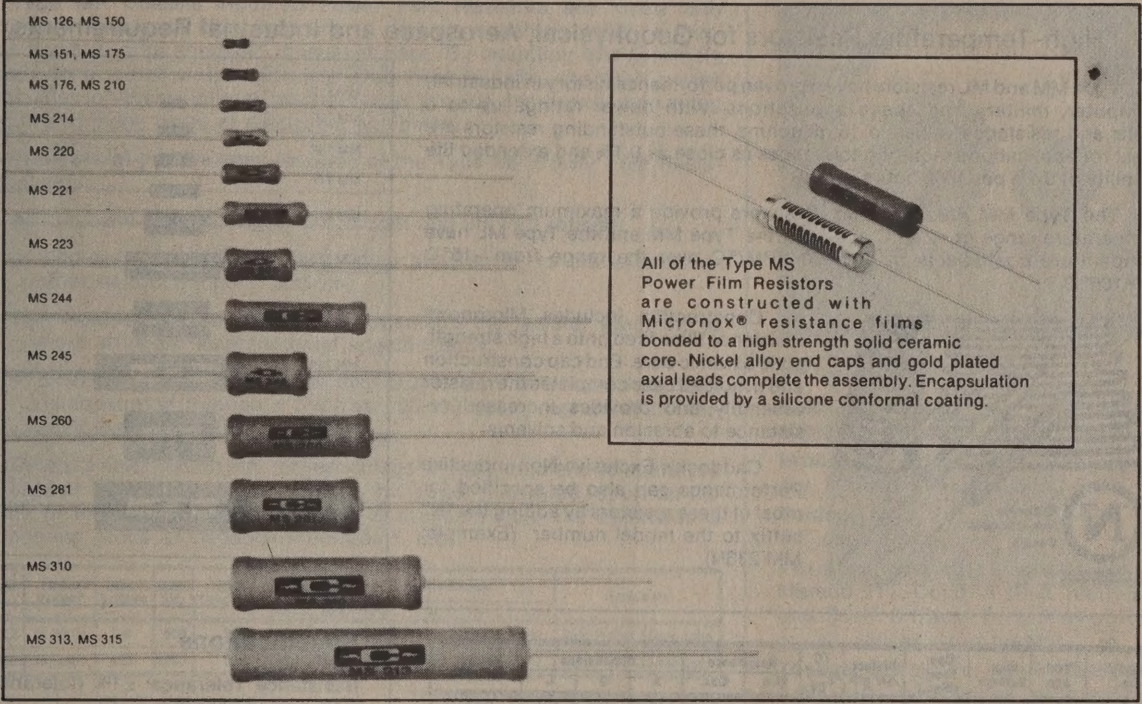
For More Information. Circle No. 384

Type MR & MS Power Film Resistors

CADDOCK

HIGH PERFORMANCE FILM RESISTORS



All of the Type MS Power Film Resistors are constructed with Micronox® resistance films bonded to a high strength solid ceramic core. Nickel alloy end caps and gold plated axial leads complete the assembly. Encapsulation is provided by a silicone conformal coating.

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encapsulation	Leadwire
						Min.	Max.	A	B	C		
MR 129	.25	200	275°C	500	150	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Nickel
MR 154	.40	300	275°C	750	150	50Ω	1 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MR 178	.60	500	275°C	750	150	50Ω	3 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Nickel
MS 126	.25	200	275°C	500	50	30Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated
MS 150	.5	—	275°C	500	50	30Ω	2 K	.188 ±.020	.070 ±.015	.020 ±.002	Silicone Conformal	Gold Plated
MS 151	.5	300	275°C	750	50	30Ω	2 Meg	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 175	.75	—	275°C	750	50	30Ω	2 K	.250 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 176	.75	500	275°C	750	50	45Ω	5 Meg	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 210	1.0	—	275°C	750	50	45Ω	3 K	.313 ±.020	.094 ±.015	.025 ±.002	Silicone Conformal	Gold Plated
MS 214	1.0	500	275°C	750	50	45Ω	5 Meg	.313 ±.030	.109 ±.025	.025 ±.002	Silicone Conformal	Gold Plated
MS 220	2.0	1000	275°C	800	50	45Ω	10 Meg	.400 ±.060	.140 ±.030	.025 ±.002	Silicone Conformal	Gold Plated
MS 221	3.0	1000	275°C	800	50	45Ω	10 Meg	.575 ±.050	.165 ±.030	.032 ±.002	Silicone Conformal	Gold Plated
MS 223	3.0	800	275°C	1000	50	30Ω	4 Meg	.480 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 244	4.0	2000	275°C	1000	50	45Ω	15 Meg	.950 ±.060	.230 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 245	4.0	800	275°C	1000	50	30Ω	6 Meg	.570 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 260	6.0	2000	275°C	1000	50	45Ω	15 Meg	.970 ±.060	.300 ±.030	.040 ±.002	Silicone Conformal	Gold Plated
MS 281	8.0	2000	275°C	1000	50	45Ω	8 Meg	.910 ±.060	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 310	10.0	4500	275°C	1000	50	45Ω	20 Meg	1.25 ±.070	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 313	12.5	6000	275°C	1000	50	50Ω	30 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated
MS 315	15.0	—	275°C	1000	50	50Ω	1 Meg	2.00 ±.080	.350 ±.040	.040 ±.002	Silicone Conformal	Gold Plated

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

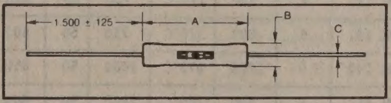
Insulation Resistance: 100 megohms, minimum.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

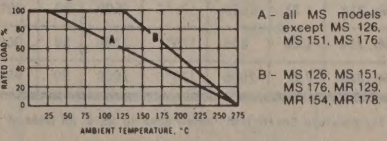
Thermal Shock: MIL-STD-202, Method 107, Cond. C, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, ΔR 0.5% max. or 0.5 ohms max., whichever is greater.



Derating Curve:



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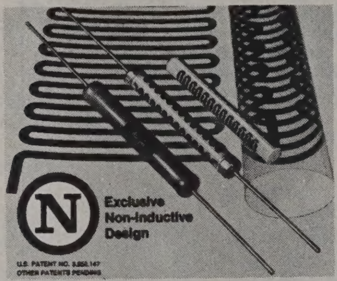
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type ML & MM Precision Film Resistors

High-Temperature Resistors for Geophysical, Aerospace and Industrial Requirements.

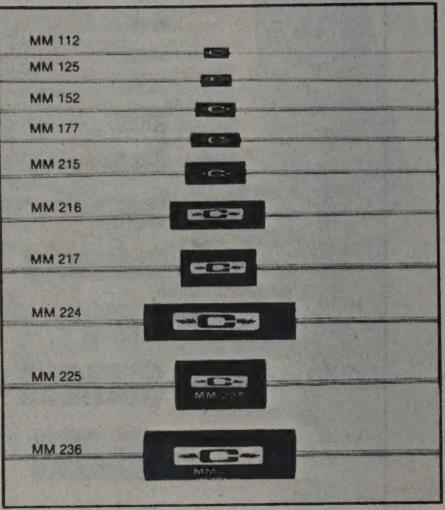
Type MM and ML resistors have a proven performance history in industrial, computer, military and space applications. With power ratings up to 3 watts and resistance values to 15 megohms, these outstanding resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1000 hours.

The Type MM Precision Film Resistors provide a maximum operating temperature range of +275° C and both the Type MM and the Type ML have temperature coefficients of only 50 PPM/°C over the range from -15° C to +105° C.



Construction includes Micronox® resistance films fired onto a high strength solid ceramic core. End cap construction and a molded case completes the resistor assembly and provides increased resistance to abrasion and solvents.

Caddock's Exclusive Non-Inductive Performance can also be specified for most of these resistors by adding the "N" suffix to the model number. (Example: MM 236N)



Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/°C†	Resistance		Dimensions			Encapsulation
						Min.	Max.	A	B	C	
MM 112	.12	200	275°C	400	50	45Ω	500 K	.160 ±.010	.065 ±.010	.016 ±.002	Black Molded Type
MM 125	.25	200	275°C	500	50	30Ω	1 Meg	.188 ±.020	.070 ±.015	.020 ±.002	Black Molded Type
MM 152	.4	300	275°C	750	50	30Ω	2 Meg	.250 ±.020	.094 ±.006	.025 ±.002	Black Molded Type
MM 177	.6	500	275°C	750	50	45Ω	5 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Black Molded Type
MM 215	1.0	800	275°C	1000	50	45Ω	10 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Black Molded Type
MM 216	1.5	1000	275°C	1000	50	45Ω	10 Meg	.625 ±.030	.190 ±.020	.032 ±.002	Black Molded Type
MM 217	1.5	800	275°C	1500	50	30Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	Black Molded Type
MM 224	2.0	2000	275°C	1500	50	45Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	Black Molded Type
MM 225	2.0	800	275°C	2000	50	30Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	Black Molded Type
MM 236	3.0	2000	275°C	2000	50	45Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	Black Molded Type
ML 104	.08	200	175°C	400	50	50Ω	300 K	.160 ±.010	.065 ±.010	.016 ±.002	Transfer Molded Type
ML 114	.15	200	175°C	500	50	50Ω	500 K	.188 ±.020	.070 ±.015	.020 ±.002	Transfer Molded Type
ML 124	.25	300	175°C	750	50	50Ω	600 K	.250 ±.020	.094 ±.006	.025 ±.002	Transfer Molded Type
ML 131	.4	500	175°C	750	50	50Ω	1 Meg	.313 ±.020	.094 ±.006	.025 ±.002	Transfer Molded Type
ML 181	.6	600	175°C	750	50	50Ω	5 Meg	.400 ±.020	.150 ±.010	.025 ±.002	Transfer Molded Type
ML 212	1.0	1000	175°C	1000	50	45Ω	10 Meg	.625 ±.030	.190 ±.020	.032 ±.002	Transfer Molded Type
ML 213	1.0	800	175°C	1500	50	30Ω	4 Meg	.500 ±.030	.250 ±.020	.040 ±.002	Transfer Molded Type
ML 218	1.25	2000	175°C	1500	50	45Ω	15 Meg	1.00 ±.030	.250 ±.020	.040 ±.002	Transfer Molded Type
ML 219	1.25	800	175°C	2000	50	30Ω	6 Meg	.600 ±.030	.330 ±.020	.040 ±.002	Transfer Molded Type
ML 226	2.0	2000	175°C	2000	50	45Ω	15 Meg	1.00 ±.030	.330 ±.020	.040 ±.002	Transfer Molded Type

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Specifications

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Insulation Resistance: 100 megohms, minimum.

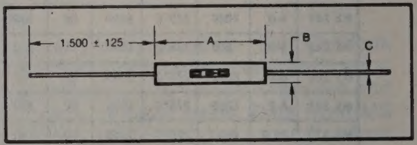
Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Thermal Shock: MIL-STD-202, Method 107, Cond. F, ΔR, 0.2% max. or 0.5 ohms max., whichever is greater.

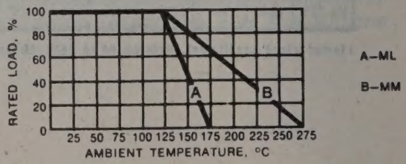
Moisture Resistance: MIL-STD-202, Method 106, ΔR, 0.5% max. or 0.5 ohms max., whichever is greater.

Loadlife: 1000 hours at rated power, ΔR 0.5% max. or 0.5 ohms max., whichever is greater.

Lead Material: Gold Plated.



Derating Curve:



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Type MP Chassis Mounted Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MP Chassis Mounted Power Film Resistors are made with Micronox® resistance films fired onto a ceramic substrate which is thermally bonded to an anodized aluminum base. By mounting this assembly directly to a metal surface for improved heat transfer, the high power capabilities of these unique resistors can provide increased packaging densities in many types of electronic equipment.

The special performance features of the Type MP Power Film Resistors include:

- Two case sizes that provide 15 watt and 30 watt ratings.
- Single-screw mounting to simplify attachment to the chassis or other heat conducting surface.
- A molded silicone case that encapsulates the resistor assembly to meet stringent environmental specifications.
- Extended-life stability better than 0.01% per 1000 hours has been demonstrated through a 5½ year, 50,000 hour program of continuous load-life testing.

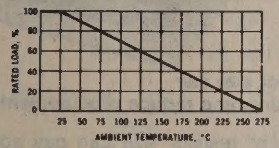
Detailed information on power ratings versus ambient temperature and chassis area has been provided on this page. A detailed report on the results of extended-life stability tests is available from the applications engineering group at Caddock Electronics, Inc.

Model No.	Power Rating†	Max. Voltage	Diel. Str.	High Temp. TC‡	Resistance Range		Dimensions				Terminals
					Min.	Max.	A	B	C	D	
MP312	15 Watts	300	600	50	10Ω	200 K	.600	.188	.185	.092	Gold Plated Solder Lugs
MP330	30 Watts	450	1000	50	10Ω	200 K	.850	.250	.250	.142	Gold Plated Solder Lugs

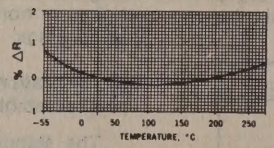
† Power rating based on chassis mounting with MP 312 on a 6" x 4" x 2" x .040" aluminum chassis and MP 330 on a 5" x 7" x 2" x .040" aluminum chassis.

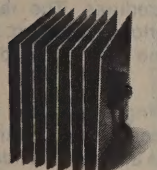
‡ TC: 50 ppm referenced to 25°C, ΔR taken at +150°C and +275°C. (Low temp. TC will be nominally −85 ppm/°C at −55°C. See typical R-T curve.)

DERATING CURVE



TYPICAL R-T CURVE

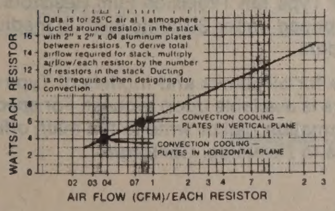




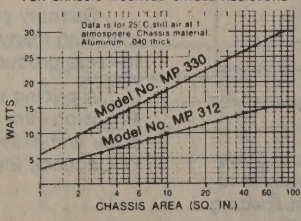
Stacked Type MP assemblies — constructed by bolting resistors between aluminum heat dissipating plates — provide a simple means of further improving packaging densities.

These charts of power ratings versus ambient temperature and chassis area show the high power levels that can be achieved with forced air cooling and with convection cooling in either vertical or horizontal orientation.

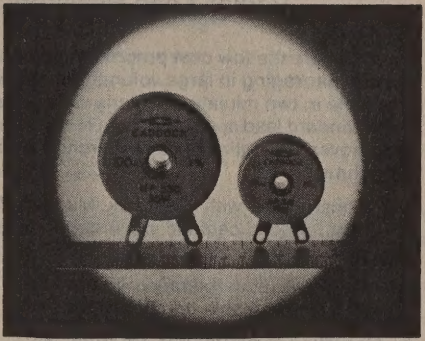
POWER RATING
FOR STACKED MP 312 POWER RESISTORS



POWER RATING
FOR CHASSIS MOUNTED SINGLE RESISTORS



U.S. Patent No's 3,636,493 and 3,649,944 Other patents pending.



SPECIFICATIONS

Resistance Tolerance: ±1% standard (Other tolerances on special order.)

Insulation Resistance: 10,000 Megohms, dry. Method — Mil-R-18546D, para. 4.6.8.

Solderability: Per Mil-R-18546D, para. 3.7, para. 4.6.4.

Terminal Strength: Per Mil-Std-202, Method 211, Cond. A (Pull Test), 5 lbs., and Cond. B (Bend Test). Max. ΔR, .2% or .2Ω, whichever is greater.

Thermal Shock: Per Mil-R-18546D, para. 4.6.9, max. ΔR, .5% or .2Ω, whichever is greater.

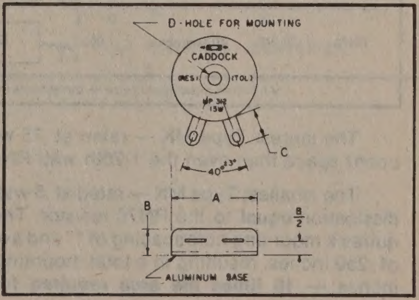
Momentary Overload: 2 times rated power or 1.5 times max. allowable working voltage, whichever gives the lower power, for 5 seconds. Max. ΔR, .5% or .2Ω, whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106B, less steps 7a and 7b, max. ΔR, .5% or .2Ω, whichever is greater.

Life: Per Mil-R-18546D, para. 4.6.12, 1,000 hrs., Max. ΔR, 1% or .2Ω, whichever is greater.

Shock, Medium Impact: 50G, per Mil-Std-202, Method 205, Cond. C.

Vibration, High Frequency: Per Mil-Std-202, Method 204, Cond. B, Max. ΔR .2% or .2Ω, whichever is greater, through shock and vibration sequence.



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Low Cost Precision Film Resistors

Radial-Lead Resistors with Resistance Range from 10 ohms to 100 Megohms.

Here are the low cost precision resistors that provide high density packaging in large volume printed circuit applications. Available in two miniature rectangular package configurations with standard lead spacings, Type MK Precision Film Resistors now cover the entire resistance range from 10 ohms to 100 Megohms.

Constructed with Caddock Micronox® resistance films fired onto a solid ceramic substrate, Type MK Precision Film Resistors combine all of these outstanding advantages:

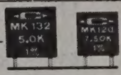
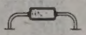
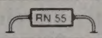
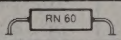
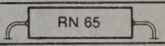
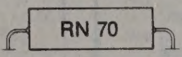
- ±1% resistance tolerance is standard and tolerances to ±0.1% are available on special order.
- Operating temperatures are from -55° C to +175° C.
- Full power rating at +125° C.
- Temperature Coefficient is only 50 PPM/° C up to 10 Megohms and 80 PPM/° C up to 100 Megohms, referenced to 25° C with the ΔR taken at -15° C and +105° C.
- Extended life stability is typically better than 0.1% per 1000 hours.
- Caddock's Non-Inductive Performance provides greater pulse fidelity and wider bandwidths in high frequency circuits.

This combination of performance advantages in a small, standardized case can simplify many engineering and production problems:

One size of Type MK resistor can replace many sizes of axial lead resistors.

This table of "RN" style axial lead resistors shows the many sizes and power ratings that can be replaced with either of the two models of Type MK Precision Film Resistors within the maximum allowable voltage ratings.

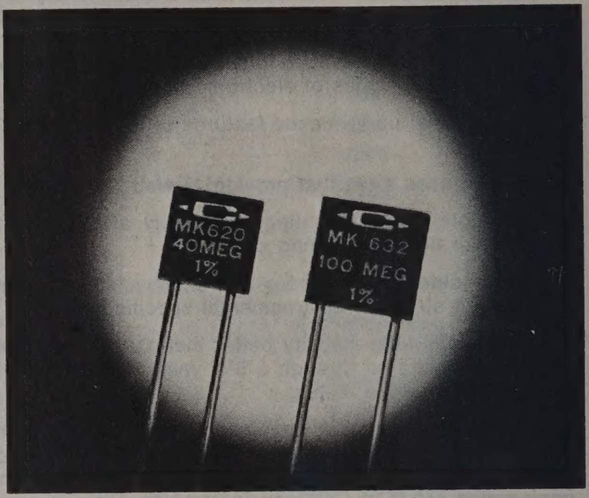
Comparison of Type MK and "RN" Ratings and Dimensions

Resistor Type	Power Rating	Maximum Resistance	Mounting Hole Spacing		
MK 120 or MK 620	**.50 WT.**	**40 Megohms**	**.150**		Even the smallest Type MK resistor can replace all of these RN type resistors.
MK 132 or MK 632	**.75 WT.**	**100 Megohms**	**.200**		
RN50	.05 WT	1 Megohm	.400		
RN 55	.10 WT	5 Megohms	.500		
RN60	.125 WT	10 Megohms	.625		
RN65	.25 WT	20 Megohms	.875		
RN70	.50 WT	40 Megohms	1.000		

All outline drawings full size — dimensions in inches.

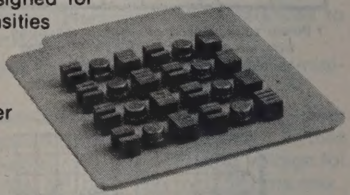
The largest Type MK — rated at .75 watt — requires less board space than even the 1/20th watt RN50.

The smallest Type MK — rated at .5 watt — provides power dissipation **equal** to the RN70 resistor. The RN70 resistor requires a mounting hole spacing of 1" and a side-to-side spacing of .250 inches, resulting in a total mounting area of .25 square inches — **10 times the area required for a .75 watt Type MK resistor!**



One standard resistor configuration can simplify board layouts.

With the exceptionally wide range of resistances that are available in each model of Type MK Precision Film Resistors, circuits can now be designed for maximum packaging densities without the need for leaving extra space where resistor value changes can require larger resistors or non-uniform lead spacings.



Standardization of resistor size can speed assembly procedures and reduce procurement costs.

The standardization of resistor size can pay additional dividends by simplifying assembly procedures. The radial leads do not require additional bending prior to insertion, and the standard lead spacing can reduce the time required for assembly.

The combination of higher power rating and smaller size can also lower procurement costs. By reducing the wide variety of sizes and types of axial lead resistors to a single, 'standardized' resistor type, unit prices can be lowered and inventory problems simplified.

Low Quantity Prices — Fast Delivery

Quantity prices for Type MK Precision Film Resistors are low, with many values priced under 60 cents each in medium-to-large production orders.

A pricing schedule for all values and models of Type MK Precision Film Resistors is available upon request. For specific price and delivery information, call or write to the main offices of Caddock Electronics in Riverside, California.

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Type MK Low Cost Precision Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Film Resistors — Standard Resistance Range

Model No.	Watt-age	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/ °C†	Resistance		Dimensions	Encap-sulation	Leadwire
						Min.	Max.			
MK 120	.5	200	175°C	300	50	30 Ω	2 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 132	.75	400	175°C	400	50	30 Ω	5 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (tolerance to ±.1% on special order).

Operating Temperature: −55°C to 175°C.

Overload: 5 times rated power for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.

Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .15% max., or .2 ohms max., whichever is greater.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, shift .2% max., or .2 ohms, max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max., or .2 ohms, whichever is greater.

Loadlife: 1000 hours at rated power, R shift .4% max., or .2 ohms, whichever is greater.

Insulation Resistance: 10,000 Megohms, minimum.

Type MK Precision Film Resistors — Extended Resistance Range

Model No.	Watt-age	Max. Voltage	Oper. Temp. (Max.)	Dielect. Str'gth	TC ppm/ °C†	Resistance		Dimensions	Encap-sulation	Leadwire
						Min.	Max.			
MK 620	.5	200	175°C	300	80	2 Meg.	40 Meg.	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
MK 632	.75	400	175°C	400	80	5.1 Meg.	100 Meg.	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper

Resistance Tolerance: ±1% (consult factory for tighter tolerances).

Operating Temperature: −55°C to 175°C.

Overvoltage: 1.5 times max. voltage for 5 seconds, R shift .5% max.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, R shift .5% max.

Moisture Resistance: Mil-Std-202, Method 106, R shift .5% max.

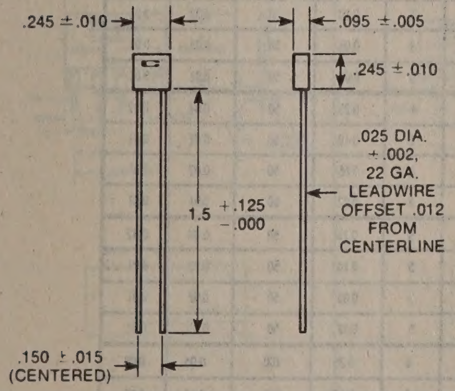
Loadlife: 1000 hours at rated power, R shift .5% max.

Insulation Resistance: 10,000 Megohms, minimum.

†Temperature Coefficient: Referenced to 25°C, ΔR taken at −15°C and +105°C

Case "A"

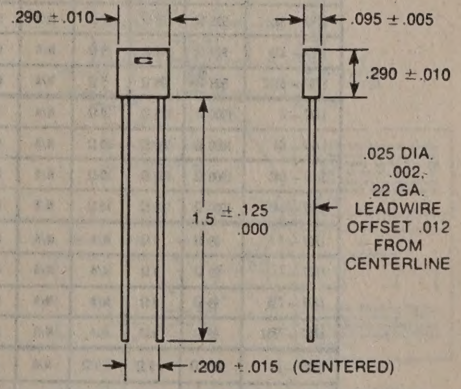
Model MK 120 and MK 620



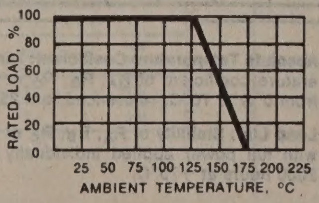
ALL DIMENSIONS IN INCHES

Case "B"

Model MK 132 and MK 632



DERATING CURVE



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type 1787 Current Shunt Resistor Networks

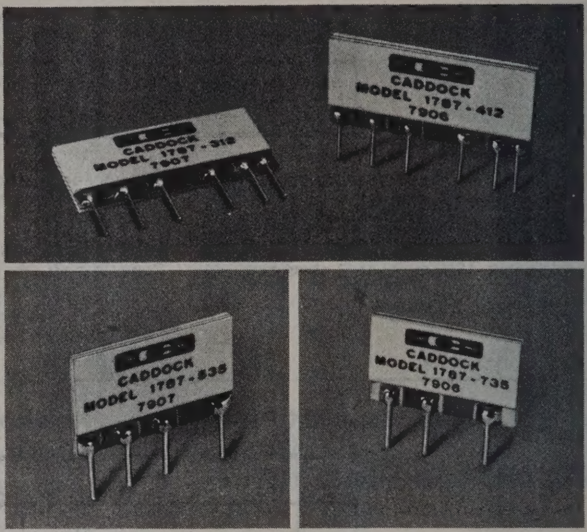
Accurate Current Sensing in Multi-Range Instrumentation

Type 1787 Current Shunt Resistor Networks utilize Caddock's Micronox® resistance films and advanced high thru-put laser manufacturing capabilities to achieve many vital advantages in precision current measurement circuits, including laboratory and bench-type digital instrumentation:

- The thin-profile single-package configuration replaces as many as four discrete current shunt resistors.
- The monolithic construction and standardized lead spacing simplifies installation.
- Caddock Micronox® resistance films provide exceptional stability for improved long-term measurement accuracy.

Eighteen standard models in six network arrangements provide the specific accuracy and resistance values required for a wide range of current measuring instruments and circuits.

Prototype quantities of most models of the Type 1787 Current Shunt Resistor Networks can be delivered from stock to within 6 weeks ARO.


CADDOCK MODEL 1787-312 7907
CADDOCK MODEL 1787-412 7906
CADDOCK MODEL 1787-535 7907
CADDOCK MODEL 1787-735 7906

Model No.	Resistance Values				Power Rating Watts				Max. Power Rating Watts Total Pkg.	Fig.	Absolute Resistance Tolerance % ①	Maximum Absolute TC ppm/°C ②	Absolute Stability Max. % Change in Resistance Value	
	R_A	R_B	R_C	R_D	R_A	R_B	R_C	R_D					Load Life ③	Shelf Life ④
1787 — 31	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.25	80	0.05	0.03
1787 — 312	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.10	80	0.03	0.02
1787 — 41	1000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.25	80	0.05	0.03
1787 — 412	1000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.10	80	0.03	0.02
1787 — 5	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.25	50	0.04	0.02
1787 — 53	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.10	50	0.02	0.01
1787 — 535	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.05	50	0.02	0.01
1787 — 5352	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.02	50	0.01	0.01
1787 — 6	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.25	50	0.04	0.02
1787 — 64	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.10	50	0.02	0.01
1787 — 645	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.05	50	0.02	0.01
1787 — 6452	1000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.02	50	0.01	0.01
1787 — 7	99 Ω	9 Ω	N/A	N/A	0.25	0.75	N/A	N/A	0.75	5	0.25	50	0.04	0.02
1787 — 73	99 Ω	9 Ω	N/A	N/A	0.25	0.75	N/A	N/A	0.75	5	0.10	50	0.02	0.01
1787 — 735	99 Ω	9 Ω	N/A	N/A	0.25	0.75	N/A	N/A	0.75	5	0.05	50	0.02	0.01
1787 — 7352	99 Ω	9 Ω	N/A	N/A	0.25	0.75	N/A	N/A	0.75	5	0.02	50	0.01	0.01
1787 — 13	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	6	0.25	100	0.05	0.03
1787 — 132	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	6	0.10	100	0.03	0.02

① **Absolute Resistance Tolerance:** Tolerance of R_A, R_B, R_C or R_D when measured in accordance with proper Figure No

② **Absolute Temperature Coefficient:** Temperature coefficient of R_A, R_B, R_C or R_D from 0°C to 70°C, referenced to +25°C.

③ **Load Life:** Stability of R_A, R_B, R_C or R_D with full power applied individually for 2000 hours at +70°C.

④ **Shelf Life:** Stability of R_A, R_B, R_C or R_D for six months at shelf conditions.

Storage Temperature: −55°C to +105°C.

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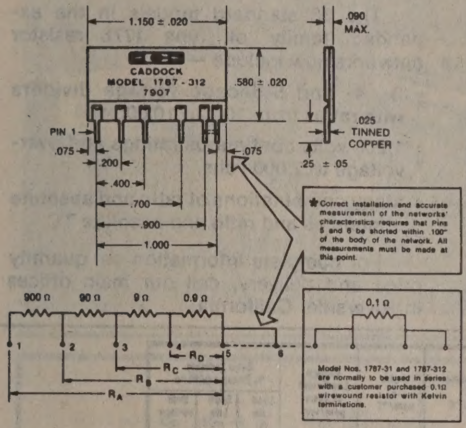
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

For More Information. Circle No. 384

Type 1787 Current Shunt Resistor Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Figure 1 — Model Nos. 1787-31 and 1787-312


1.150 ± .020
.090 MAX.
CADDOCK MODEL 1787-312 7907
.580 ± .020
.025 TINNED COPPER
PIN 1
.075
.200
.400
.700
.900
1.000
.25 ± .05
900 Ω
90 Ω
9 Ω
0.9 Ω
0.1 Ω
1
2
3
4
5
6
R_D
R_C
R_B
R_A

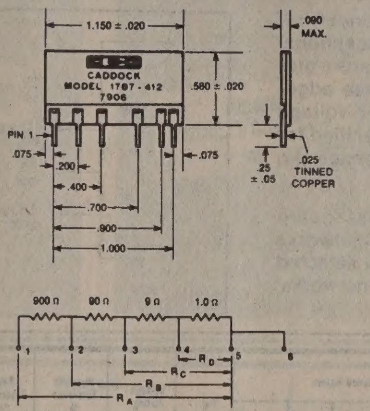
★ Correct installation and accurate measurement of the networks' characteristics requires that Pins 5 and 6 be shorted within .100" of the body of the network. All measurements must be made at this point.

Model Nos. 1787-31 and 1787-312 are normally to be used in series with a customer purchased 0.1Ω wirewound resistor with Kelvin terminations.

Model Nos. 1787-31 and 1787-312 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	999.9 Ω	Pin 1	Pin 1	Pin 5 ★	Pin 6 ★
R_B	99.9 Ω	Pin 1	Pin 2	Pin 5 ★	Pin 6 ★
R_C	9.9 Ω	Pin 1	Pin 3	Pin 5 ★	Pin 6 ★
R_D	0.9 Ω	Pin 1	Pin 4	Pin 5 ★	Pin 6 ★

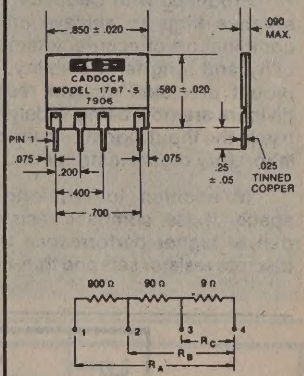
Figure 2 — Model Nos. 1787-41 and 1787-412


1.150 ± .020
.090 MAX.
CADDOCK MODEL 1787-412 7906
.580 ± .020
PIN 1
.075
.200
.400
.700
.900
1.000
.25 ± .05
.025 TINNED COPPER
900 Ω
90 Ω
9 Ω
1.0 Ω
1
2
3
4
5
6
R_D
R_C
R_B
R_A

Model Nos. 1787-41 and 1787-412 Measurement Connections

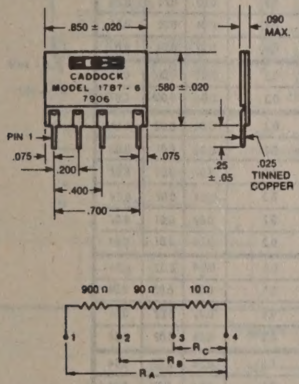
Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	1000 Ω	Pin 1	Pin 1	Pin 5	Pin 6
R_B	100 Ω	Pin 1	Pin 2	Pin 5	Pin 6
R_C	10 Ω	Pin 1	Pin 3	Pin 5	Pin 6
R_D	1 Ω	Pin 1	Pin 4	Pin 5	Pin 6

Figure 3 — Model Nos. 1787-5, 1787-53, 1787-535 and 1787-5352


.850 ± .020
.090 MAX.
CADDOCK MODEL 1787-5 7906
.580 ± .020
PIN 1
.075
.200
.400
.700
.25 ± .05
.025 TINNED COPPER
900 Ω
90 Ω
9 Ω
1
2
3
4
R_C
R_B
R_A

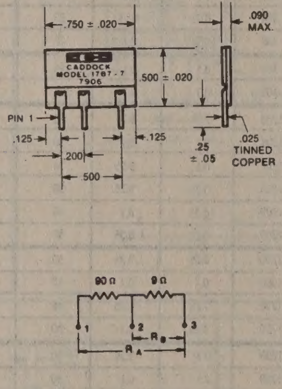
Resistances	
"R"	Total Value
R_A	999 Ω
R_B	99 Ω
R_C	9 Ω

Figure 4 — Model Nos. 1787-6, 1787-64, 1787-645 and 1787-6452


.850 ± .020
.090 MAX.
CADDOCK MODEL 1787-6 7906
.580 ± .020
PIN 1
.075
.200
.400
.700
.25 ± .05
.025 TINNED COPPER
900 Ω
90 Ω
10 Ω
1
2
3
4
R_C
R_B
R_A

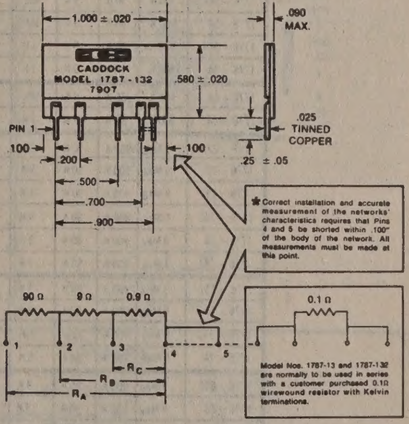
Resistances	
"R"	Total Value
R_A	1000 Ω
R_B	100 Ω
R_C	10 Ω

Figure 5 — Model Nos. 1787-7, 1787-73, 1787-735 and 1787-7352


.750 ± .020
.090 MAX.
CADDOCK MODEL 1787-7 7906
.500 ± .020
PIN 1
.125
.200
.500
.25 ± .05
.025 TINNED COPPER
90 Ω
9 Ω
1
2
3
R_B
R_A

Resistances	
"R"	Total Value
R_A	99 Ω
R_B	9 Ω

Figure 6 — Model Nos. 1787-13 and 1787-132


1.000 ± .020
.090 MAX.
CADDOCK MODEL 1787-132 7907
.580 ± .020
.025 TINNED COPPER
PIN 1
.100
.200
.500
.700
.900
.25 ± .05
90 Ω
9 Ω
0.9 Ω
0.1 Ω
1
2
3
4
5
R_C
R_B
R_A

★ Correct installation and accurate measurement of the networks' characteristics requires that Pins 4 and 5 be shorted within .100" of the body of the network. All measurements must be made at this point.

Model Nos. 1787-13 and 1787-132 are normally to be used in series with a customer purchased 0.1Ω wirewound resistor with Kelvin terminations.

Model Nos. 1787-13 and 1787-132 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	99.9 Ω	Pin 1	Pin 1	Pin 4 ★	Pin 5 ★
R_B	9.9 Ω	Pin 1	Pin 2	Pin 4 ★	Pin 5 ★
R_C	0.9 Ω	Pin 1	Pin 3	Pin 4 ★	Pin 5 ★

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CADDOCK

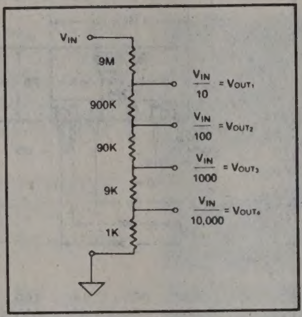
HIGH PERFORMANCE FILM RESISTORS

Type 1776 Precision Decade Resistor Voltage Dividers

Input Voltage Dividers for Digital Multimeters and Range-Switching Instruments.

Produced with Caddock Tetrinox® resistance films to achieve an exceptional combination of accuracy, temperature stability and long-term stability, these edge-mount precision decade resistor voltage dividers are now being widely specified for use in the input signal circuits of bench and laboratory digital instruments.

In addition to requiring less board space, these compact resistor networks deliver higher performance than selected discrete resistor sets and thin-film networks.


V_{IN}
9M
900K
90K
9K
1K
$\frac{V_{IN}}{10} = V_{OUT_1}$
$\frac{V_{IN}}{100} = V_{OUT_2}$
$\frac{V_{IN}}{1000} = V_{OUT_3}$
$\frac{V_{IN}}{10,000} = V_{OUT_4}$

The 33 standard models in the expanded 'family' of Type 1776 resistor networks now include —

- 3-, 4- and 5-decade voltage dividers with ratios from 10:1 to 10,000:1
- 1,200 volts continuous ratings and overvoltage to 2,000 volts.
- Many combinations of ratio and absolute tolerances and ratio and absolute TC.

For complete information on quantity price and delivery, call our main offices in Riverside, California.

Model No	Resistance Values					Fig	Voltage Rating ⑦	Absolute Tolerance %	Ratio Tolerance % ①	Absolute TC ppm/°C	Ratio TC ppm/°C ②	Voltage Coefficient of Ratio ppm/volt ③	Ratio Stability % Change in Ratio		
	R_1	R_2	R_3	R_4	R_5								Load Life ④	Shelf Life ⑤	Over-voltage ⑥
1776 - 9	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776 - 91	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776 - 912	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.02	30	5	0.02	0.01	0.005	0.01
1776 - 82	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.25	30	25	0.3	0.04	0.02	0.04
1776 - 8	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.1	30	25	0.2	0.02	0.01	0.02
1776 - 81	9.9 Meg	90 K	10 K	—	—	1	1200	0.25	0.05	30	25	0.2	0.02	0.01	0.02
1776 - 1	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776 - 14	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776 - 72	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.25	30	30	0.3	0.04	0.02	0.04
1776 - 7	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.1	30	25	0.2	0.02	0.01	0.02
1776 - 71	9 Meg	900 K	90 K	10 K	—	2	1200	0.25	0.05	30	25	0.2	0.02	0.01	0.02
1776 - 10*	9 Meg	900 K	90 K	10 K	—	4	1200	+0. −0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776 - 105*	9 Meg	900 K	90 K	10 K	—	4	1200	+0. −0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776 - 532	900 K	90 K	9 K	900	—	5	300	0.25	0.25	25	25	0.4	0.04	0.02	0.04
1776 - 53	900 K	90 K	9 K	900	—	5	300	0.1	0.1	25	25	0.3	0.02	0.01	0.02
1776 - 542	900 K	90 K	9 K	1 K	—	5	300	0.25	0.25	25	25	0.4	0.04	0.02	0.04
1776 - 54	900 K	90 K	9 K	1 K	—	5	300	0.1	0.1	25	25	0.3	0.02	0.01	0.02
1776 - 63	900 K	90 K	9 K	900	—	6	300	0.1	0.1	25	10	0.3	0.01	0.005	0.01
1776 - 64	900 K	90 K	9 K	1 K	—	6	300	0.1	0.1	25	10	0.3	0.01	0.005	0.01
1776 - 232	9 Meg	900 K	90 K	9 K	900	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776 - 23	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.1	50	50	0.2	0.02	0.01	0.02
1776 - 231	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.05	50	50	0.2	0.02	0.01	0.02
1776 - 242	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776 - 24	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.1	50	50	0.2	0.02	0.01	0.02
1776 - 241	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.05	50	50	0.2	0.02	0.01	0.02
1776 - 732	9 Meg	900 K	90 K	9 K	900	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776 - 73	9 Meg	900 K	90 K	9 K	900	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776 - 742	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.25	0.25	50	50	0.5	0.01	0.02	0.01
1776 - 74	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.25	0.1	50	50	0.5	0.04	0.02	0.04
1776 - 832	9 Meg	900 K	90 K	9 K	900	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776 - 83	9 Meg	900 K	90 K	9 K	900	8	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776 - 842	9 Meg	900 K	90 K	9 K	1 K	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776 - 84	9 Meg	900 K	90 K	9 K	1 K	8	1200	0.25	0.1	50	50	0.5	0.04	0.02	0.04

*Resistors Isolated

① **Ratio Tolerance:** Maximum ratio difference between any two resistors in the network.

② **Ratio Temperature Coefficient:** Ratio track between any two resistors in the network from 0°C to +70°C.

③ **Voltage Coefficient of Ratio (ppm/volt):** R_1 in series with any combination of R_2, R_3, R_4 and R_5, 100 volts to 1200 volts.

④ **Load Life:** Ratio stability of resistance under full load. 1200 volts DC applied to all resistors in series for 2000 hours at +70°C.

⑤ **Shelf Stability of Ratio:** Six months at shelf conditions.

⑥ **Overvoltage:** Maximum voltage of 1.67 times rated DC voltage. Volts DC or peak AC applied to R_1 and any combination of R_2, R_3, R_4, and R_5 in series with R_1 for 10 seconds.

⑦ **Voltage Rating:** DC or RMS AC voltage applied to all resistors in series.

Storage Temperature: −55°C to +85°C.

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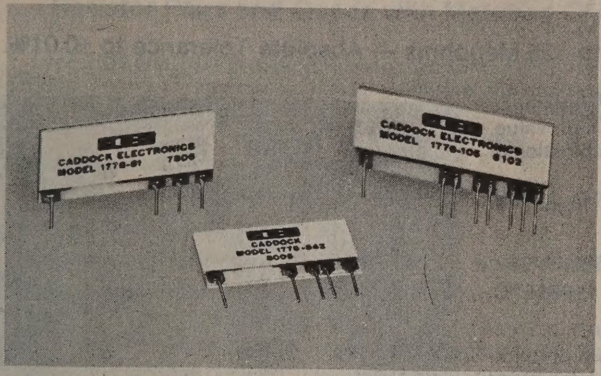
Type 1776 Precision Decade Resistor Voltage Dividers

CADDOCK
HIGH PERFORMANCE FILM RESISTORS


CADDOCK ELECTRONICS MODEL 1776-81 7806
CADDOCK ELECTRONICS MODEL 1776-105 8102
CADDOCK MODEL 1776-842 8005

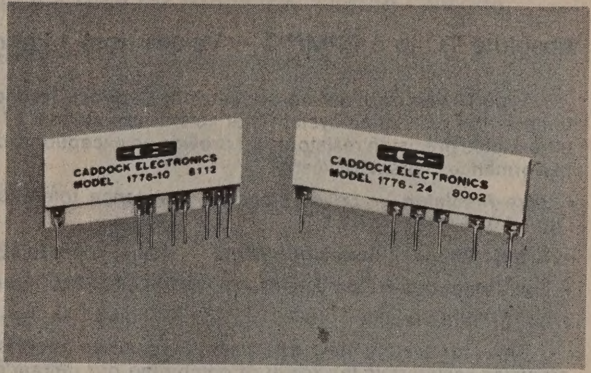

CADDOCK ELECTRONICS MODEL 1776-10 8112
CADDOCK ELECTRONICS MODEL 1776-24 8002

Figure 1

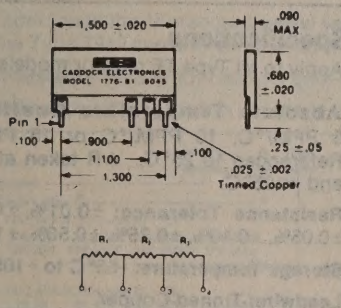

1,500 ± .020
.090 MAX
CADDOCK ELECTRONICS MODEL 1776-81 8043
.680 ±.020
Pin 1
.100
.900
1.100
1.300
.100
.25 ±.05
.025 ± .002 Tinned Copper
R1 R2 R3
1 2 3 4

Figure 2

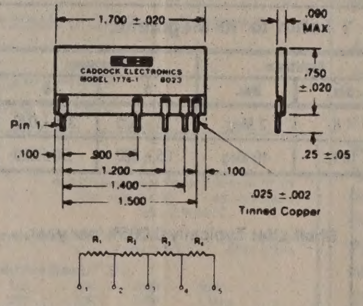

1.700 ± .020
.090 MAX
CADDOCK ELECTRONICS MODEL 1776-1 8023
.750 ±.020
Pin 1
.100
.900
1.200
1.400
1.500
.100
.25 ±.05
.025 ± .002 Tinned Copper
R1 R2 R3 R4
1 2 3 4 5

Figure 3

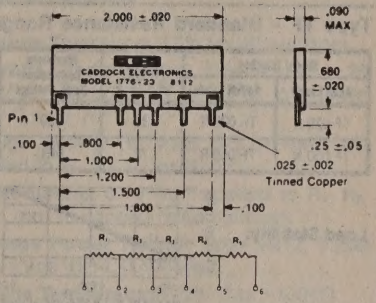

2.000 ± .020
.090 MAX
CADDOCK ELECTRONICS MODEL 1776-23 8112
680 ±.020
Pin 1
.100
.800
1.000
1.200
1.500
1.800
.100
.25 ±.05
.025 ± .002 Tinned Copper
R1 R2 R3 R4 R5
1 2 3 4 5 6

Figure 4

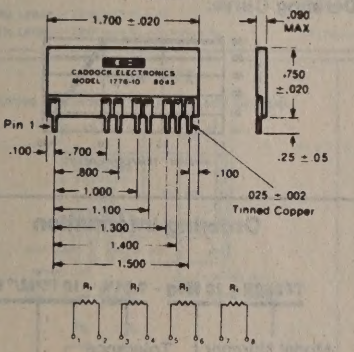

1.700 ± .020
.090 MAX
CADDOCK ELECTRONICS MODEL 1776-10 8043
.750 ±.020
Pin 1
.100
.700
.800
1.000
1.100
1.300
1.400
1.500
.100
.25 ± .05
.025 ± .002 Tinned Copper
R1 R2 R3 R4
1 2 3 4 5 6 7 8

Figure 5

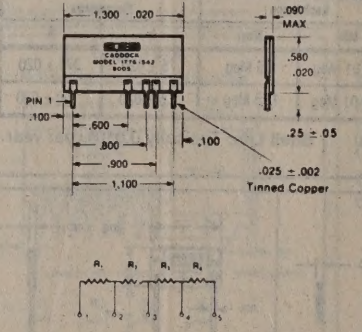

1.300 .020
.090 MAX
CADDOCK MODEL 1776-842 8005
.580 .020
PIN 1
.100
.600
.800
.900
1.100
.100
.25 ± .05
.025 ± .002 Tinned Copper
R1 R2 R3 R4
1 2 3 4 5

Figure 6

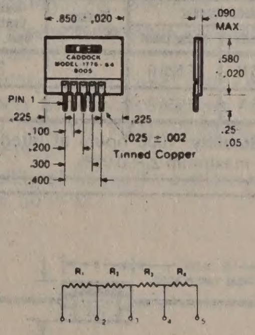

.850 ,020
.090 MAX
CADDOCK MODEL 1776-84 8005
.580 .020
PIN 1
.225
.100
.200
.300
.400
.225
.025 ± .002 Tinned Copper
.25 .05
R1 R2 R3 R4
1 2 3 4 5

Figure 7

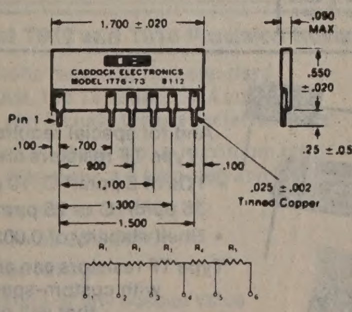
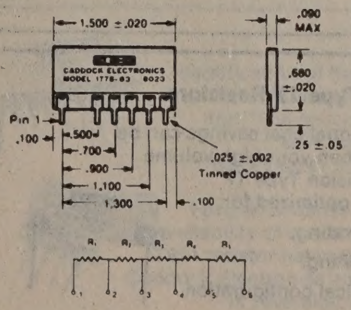

1.700 ± .020
.090 MAX
CADDOCK ELECTRONICS MODEL 1776-73 8112
.550 ±.020
Pin 1
.100
.700
900
1,100
1,300
1.500
.100
.25 ±.05
.025 ±.002 Tinned Copper
R1 R2 R3 R4 R5
1 2 3 4 5 6

Figure 8


1.500 ± .020
.090 MAX
CADDOCK ELECTRONICS MODEL 1776-83 8023
.680 ±.020
Pin 1
.100
.500
.700
.900
1.100
1.300
.100
25 ± .05
.025 ±.002 Tinned Copper
R1 R2 R3 R4 R5
1 2 3 4 5 6

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For More Information. Circle No. 384

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

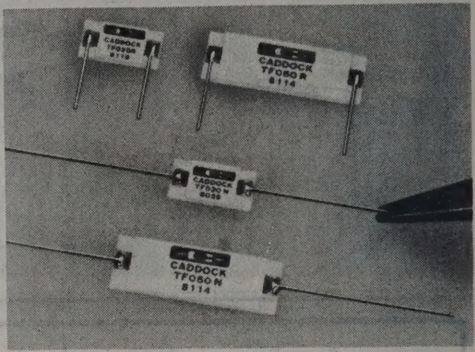
Type TF Low TC Ultra-Precision Film Resistors

Absolute TC to 5 PPM/°C — Values from 1 kohm to 125 Megohms — Absolute Tolerance to ±0.01%.

Type TF precision resistors employ the Caddock Tetrinox® resistance films — the resistance system that sets a new standard for high value, ultra-stable precision resistors that provide an exceptional combination of performance characteristics:

- **Ultra-Precision** – Seven standard resistance tolerances from ±1% to ±0.01%
- **A Wide Range of Resistance Values** – from 1 kohm to 125 Megohms.
- **Low Temperature Coefficients** – 5 PPM/°C, 10 PPM/°C and 15 PPM/°C.
- **Long-Term Stability** – to 0.01% per 1000 hours.

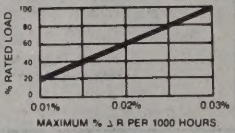
This completely new approach to quantity production of ultra-precision resistors is the result of combining our unique complex-oxide technology with an advanced high thru-put laser manufacturing capability.



Type TF - Standard Resistance Range - 1 kohm to 10 Megohms.

Model Number		Wattage @ +70°C.	Maximum Continuous Oper. Voltage	Resistance		Dimensions	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF 020 N	TF 020 R	.33	300	1 K	2 Meg	.75 ±.020	.375 ±.020
TF 050 N	TF 050 R	.75	1400	10 K	10 Meg	1.5 ±.020	.50 ±.020

Load Stability:



Shelf Life: Typically 0.005% per year.

Type TF - Extended Resistance Range - 2 Megohms to 125 Megohms.

Model Number		Wattage @ +70°C.	Maximum Continuous Oper. Voltage	Resistance		Dimensions	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF 626 N	TF 626 R	.33	300	2.01 Meg	35 Meg	.75 ±.020	.375 ±.020
TF 656 N	TF 656 R	.75	1400	10.01 Meg	125 Meg	1.5 ±.020	.50 ±.020

Load Stability: 1000 hours at rated voltage at +70° C, maximum ΔR 0.03%.

Shelf Life: Typically 0.010% per year.

Specifications

Apply to all Type TF resistor models

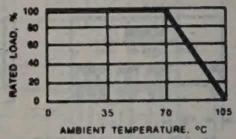
Absolute Temperature Coefficient: 5 PPM/°C, 10 PPM/°C or 15 PPM/°C. Referenced to 25°C, ΔR taken at -15°C and +105°C.

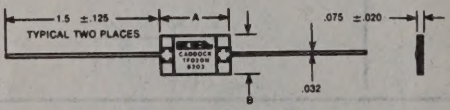
Resistance Tolerance: ±0.01%, ±0.025%, ±0.05%, ±0.10%, ±0.25%, ±0.50%, ±1.0%.

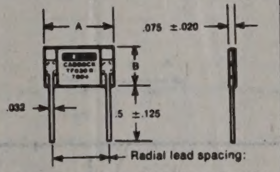
Storage Temperature: -55°C to +105°C.

Leadwire: Tinned Copper.

Derating Curve:







Radial lead spacing:
.60 ±.02 for Models TF 020 R and TF 626 R
1.35 ±.02 for Models TF 050 R and TF 656 R

Ordering Information

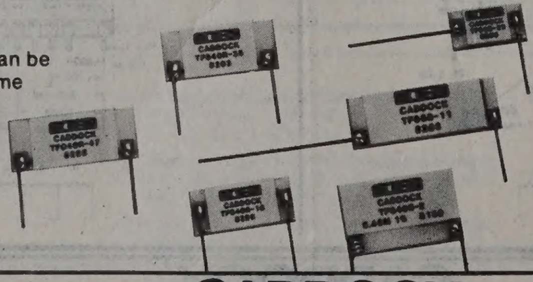
TF050R - 10 Meg - 0.01% - 10 PPM/°C

Model Number
Resistor Value
Tolerance
Temperature Coefficient

Custom Type TF Resistors

Additional cost savings can be realized when your high volume ultra-precision Type TF resistor is optimized for:

- Voltage rating.
- Power rating.
- Mechanical configuration.
- Ratio matched sets.



And for special requirements, custom Type TF resistors are available with:

- TCs of 5 ppm/°C, 10 ppm/° C 15 ppm/°C or 25 ppm/°C.
- Shelf stability of 0.0025% per year.

Type TF resistors can also be produced with custom-spaced radial leads that will plug directly into your existing circuit layouts.

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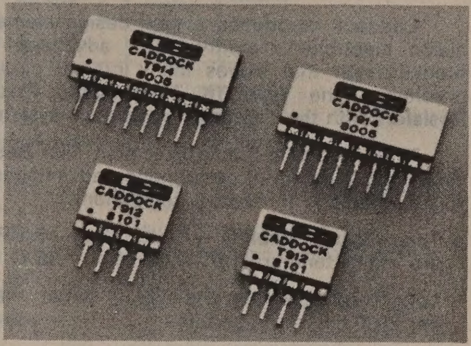
For More Information. Circle No. 384

Type T912 and T914 Precision Resistor Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Resistor Pairs and Quads with Matched Characteristics for Precision Analog Circuits.



Type T912 and T914 Precision Resistor Networks are constructed with Caddock Tetrinox® resistance films to achieve the matched resistor characteristics and stability required by highly accurate amplifier circuits, voltage reference circuits and precision bridge circuits.

- **Ratio Tolerances** – from ±0.1% to ±0.01%.
- **Ratio Temperature Coefficients** – 10 PPM/°C, 5 PPM/°C or 2 PPM/°C.
- **Absolute Temperature Coefficient** – 25 PPM/°C.
- **Ratio Stability of Resistance at Full Load for 2000 hours** – Within ±0.01%.
- **Shelf Life Stability of Ratio for 6 Months** – Within ±0.005%.

Both the T912 and T914 are available in 14 standard resistance values between 1000 ohms and 1 Megohm. Caddock's high thru-put manufacturing capability assures delivery of prototype and large-volume production quantities from stock to within 6 weeks after receipt of order.

Standard Type T912 and T914 Precision Resistor Networks

In addition to the 14 standard **equal value** models of the Type T912 and T914, the Type T912 can also be ordered with —

- **10:1 resistance ratio** — for use with gain-setting amplifiers.
- **9:1 resistance ratio** — for use in voltage reference dividers.

T912 - A 10K - 010 - 02

Model Number

Ratio Code Letter: *

A - T912 with R_1:R_2 where R_2 = $10R_1$

1K:10K	5K:50K	20K:200K	40K:400K
2K:20K	10K:100K	25K:250K	50K:500K
			100K:1 Megohm

B - T912 with R_1:R_2 where R_2 = $9R_1$

1K:9K	5K:45K	20K:180K	40K:360K
2K:18K	10K:90K	25K:225K	50K:450K
			100K:900K

No Letter — T912 with R_1 = R_2

No Letter — T914 with R_2 = R_2 = R_3 = R_4

Ratio Temperature Track:* (0°C to 70°C)
-10 = 10 PPM/°C
-05 = 5 PPM/°C
-02 = 2 PPM/°C

Ratio Tolerance:*
-100 = 0.1%
-050 = 0.05%
-020 = 0.02%
-010 = 0.01%

Standard Resistance Values:* (R_1)

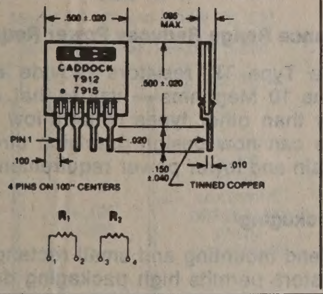
1K	10K	40K	200K	500K
2K	20K	50K	250K	1 Meg.
5K	25K	100K	400K	

Special or mixed resistance values are available as custom networks. See the custom section at the bottom of this page.

* (This information appears on the back side of the network)

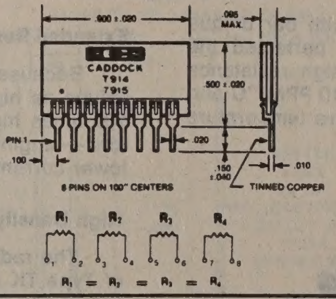
Type T912

Ratios Available: 1:1, 9:1, 10:1 and Custom.



Type T914

Ratios Available: 1:1 and Custom.



Specifications

Absolute Tolerance: 0.1% for all resistors.

Absolute Temperature Coefficient: ±25 PPM/°C. Referenced to 25°C, ΔR taken at 0°C and 70°C.

Voltage Rating: 30 Volts DC or RMS AC applied to R_1, R_2, R_3, or R_4.

Power Rating: 0.10 watt applied to R_1, R_2, R_3, R_4 (not to exceed rated voltage).

Package Power Rating: Type T912, 0.200 watt. Type T914, 0.400 watt.

Storage Temperature: -55°C to +105°C.

Insulation Resistance Between Isolated Pins: Pin 2 to Pin 3, Pin 4 to Pin 5, or Pin 6 to Pin 7, 1000 Megohms, minimum.

Dielectric Strength Between Isolated Pins: 50 volts RMS AC.

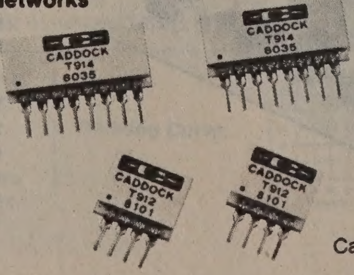
Ratio Stability Under Load: Ratio change between any two resistors in the network under full load for 2000 hours at 70°C, 0.01% maximum.

Shelf Stability of Ratio: Six months at shelf conditions, 50 PPM.

Custom Model T912 and T914 Precision Resistor Networks

For applications requiring non-standard resistance values, the T912 and T914 custom configurations can include these special features:

- Mixed resistance values with a maximum ratio of 250-to-1. (Example: 1.0 Megohm and 4K)
- Absolute TC as low as 15 PPM/°C.
- Ratio TC as low as 2 PPM/°C.
- Custom voltage ratings.
- Matched resistors of any special value between 1K and 2 Megohms.



Identification of the electrical characteristics of each T912 and T914 resistor network is included on the back side of the network.

For performance, price and availability of custom T912 and T914 resistor networks, contact Caddock Electronics' main offices in Riverside, California.

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CADDOCK

HIGH PERFORMANCE FILM RESISTORS

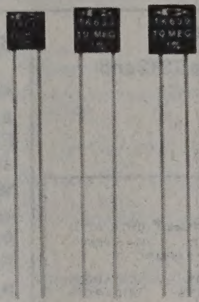
Type TK Temp-Stable Precision Film Resistors

Small Package with Low TC of 10 PPM/° C and Resistance Range from 1 kohm to 10 Megohms.

Caddock introduces a new design element for precision electronic circuitry — an advanced technology breakthrough that solves many critical circuit stability problems — the **Type TK Temp-Stable Precision Film Resistors with the Tetrinox® resistance system.**

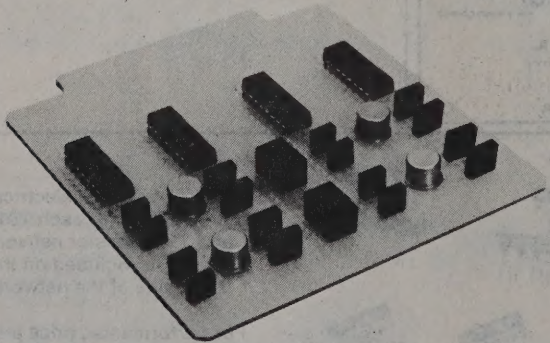
Type TK Temp-Stable Precision Film Resistors provide a combination of performance advantages never before available in a resistive component:

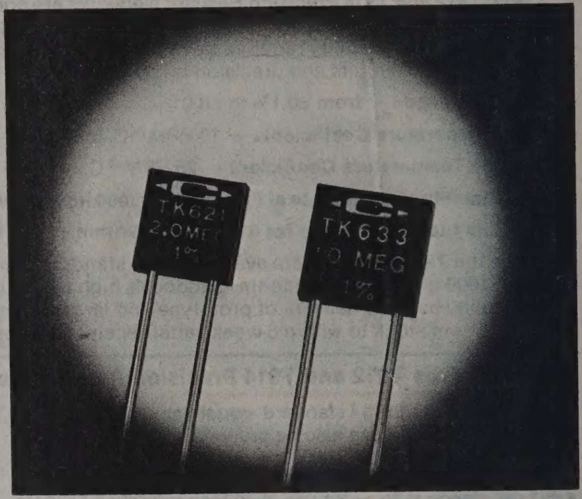
- **Temperature Stability** — better than 10 PPM/°C over the entire temperature range from −55°C to +125°C!
- **Long-Term Absolute Stability** — better than ±0.05% per 2000 hours of operation.
- **Extended Resistance Range** — from 1000 ohms to 10 Megohms.
- **Precision Tolerances** — ±1% is standard, and tolerances as close as ±0.05% are available.
- **Wide Operating Temperature Range**—from −55°C to +175°C.
- **Small Size** — with two miniature rectangular cases for maximum packaging density and minimum mounting area.
- **High Power Density**—with power ratings of .2 watt and .3 watt in molded cases, the largest of which is a standard CK 06 package.
- **Highest Performance-to-Cost Ratio** — with many values priced below $2.00 each in 1000 lot quantities.



(Photos show resistors full size)

Building on 20 years of experience with our unique complex-oxide technology, Caddock has perfected the Tetrinox® resistance system — the first high resistance system to provide a TC that is well within 10 PPM/°C and that is also essentially linear over the entire temperature range from −55°C to +125°C.





The exceptional performance of Type TK resistors can achieve improvements in many circuit applications:

Low TC "Matched-Pair" Voltage Dividers Can be Assembled Without Pre-Selection of Resistors.

An important application for Type TK resistors is in "matched-pair" voltage dividers where the low 5 PPM/°C temperature coefficient provides ratio tracking of less than 10 PPM/°C without resistor pre-selection or special testing.

With factory selection, Type TK resistor pairs can be matched to within 1 PPM/°C.

Extended Resistance Range Reduces Power Requirements

Because the Type TK resistors provide resistance values as high as 10 Megohms — values that are up to 100 times higher than other types of ultra-low TC resistors — engineers can now design precision circuits with lower current drain and lower power requirements.

High Density Packaging

The radial lead mounting and small rectangular case of Type TK resistors permits high packaging densities in low profile electronic circuitry. And because both models of Type TK resistors are available in an exceptionally wide range of resistances, lead spacing and mounting space can be standardized.

For additional information on the Type TK resistors for your high stability circuits, contact the engineering staff of Caddock Electronics in Riverside, California. They can assist you in determining the exact temperature coefficient and tolerances your application requires, and will provide both evaluation and production quantities of these new resistors on fast-delivery schedules.

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Type TK Temp-Stable Precision Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TK Temp-Stable Precision Film Resistors — Standard Resistance Range

Model No.	Temperature Coefficient ppm/°C †	Resistance		Wattage @ +125°C	Max. Working Voltage	Dielect. Str'gth	Dimensions	Encap-sulation	Leadwire
		Min.	Max.						
TK121	5, 10 or 20	1K	500K	.2	200	300	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK133	5, 10 or 20	1K	1.5 Meg.	.3	300	400	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper
TK139	5, 10 or 20	1K	1.5 Meg.	.3	300	400	Ref. Case "C" Dwg.	Transfer Molded Type	Tinned Copper

† Specify TC when ordering. 10 PPM/°C is standard.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.05% on special order.)

Operating Temperature: −55°C to +175°C.

TC Temperature Range: −55°C to +125°C.

Overload:* 6.25 times rated power for 5 seconds at voltages not to exceed 1.5 times maximum rated working voltage, R shift less than 0.05%.

Thermal Shock: Mil-Std-202, Method 107, Condition B, R shift less than 0.05%.

Low Temperature Operation:* R shift less than 0.02%.

Dielectric Withstanding Voltage:* R shift less than 0.02%.

Moisture Resistance:* Mil-Std-202, Method 106, R shift less than 0.02%.

Load Life:* 2000 hours at +125°C, R shift less than 0.05%.

Shelf Life (Typical): 25 ppm/year.

Insulation Resistance: 10,000 Megohms.

Vibration:* R shift less than 0.01%.

Shock:* R shift less than 0.02%.

*Test methods per specifications and procedures of Mil-R-55182/9.

Type TK Temp-Stable Precision Film Resistors — Extended Resistance Range

Model No.	Temperature Coefficient ppm/°C †	Resistance		Wattage @ +125°C	Max. Working Voltage	Dielect. Str'gth	Dimensions	Encap-sulation	Leadwire
		Min.	Max.						
TK621	5, 10 or 20	501K	2 Meg	Limited by Maximum Working Voltage	200	300	Ref. Case "A" Dwg.	Transfer Molded Type	Tinned Copper
TK633	5, 10 or 20	1.51 Meg.	10 Meg.		300	400	Ref. Case "B" Dwg.	Transfer Molded Type	Tinned Copper
TK639	5, 10 or 20	1.51 Meg.	10 Meg.		300	400	Ref. Case "C" Dwg.	Transfer Molded Type	Tinned Copper

† Specify TC when ordering. 10 PPM/°C is standard.

Resistance Tolerance: ±1% Standard. (Tolerances to ±0.05% on special order.)

Operating Temperature: −55°C to +175°C.

TC Temperature Range: −55°C to +105°C.

Overload:* 1.5 times maximum rated working voltage for 5 seconds, R shift less than 0.2%.

Thermal Shock: Mil-Std-202, Method 107, Condition B, R shift less than 0.1%.

Low Temperature Operation:* R shift less than 0.05%.

Dielectric Withstanding Voltage:* R shift less than 0.05%.

Moisture Resistance:* Mil-Std-202, Method 106, R shift less than 0.05%.

Load Life:* 2000 hours at +125°C, R shift less than 0.2%.

Shelf Life (Typical): 200 ppm/year.

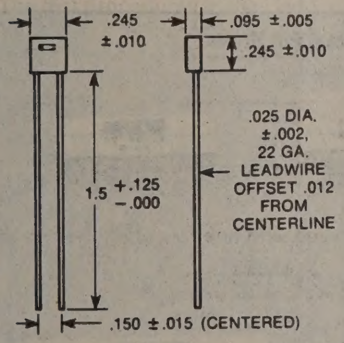
Insulation Resistance: 10,000 Megohms.

Vibration:* R shift less than 0.05%.

Shock:* R shift less than 0.05%.

*Test methods per specifications and procedures of Mil-R-55182/9.

Case "A"
Model TK 121 and Model TK 621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±.010
.095 ±.005
.245 ±.010
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±.002,
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LEADWIRE
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FROM
CENTERLINE
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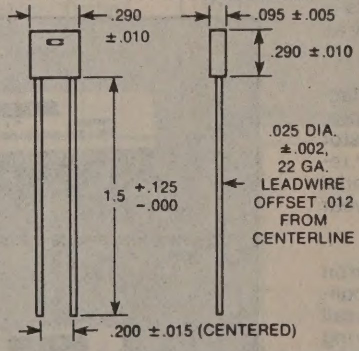
Case "B"
Model TK 133 and Model TK 633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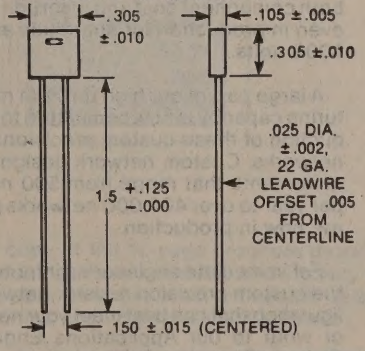
Case "C"
Model TK 139 and Model TK 639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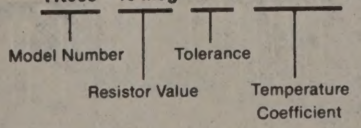
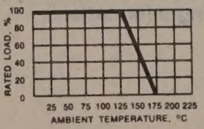
Ordering Information

TK633 - 10 Meg - 0.1% - 10 PPM/°C


Model Number
Resistor Value
Tolerance
Temperature Coefficient

Derating Curve:



APPLIES TO ALL MODELS OF TYPE TK RESISTORS

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For More Information. Circle No. 384

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type T1794 Custom Precision SIP Resistor Networks

Resistor Networks with Custom Package Size and Custom Performance.

For precision analog designs with special circuit requirements Caddock Type T1794 Custom Precision SIP Resistor Networks can include from 2 to 15 resistors per assembly and are available with performance that includes -

- Absolute tolerances from 1.0% to 0.1% - to as close as 0.025%.
- Ratio tolerances from 1.0% to 0.1% - to as close as 0.025%.
- Resistance tolerances from 500 ohms to 50 Megohms.
- Absolute temperature coefficients of 50 PPM/°C, 25 PPM/°C and 15 PPM/°C.
- Ratio temperature coefficients from 25 PPM/°C to 10 PPM/°C - to as close as 5 PPM/°C.
- Ratio stability of resistance at full load for 2000 hours to within ±0.02%.
- Shelf life stability of ratio for six months to within ±0.005%.
- Custom voltage and power ratings.

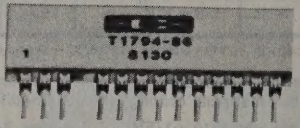
The unique thin-profile, single-in-line edge-mount package design allows the wide range of flexibility necessary to blend the performance of Tetrinox® resistance technology with particular circuit specifications to arrive at the final network package size, pin spacing and pin style.

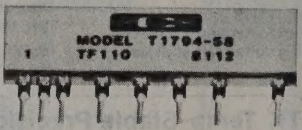
In addition to the normal upright configuration with SIP-socket pin spacing, special low-profile packages with extended leads and right-angle leads are also available.

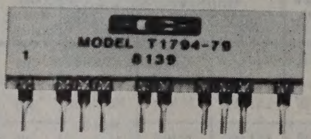
By optimizing both performance and configuration many designers find that these precision networks can achieve savings in both component cost and insertion costs—even in production-lot quantities as low as 1000 units.

A large part of our high thru-put manufacturing capacity is now committed to the production of these custom precision resistor networks. Custom network designs for requirements that range from 500 networks per year to over 400,000 networks per year are now in production.

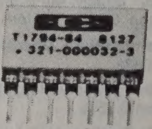
For immediate engineering information on the custom precision resistor network configuration that can best meet your needs, call or write to our Applications Engineering Group in Riverside, California, and we will be pleased to provide both technical performance and pricing information.

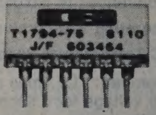


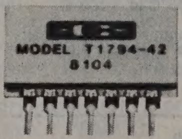




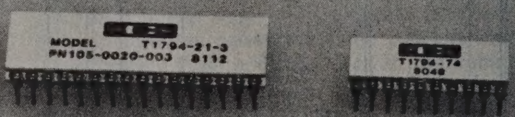
T1794-16 8138
3080797 19847



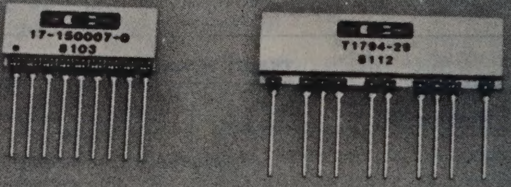




Optional Pin Styles



Low-profile, single-in-line package with one row of right-angle pins.



SIP package with extra-long pin length.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

The outstanding levels of performance and reliability that Caddock resistors provide is maintained through a continuous program of testing and process control that includes every step in the production process.

Manufacturing Control

Our manufacturing controls include processes for power conditioning, over-voltage conditioning and maximum temperature conditioning. We also perform many in-process tests to verify the performance levels and consistency of all of our resistor types, and to screen out defects not detectable by visual inspection.

Quality Control

The Caddock Quality Control System covers every step in the manufacturing process from the examination of incoming raw materials to the final testing and packaging of each resistor.

To meet the most stringent QC requirements, Caddock's Quality Control Procedures have been approved as being in conformance to the requirements of NASA NHB5300.4(1C) and MIL-1-45208 in recent surveys.

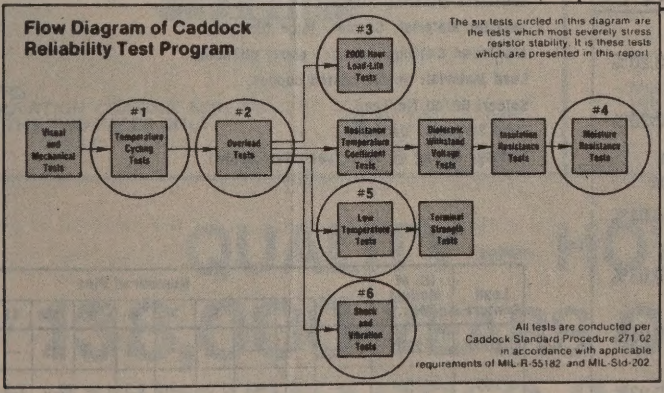
Reliability Verification

In addition to the tests for tolerance, stability and temperature characteristics that are part of our normal manufacturing procedures, we also perform semi-annual reliability tests to confirm compliance to our exacting product specifications.

The flow diagram of the Caddock Reliability Test Program illustrates the sequence of the eleven tests in this program.

The test procedures in the Caddock Reliability Testing Specification 271-02 generally follow the format of MIL-R-55182 and MIL-Std-202. The results of these tests may be used to qualify Caddock resistors for substitution in existing designs.

Flow Diagram of Caddock Reliability Test Program


Visual and Mechanical Tests
#1
Temperature Cycling Tests
#2
Overload Tests
#3
2000 Hour Load-Life Tests
Resistance Temperature Coefficient Tests
Dielectric Withstand Voltage Tests
Insulation Resistance Tests
#4
Moisture Resistance Tests
#5
Low Temperature Tests
Terminal Strength Tests
#6
Shock and Vibration Tests

The six tests circled in this diagram are the tests which most severely stress resistor stability. It is these tests which are presented in this report.

All tests are conducted per Caddock Standard Procedure 271 02 in accordance with applicable requirements of MIL-R-55182 and MIL-Std-202.

Reliability Test Summary — "Caddock Report No. 1".

To provide electronic engineers with actual stability data — data that can be used to determine actual improvements in circuit performance — we have compiled test results taken since 1972 from our continuing reliability program.

Of the eleven tests in this program, we have graphically summarized data from the six tests that measure resistor stability under conditions most important to circuit designers:

1 — Temperature Cycling Tests

2 — Overload Tests

3 — 2000 Hour Load-Life Tests

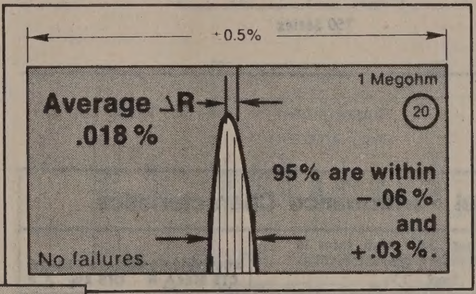
4 — Moisture Resistance Tests

5 — Low Temperature Operation

6 — Shock and Vibration Tests

This stability data appears in a series of 96 graphs that show the actual stability of 740 Caddock High Performance Film Resistors.

The individual and average resistance change is also shown in these graphs for the low, high and 'critical' values, to provide data that can be used to pre-determine actual circuit performance and long-term equipment specifications.



A copy of the 12-page brochure describing the results of these reliability and stability tests is available from the main offices of Caddock Electronics, Inc. in Riverside, California.

CADDOCK
ELECTRONICS, INCORPORATED
1717 CHICAGO AVENUE, RIVERSIDE, CALIF. 92507 • PHONE: (714) 788-1700 • TWX: 910-332-6108

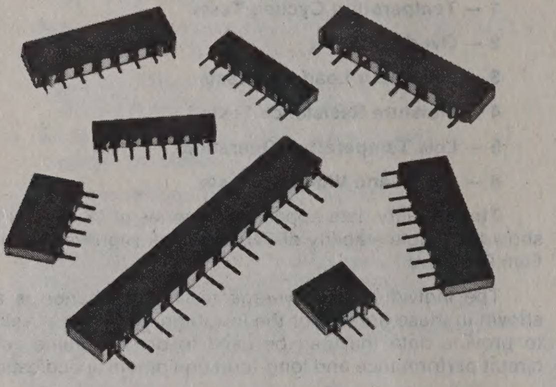
CTS® CORPORATION*
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

CERMET RESISTOR NETWORKS (Available with capacitor chips and/or active devices)*

CTS . . . Leader in the field of **Low Profile** space-saving Cermet Resistor Modules. Readily recognizable because of the familiar CTS Blue.

As is well illustrated, these modules have been specifically designed to save space.



750 Series

So if you want to reduce the size of your design or add more complex circuitry without increasing size, CTS rates top consideration.

Most appealing is the fact that "The Little Blue Brick" is an extensive "Off The Shelf" item with CTS.

FEATURES:

- Compact edge mount modules
- Ultra high stability and reliability
- Automatic insertion capabilities
- Reduced insertion time
- Fewer items to inventory
- Space savings over individual resistors
- Available with capacitors and/or active devices*
- Available with .100″ and .125″ lead centers

ELECTRICAL AND MECHANICAL SPECIFICATIONS:

Description: Cermet thick film single-in-line resistor networks.

Standard Resistance Range: 33Ω through 1 MegΩ.

Special Resistance Range: Below 33Ω and above 1 MegΩ.

Resistance Matching (2 like resistors):
50Ω to 30KΩ — 0.5%
30KΩ to 250KΩ — 1%
250KΩ to 3 MegΩ —2.5%

Ratio Matching:
50Ω to 30KΩ — ±1%
30KΩ to 250KΩ — ±2%
250KΩ to 3 MegΩ —±5%

Standard Temperature Coefficient: ±250 ppm/°C.

Special Temperature Coefficient: ±100 ppm/°C.

Temperature Coefficient Tracking: Available to 50 ppm/°C.

Standard Resistance Tolerance: ±5%.

Special Resistance Tolerance: to ±0.5% or ½Ω (whichever is greater).

Substrate Material: Alumina.

Resistor Material: Cermet - thick film.

Insulation Coating: Organic - epoxy phenolic.

Lead Material: Solder coated copper.

Solder: 60/40 Tin/Lead.

Lead Strength: 5# pull.

Wattage Rating @ 70°C (see chart below).

Lead Centers	Ht. of Module (Max.)	Number of Pins										
		2	4	5	6	7	8	9	10	11	12	13
.100	(.250)	—	—	—	.9	—	1.1	1.3	1.5	—	—	—
.100	(.350)	—	.7	—	1.0	—	1.3	—	2.0	2.3	2.5	—
.125	(.350)	.5	1.0	—	1.5	—	2.0	—	2.5	—	3.0	—

* Active devices added by CTS Microelectronics, Inc., Lafayette, Indiana.

Environmental Performance Characteristics

For units less than .340″ high, refer to page 8 for performance characteristics. Test	Allowable Resistance Change CTS Max△ R	CTS Avg. △ R
Load Life: 1,000 hrs., 0.1 watt per resistor at 70°C	±0.40%	±0.20%
Moisture Resistance: 0.1 rated wattage at 70°C, 90-98% humidity, 1,000 hrs.	±0.50%	±0.20%
Insulation Resistance: Measured wet after moisture resistance test, 200 VDC	Greater than 1000 megohms	
Low Temperature Exposure: −63°C, 4 hrs.	±0.10%	±0.04%
Thermal Shock: 5 cycles, −63°C to +125°C, no load	±0.10%	±0.03%
Short Time Overload: 2.5 times rated voltage, 5 sec.	±0.25%	±0.05%
Terminal Strength: 5 lb. tensile & compression, 30 sec.	±0.10%	±0.03%
Effect of Soldering: 60/40 solder, 246°C, 2 sec.	±0.10%	±0.05%

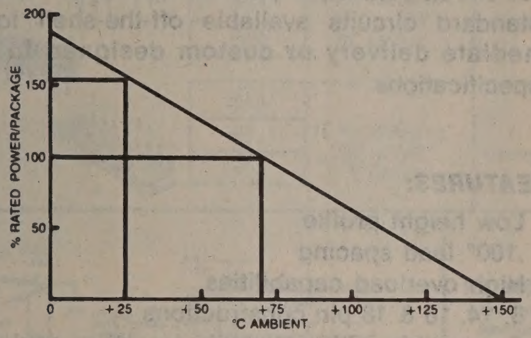
ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

* In Indiana, dba CTS Electronics Corporation

For More Information. Circle No. 385

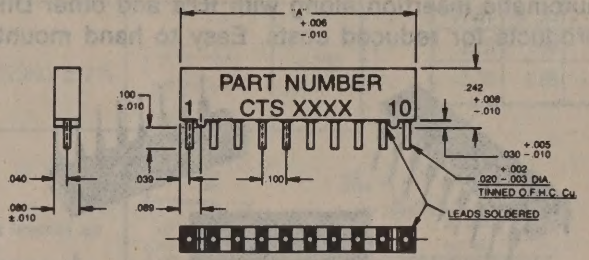
CTS® CORPORATION
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS



TYPICAL DERATING CURVE FOR CTS 750 SERIES

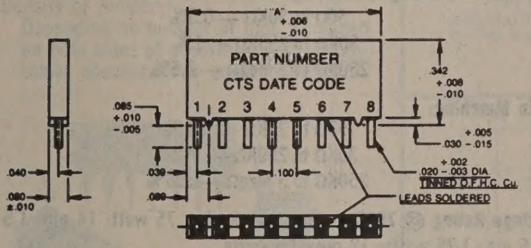
NC. OF PINS	"A" DIMENSION
6	.578
8	.778
9	.878
10	.978


"A"
+.006
−.010
PART NUMBER
CTS XXXX
1
10
.100
±.010
.242
+.008
−.010
+.005
.030 −.010
+.002
.020 −.003 DIA.
TINNED O.F.H.C. Cu.
LEADS SOLDERED
.040
.080
±.010
.039
.089
.100

NOTE:
INSULATION COATING
APPLIED ON THE
TWO FACES ONLY.

GEN. TOL. ±.005

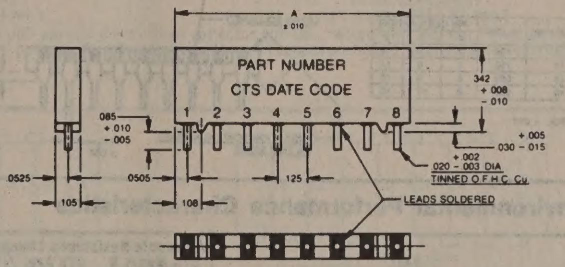
NO. OF PINS	"A" DIMENSION
4	.378
6	.578
8	.778
10	.978
11	1.078
12	1.178


"A"
+.006
−.010
PART NUMBER
CTS DATE CODE
1 2 3 4 5 6 7 8
.085
+.010
−.005
.342
+.008
−.010
+.005
.030 −.015
+.002
.020 −.003 DIA.
TINNED O.F.H.C. Cu.
LEADS SOLDERED
.040
.080
±.010
.039
.089
.100

NOTE:
INSULATION COATING APPLIED
ON THE TWO FACES ONLY.

GEN. TOL. ±.005

NO. OF PINS	"A" DIMENSION
2	.228
4	.478
6	.728
8	.978
10	1.228
12	1.478


A
±.010
PART NUMBER
CTS DATE CODE
1 2 3 4 5 6 7 8
.085
+.010
−.005
.342
+.008
−.010
+.005
.030 −.015
+.002
.020 −.003 DIA
TINNED O.F.H.C. Cu.
LEADS SOLDERED
.0525
.105
.0505
.108
.125

NOTE:
INSULATION COATING APPLIED
ON THE TWO FACES ONLY.

GEN. TOL. ±.005

QUALITY — HOW'S THIS!!

138,000 YEARS OF LIFE TESTING UNSURPASSED IN THE INDUSTRY

ORDERING INFORMATION: Place orders using following address:
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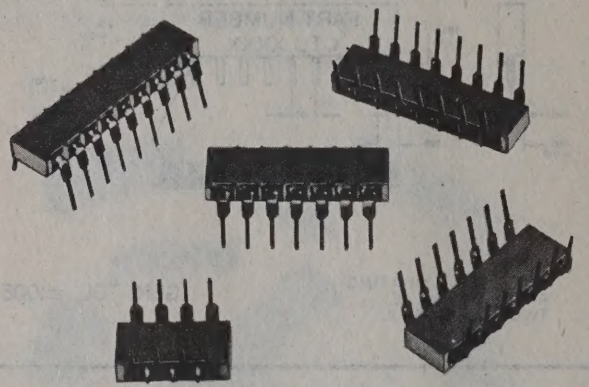
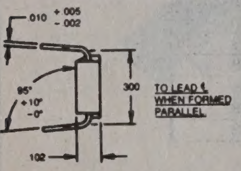
CTS® CORPORATION*
BERNE DIVISION

DUAL-IN-LINE CERMET RESISTOR NETWORKS

CERMET RESISTOR NETWORKS (Available with capacitor chips and/or active devices)*

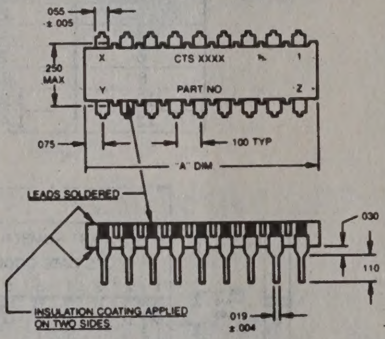
CTS Series 760 Dual-In-Line cermet resistor networks are available in 8, 14, 16, and 18 lead styles. CTS now offers you a choice of four popular space-saver packages. All are designed to simplify automatic insertion along with IC's and other DIP products for reduced costs. Easy to hand mount, too. Available without cover coat, so you can trim for circuit balance in your own plant. Choose from standard circuits available off-the-shelf for immediate delivery or custom designed to your specifications.





NO. OF PINS	"A" DIM	PIN DESIGNATION		
		X	Y	Z
8	450	4	5	8
14	750	7	8	14
16	850	8	9	16
18	950	9	10	18

GEN. TOL ±.010



Environmental Performance Characteristics

Test	Allowable Resistance Change CTS Max△ R	CTS Avg. △ R
Load Life: 1,000 hrs., 0.1 watt per resistor at 70°C	±0.50%	±0.20%
Moisture Resistance: 0.1 rated wattage at 70°C, 90-98% humidity, 1,000 hrs.	±0.50%	±0.20%
Insulation Resistance: Measured wet after moisture resistance test, 200 VDC	Greater than 1000 megohms	
Low Temperature Exposure: −63°C, 4 hrs.	±0.25%	±0.10%
Thermal Shock: 5 cycles, −63°C to +125°C, no load	±0.25%	±0.10%
Short Time Overload: 2.5 times rated voltage, 5 sec.	±0.25%	±0.05%
Terminal Strength: 5 lb. tensile & compression, 30 sec.	±0.25%	±0.03%
Effect of Soldering: 60/40 solder, 246°C, 2 sec.	±0.25%	±0.05%

FEATURES:

- Low height profile
- .100″ lead spacing
- High overload capabilities
- 8, 14, 16 & 18 pin constructions
- Compatible with automatic insertion equipment
- 2 watt power capabilities
- Reduced insertion time
- Available with capacitors and/or active devices*

ELECTRICAL AND MECHANICAL SPECIFICATIONS:

Description: 8, 14, 16, and 18 pin dual-in-line modules on .100″ lead centers.

Standard Resistance Range: 22Ω through 1 MegΩ.

Special Resistance Range: Below 22Ω and above 1 MegΩ.

Resistance Matching (2 like resistors):
50Ω to 30KΩ — 0.5%
30KΩ to 250KΩ — 1%
250KΩ to 3 MegΩ — 2.5%

Ratio Matching:
50Ω to 30KΩ — ±1%
30KΩ to 250KΩ — ±2%
250KΩ to 3 MegΩ — ±5%

Wattage Rating @ 70°C per module: 8 pin - .75 watt; 14 pin - 1.5 watts; 16 pin - 1.75 watts; 18 pin - 2.0 watts.

Standard Temperature Coefficient: ±300 ppm/°C.

Special Temperature Coefficient: to ±100 ppm/°C.

Temperature Coefficient Tracking: Available to 50 ppm/°C.

Standard Resistance Tolerance: ±5%.

Special Resistance Tolerance: ±1% or ½Ω (whichever is greater).

Substrate Material: Alumina.

Resistor Material: Cermet - thick film.

Insulation Coating: Organic - epoxy phenolic.

Lead Material: Solder coated copper.

Solder: 60/40 Tin/Lead.

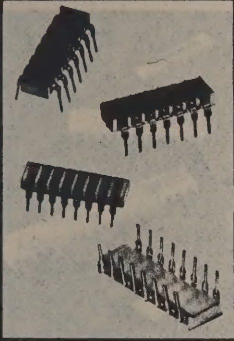
Lead Strength: 5# pull.

* Active devices added by CTS Microelectronics, Inc., Lafayette, Indiana.

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880
* In Indiana, dba CTS Electronics Corporation

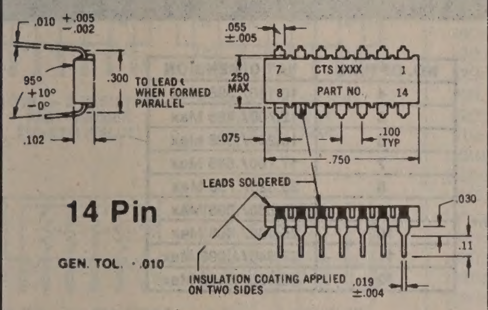
CTS® CORPORATION*
BERNE DIVISION

DUAL-IN-LINE CERMET RESISTOR NETWORKS



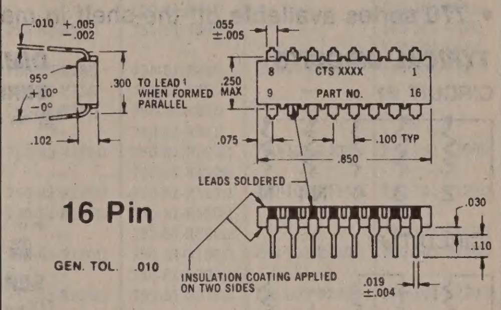
CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	Typical TC
760-3	14 Pin Module on .100" x .300" DIP Centers	Cermet	22Ω-220KΩ*±2%	1.5 @ 70°C per module	±100 ppm/°C
760-1					
760-5					
761-3	16 Pin Module on .100" x .300" DIP Centers	Cermet	68Ω-220KΩ*±2%	1.75 @ 70°C per module	±100 ppm/°C
761-1					
761-5					

Prices		
1-99	100-499	500-999
$1.15	$ .93	$ .66
1.20	.95	.68
2.15	1.75	1.25
$1.20	$ .95	$ .68
1.25	.98	.70
2.30	1.88	1.34


.010 +.005 −.002
95° +10° −0°
.300 TO LEAD ℄ WHEN FORMED PARALLEL
.102
.055 ±.005
.250 MAX
7
CTS XXXX
1
8
PART NO.
14
.075
.100 TYP
.750
LEADS SOLDERED
14 Pin
.030
.11
GEN. TOL. ·.010
INSULATION COATING APPLIED ON TWO SIDES
.019 ±.004

FEATURES:

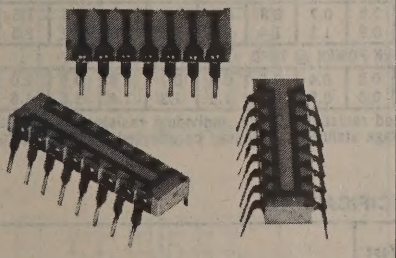
- Low cost automatic insertion and handling
- High overload capabilities
- Low height profile
- Package compatibility with monolithic packages
- .100" lead spacing


.010 +.005 −.002
95° +10° −0°
.300 TO LEAD ℄ WHEN FORMED PARALLEL
.102
.055 ±.005
.250 MAX
8
CTS XXXX
1
9
PART NO.
16
.075
.100 TYP
.850
LEADS SOLDERED
16 Pin
.030
.110
GEN. TOL. .010
INSULATION COATING APPLIED ON TWO SIDES
.019 ±.004

CONDUCTOR MODULES

Eliminate time consuming installation of jumper wires.

Density of Jumpers:
Depending on number of pins, screened on both sides of substrate. Built to customer specifications and requirements.



CTS® CORPORATION*

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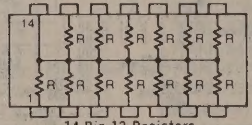
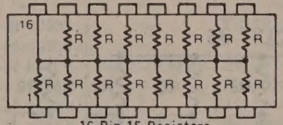
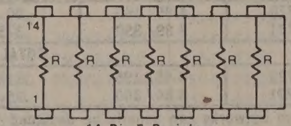


14 Pin-13 Resistors
Part Number 760-1-R+value

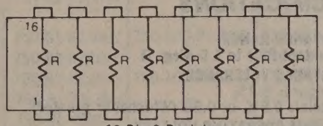


16 Pin-15 Resistors
Part Number 761-1-R+value

APPLICATIONS: MOS/ROM pull-up/pull-down; Open collector pull-up; "Wired OR" pull-up; Power driver pull-up; High speed parallel pull-up; TTL unused gate pull-up; TTL input pull-down; Digital pulse squaring.

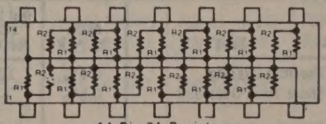


14 Pin-7 Resistors
Part Number 760-3-R+value

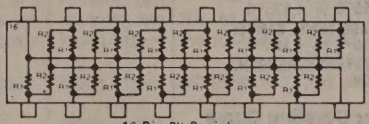


16 Pin-8 Resistors
Part Number 761-3-R+value

APPLICATIONS: "Wired OR" pull-up; Power driver pull-up; Power gate pull-up; Line termination; Long-line impedance balancing; LED current limiting; ECL output pull-down resistors; TTL input pull-down.



14 Pin-24 Resistors
Part Number 760-5-R+values



16 Pin-28 Resistors
Part Number 761-5-R+values

Resistance Values R1/R2	Part Numbers	
220Ω/270Ω	760-5-R220/270	761-5-R220/270
220Ω/330Ω	760-5-R220/330	761-5-R220/330
1.5K/3.3K	760-5-R1.5/3.3K	761-5-R1.5K/3.3K

Other combinations available upon request

Pulse Squaring TTL Terminators

CTS Terminator networks consist of two resistor pairs of the above value combinations. The resistors are connected together in series with a common line for power and a common line for ground. The junction of each pair is brought out to a separate terminal.

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

* In Indiana, dba CTS Electronics Corporation

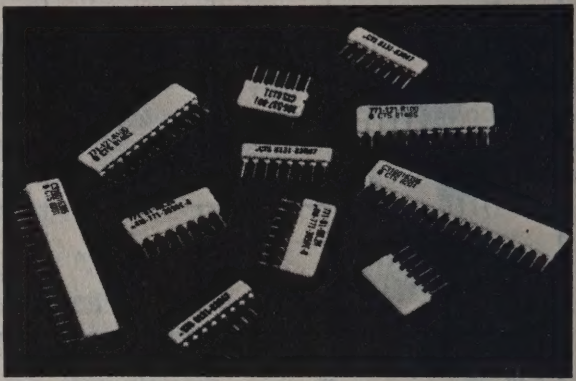
For More Information. Circle No. 385

CTS® CORPORATION
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

CONFORMAL COATED SERIES 770-771

These conformal coated networks are supplied in both the 4.95mm/.195 in. max. and 8.89mm/.350 in. max. height. Custom networks can be supplied with special resistor values and resistor combinations and tolerance to meet most customer applications.

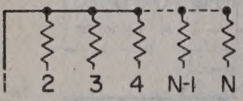


FEATURES:

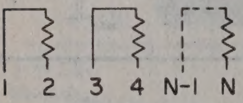
- High reliability cermet resistors
- Space saving over individual resistors
- Available with capacitors
- Available at 4.95mm/.195 in or 8.89mm/.350 in. high; 2.54mm/.100 in. pin spacing
- 770 series available off-the-shelf in many values

TYPICAL CIRCUITS

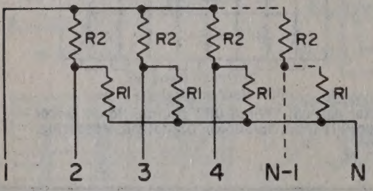
CIRCUIT #1



CIRCUIT #3



CIRCUIT #5



R2
R2
R2
R2
R1
R1
R1
R1
1
2
3
4
N-1
N

SPECIFICATIONS

***RESISTANCE RANGE:**
Standard 33Ω to 1.0 Meg. Ω

RESISTANCE TOLERANCE:
Standard: ±2%
Special: 0.5% or 0.5Ω (Whichever greater)

***MAXIMUM OPERATING VOLTAGE:**
Series 770: 50V not to exceed rated power
Series 771: 100V not to exceed rated power

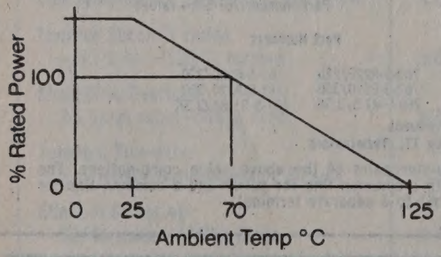
***TEMPERATURE COEFFICIENT:**
±100 PPM @ −55°C to +125°C

***OPERATING TEMP. RANGE:**
−55°C to +125°C

STORAGE TEMP. RANGE:
−55°C to +125°C

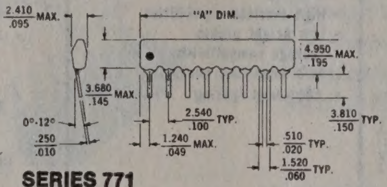
DIELECTRIC STRENGTH:
100V

Power Derating Curve



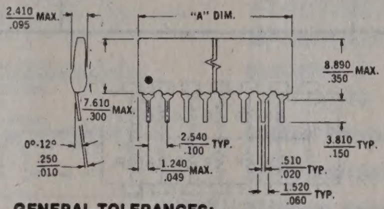
DIMENSIONS

SERIES 770



2.410/.095 MAX.
"A" DIM.
4.950/.195 MAX.
3.680/.145 MAX.
0°-12°
.250/.010
2.540/.100 TYP.
1.240/.049 MAX.
.510/.020 TYP.
1.520/.060 TYP.
3.810/.150 TYP.

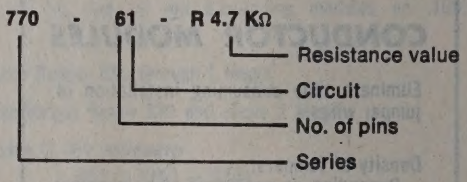
SERIES 771



2.410/.095 MAX.
"A" DIM.
8.890/.350 MAX.
7.610/.300 MAX.
0°-12°
.250/.010
2.540/.100 TYP.
1.240/.049 MAX.
.510/.020 TYP.
1.520/.060 TYP.
3.810/.150 TYP.

NO. OF PINS	"A" DIMENSION
4	10.160/.398 Max
5	12.700/.498 Max
6	15.240/.598 Max
7	17.780/.698 Max
8	20.320/.798 Max
9	22.860/.898 Max
10	25.400/.998 Max
11	27.940/1.098 Max
12	30.480/1.198 Max

CODING SYSTEM



770 - 61 - R 4.7 KΩ
Resistance value
Circuit
No. of pins
Series

GENERAL TOLERANCES:
Decimal dimensions ±.25mm/±.010"

***POWER RATING:**

TOTAL NETWORK POWER @ 25°C											
Series	Package	Resistor Power	Number of Pins								
			4	5	6	7	8	9	10	11	12
770	4.95/.195	.20	0.5	0.7	0.8	0.9	1.1	1.2	1.4	1.5	1.6
771	8.89/.350	.375	0.9	1.1	1.4	1.6	1.8	2.0	2.2	2.5	2.7
TOTAL NETWORK POWER @ 70°C											
770	4.95/.195	.125	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1
771	8.89/.350	.25	0.6	0.8	0.9	1.0	1.2	1.4	1.5	1.6	1.8

* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standards. TCR may be affected by some custom network requirements.

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

Test	Max. % △ R	Mil Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	0.5%	107	B	5 cycles −65°C to +125°C
Short Time Overload	0.5%	—	—	2½ x rated voltage 5 sec. (Series 770: 100V max.) (Series 771: 200V max.)
Moisture Resistance	0.5%	106	—	240 hours .1 rated load −10°C to +65°C 90% RH
Load Humidity	1.0%	—	—	1000 hours .1 rated load 65°C 90-98% RH
High Temp Exposure	1.0%	—	—	240 hours no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C rated load
Resistance to Solder Heat	.25%	210	A	350°C 3 sec dwell
Mechanical Shock	.25%	213	D	500g 1 msec 3/shocks ea plane
Vibration	.25%	204	D	20g 10-2000 Hz 4 hours/plane
Terminal Strength	.25%	—	—	2.0 Kg pull 30 sec two 45° bends
Low Temp Storage	.25%	—	—	24 hours @ −65°C no load
Low Temp Operation	.25%	—	—	1 hour @ −65°C full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC
Solderability		208	—	RMA flux 230°C 5 sec dip 95% coverage

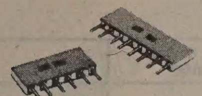
ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

For More Information. Circle No. 385

CTS® CORPORATION*
BERNE DIVISION

SINGLE-IN-LINE CERMET RESISTOR NETWORKS

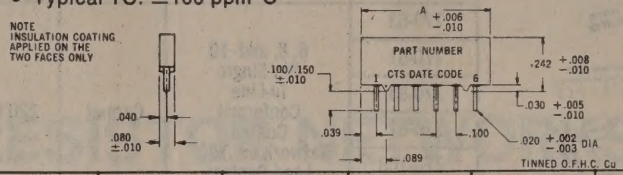
750 SERIES SINGLE-IN-LINE CERMET RESISTOR NETWORKS



- 6, 8 and 10-pin modules on .100″ lead centers
- Resistance: 32Ω - 220 KΩ* ±2% (for 750-85 Series, see table below schematic)
- Power ratings @ 70°C per module: 6 pin .9 watt; 8 pin 1.1 watt; 10 pin 1.5 watt
- Typical TC: ±100 ppm°C

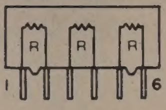
FEATURES:

- Low profile construction
- High reliability
- Alumina substrate
- Low cost automatic insertion and handling

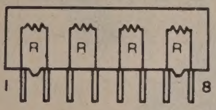


No. of Pins	A
6	.578
8	.778
10	.987

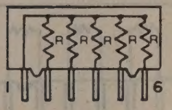
GENERAL TOLERANCES:
Decimal dimensions ±.005″



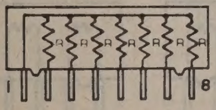
6 PIN — 3 RESISTORS
PART NUMBER
750-63-R (VALUE)



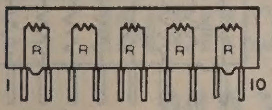
8 PIN — 4 RESISTORS
PART NUMBER
750-83-R-(VALUE)



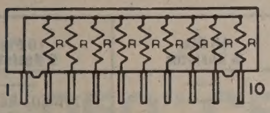
6 PIN — 5 RESISTORS
PART NUMBER
750-61-R (VALUE)



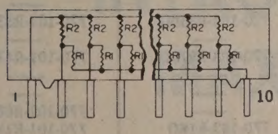
8 PIN — 7 RESISTORS
PART NUMBER
750-81-R (VALUE)



10 PIN — 5 RESISTORS
PART NUMBER 750-103-R (VALUE)



10 PIN — 9 RESISTORS
PART NUMBER 750-101-R (VALUE)



8 PIN — 12 RESISTORS
PART NUMBER 750-85 — 750-85-R (R1/R2)
10 PIN — 16 RESISTORS
PART NUMBER 750-105 — 750-105R (R1/R2)

R1/R2 Ohms	Thevenin Impedance
180/390	123Ω
220/330	132Ω
330/390	180Ω
330/470	195Ω

Resistance Value, Tolerance	6 Pin, 3 Resistor	6 Pin, 5 Resistor	8 Pin, 4 Resistor	8 Pin, 7 Resistor	10 Pin, 5 Resistor	10 Pin, 9 Resistor
33Ω±2%	750-63-R33Ω	750-61-R33Ω	750-83-R33Ω	750-81-R33Ω	750-103-R33Ω	750-101-R33Ω
47Ω±2%	—	—	750-83-R47Ω	—	750-103-R47Ω	750-101-R47Ω
51Ω±2%	—	750-61-R51Ω	—	750-81-R51Ω	—	750-101-R51Ω
56Ω±2%	—	—	750-83-R56Ω	750-81-R56Ω	—	750-101-R56Ω
62Ω±2%	—	—	—	—	—	750-101-R62Ω
68Ω±2%	750-63-R68Ω	750-61-R68Ω	750-83-R68Ω	750-81-R68Ω	750-103-R68Ω	750-101-R68Ω
75Ω±2%	—	—	750-83-R75Ω	750-81-R75Ω	—	—
82Ω±2%	—	750-61-R82Ω	750-83-R82Ω	750-81-R82Ω	—	—
91Ω±2%	—	750-61-R91Ω	—	750-81-R91Ω	—	—
100Ω±2%	750-63-R100Ω	750-61-R100Ω	750-83-R100Ω	750-81-R100Ω	750-103-R100Ω	750-101-R100Ω
110Ω±2%	—	750-61-R110Ω	—	750-81-R110Ω	—	—
120Ω±2%	—	750-61-R120Ω	750-83-R120Ω	750-81-R120Ω	750-103-R120Ω	750-101-R120Ω
150Ω±2%	750-63-R150Ω	750-61-R150Ω	750-83-R150Ω	750-81-R150Ω	—	—
160Ω±2%	—	750-61-R160Ω	—	750-81-R160Ω	—	750-101-R160Ω
180Ω±2%	—	750-61-R180Ω	750-83-R180Ω	750-81-R180Ω	750-103-R180Ω	750-101-R180Ω
200Ω±2%	—	750-61-R200Ω	—	750-81-R200Ω	—	—
220Ω±2%	750-63-R220Ω	750-61-R220Ω	750-83-R220Ω	750-81-R220Ω	750-103-R220Ω	750-101-R220Ω
240Ω±2%	—	750-61-R240Ω	—	—	—	—
270Ω±2%	—	750-61-R270Ω	750-83-R270Ω	750-81-R270Ω	750-103-R270Ω	750-101-R270Ω
330Ω±2%	750-63-R330Ω	750-61-R330Ω	750-83-R330Ω	750-81-R330Ω	750-103-R330Ω	750-101-R330Ω
360Ω±2%	—	750-61-R360Ω	—	—	—	—
390Ω±2%	—	750-61-R390Ω	—	750-81-R390Ω	—	750-101-R390Ω
430Ω±2%	—	750-61-R430Ω	—	750-81-R430Ω	—	—
470Ω±2%	750-63-R470Ω	750-61-R470Ω	750-83-R470Ω	750-81-R470Ω	750-103-R470Ω	750-101-R470Ω
500Ω±2%	—	750-61-R500Ω	—	750-81-R500Ω	—	750-101-R510Ω
510Ω±2%	—	750-61-R510Ω	—	750-81-R510Ω	—	—
560Ω±2%	—	—	—	750-81-R560Ω	750-103-R560Ω	750-101-R560Ω
680Ω±2%	750-63-R680Ω	750-61-R680Ω	750-83-R680Ω	750-81-R680Ω	750-103-R680Ω	750-101-R680Ω
820Ω±2%	—	—	—	750-81-R820Ω	—	750-101-R820Ω
910Ω±2%	—	—	—	750-81-R910Ω	—	—
1KΩ±2%	750-63-R1KΩ	750-61-R1KΩ	750-83-R1KΩ	750-81-R1KΩ	750-103-R1KΩ	750-101-1RKΩ
1.1KΩ±2%	—	—	—	—	—	750-101-R1.1KΩ
1.2KΩ±2%	—	750-61-R1.2KΩ	750-83-R1.2KΩ	750-81-R1.2KΩ	—	750-101-R1.2KΩ
1.33KΩ±2%	—	750-61-R1.33KΩ	—	—	—	—
1.5KΩ±2%	750-63-R1.5KΩ	750-61-R1.5KΩ	750-83-R1.5KΩ	750-81-R1.5KΩ	750-103-R1.5KΩ	750-101-R1.5KΩ
2KΩ±2%	750-63-R2KΩ	750-61-R2KΩ	750-83-R2KΩ	750-81-R2KΩ	—	750-101-R2KΩ
2.2KΩ±2%	750-63-R2.2KΩ	750-61-R2.2KΩ	750-83-R2.2KΩ	750-81-R2.2KΩ	750-103-R2.2KΩ	750-101-R2.2KΩ
2.7KΩ±2%	—	750-61-R2.7KΩ	—	750-81-R2.7KΩ	—	—
3KΩ±2%	—	—	750-83-R3KΩ	750-81-R3KΩ	—	—
3.3KΩ±2%	750-63-R3.3KΩ	750-61-R3.3KΩ	750-83-R3.3KΩ	750-81-R3.3KΩ	750-103-R3.3KΩ	750-101-R3.3KΩ
3.9KΩ±2%	—	—	—	750-81-R3.9KΩ	—	—
4.7KΩ±2%	750-63-R4.7KΩ	750-61-R4.7KΩ	750-83-R4.7KΩ	750-81-R4.7KΩ	750-103-R4.7KΩ	750-101-R4.7KΩ
5.1KΩ±2%	—	750-61-R5.6KΩ	750-83-R5.1KΩ	—	—	—
5.6KΩ±2%	—	—	750-83-R5.6KΩ	750-81-R5.6KΩ	—	750-101-R5.6KΩ
6.8KΩ±2%	750-63-R6.8KΩ	750-61-R6.8KΩ	750-83-R6.8KΩ	750-81-R6.8KΩ	750-103-R6.8KΩ	750-101-R6.8KΩ
10KΩ±2%	750-63-R10KΩ	750-61-R10KΩ	750-83-R10KΩ	750-81-R10KΩ	750-103-R10KΩ	750-101-R10KΩ
12KΩ±2%	—	—	—	—	—	750-101-R12KΩ
15KΩ±2%	750-63-R15KΩ	750-61-R15KΩ	750-83-R15KΩ	750-81-R15KΩ	750-103-R15KΩ	750-101-R15KΩ
16KΩ±2%	—	—	—	—	—	—
18KΩ±2%	—	—	—	750-81-R18KΩ	—	—
20KΩ±2%	—	—	750-83-R20KΩ	—	—	—
22KΩ±2%	750-63-R22KΩ	750-61-R22KΩ	750-83-R22KΩ	750-81-R22KΩ	750-103-R22KΩ	750-101-R22KΩ
33KΩ±2%	750-63-R33KΩ	750-61-R33KΩ	750-83-R33KΩ	750-81-R33KΩ	750-103-R33KΩ	750-101-R33KΩ
47KΩ±2%	750-63-R47KΩ	750-61-R47KΩ	750-83-R47KΩ	750-81-R47KΩ	750-103-R47KΩ	750-101-R47KΩ
56KΩ±2%	—	—	—	750-81-R56KΩ	—	750-101-R56KΩ
68KΩ±2%	750-63-R68KΩ	750-61-R68KΩ	750-83-R68KΩ	750-81-R68KΩ	750-103-R68KΩ	—
100KΩ±2%	750-63-R100KΩ	750-61-R100KΩ	750-83-R100KΩ	750-81-R100KΩ	750-103-R100KΩ	750-101-R100KΩ
120KΩ±2%	—	—	750-83-R120KΩ	—	—	—
150KΩ±2%	750-63-R150KΩ	750-61-R150KΩ	750-83-R150KΩ	750-81-R150KΩ	—	750-101-R150KΩ
220KΩ±2%	750-63-R220KΩ	750-61-R220KΩ	750-83-R220KΩ	750-81-R220KΩ	—	750-101-R220KΩ

NOTE: Additional resistance values are constantly being added. Please contact your local CTS Industrial Distributor to check availability of values not shown above.

ORDERING INFORMATION: Place orders using following address:
BERNE DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • TWX 810-323-1880

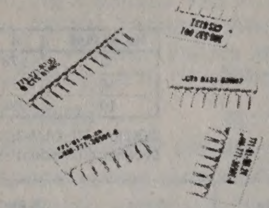
* In Indiana, dba CTS Electronics Corporation

For More Information. Circle No. 385

CTS® CORPORATION
BERNE DIVISION

SIP RESISTOR NETWORKS

770 SERIES SINGLE-IN-LINE CONFORMAL COATED CERMET RESISTOR NETWORKS

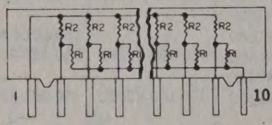
	CTS Series	Description	Element Type	Resistance Range & Tol.	Power Rating (Watts)	TC
	770-63	6, 8, and 10 Pin Single In-Line Conformal Coated Network on .100″ Lead Centers	Cermet	33Ω-220 KΩ* ±2%	6 Pin .5 Watt 8 Pin .7 Watt 10 Pin .9 Watt @ 70°C per module	±100 ppm/°C typical
	770-61					
	770-83					
	770-81					
	770-103					
	770-101					

FEATURES

- High reliability cermet resistors
- Low-Profile construction
- .100″ lead spacing
- High reliability
- Alumina substrate

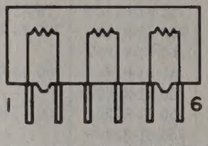
NO. OF PINS	"A" DIMENSION
6	15.240/.598 Max.
8	20.320/.798 Max.
10	25.400/.998 Max.

General Tolerances: ±.25mm/±.010 decimal dimensions.

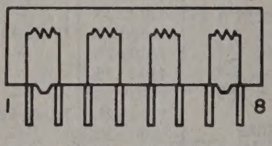


8 PIN — 12 RESISTORS
PART NUMBER 750-85 — 750-85-R (R1/R2)
10 PIN — 16 RESISTORS
PART NUMBER 750-105 — 750-105R (R1/R2)

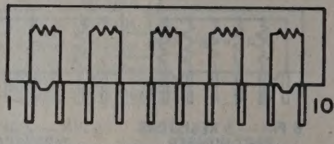
R1/R2 Ohms	Thevenin Impedance
180/390	123Ω
220/330	132Ω
330/390	180Ω
330/470	195Ω



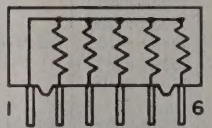
6 Pin-3 Resistors Conformal Coated
Part Number 770-63-R (value)



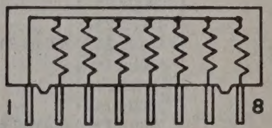
8 Pin-4 Resistors Conformal Coated
Part Numer 770-83-R (value)



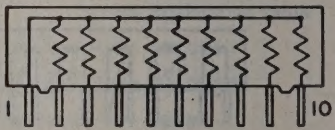
10 Pin-5 Resistors Conformal Coated
Part number 770-103-R (value)



6 Pin-5 Resistors Conformal Coated
Part Number 770-61-R (value)



8 Pin-7 Resistors Conformal Coated
Part Number 770-81-R (value)



10 Pin-9 Resistors Conformal Coated
Part Number 770-101-R (value)

STANDARD "OFF THE SHELF" PART NUMBERS*

Resistance Value, ±2% Tolerance	6 Pin, 3 Resistor	6 Pin, 5 Resistor	8 Pin 4 Resistor	8 Pin, 7 Resistor	10 Pin, 5 Resistor	10 Pin, 9 Resistor
33Ω	—	—	770-83-R33Ω	770-81-R33Ω	—	—
47Ω	—	—	770-83-R47Ω	—	—	770-101-R47Ω
56Ω	—	—	770-83-R56Ω	770-81-R56Ω	—	770-101-R56Ω
100Ω	770-63-R100Ω	770-61-R100Ω	770-83-R100Ω	770-81-R100Ω	770-103-R100Ω	770-101-R100Ω
150Ω	—	770-61-R150Ω	770-83-R150Ω	770-81-R150Ω	—	—
180Ω	—	—	770-83-R180Ω	770-81-R180Ω	—	—
220Ω	770-63-R220Ω	770-61-R220Ω	770-83-R220Ω	770-81-R220Ω	770-103-R220Ω	770-101-R220Ω
270Ω	—	—	—	770-81-R270Ω	—	—
330Ω	770-63-R330Ω	770-61-R330Ω	770-83-R330Ω	770-81-R330Ω	770-103-R330Ω	770-101-R330Ω
390Ω	—	770-61-R390Ω	—	770-81-R390Ω	—	—
470Ω	770-63-R470Ω	770-61-R470Ω	770-83-R470Ω	770-81-R470Ω	770-103-R470Ω	770-101-R470Ω
510Ω	—	—	—	770-81-R510Ω	—	—
560Ω	—	—	—	770-81-R560Ω	—	—
680Ω	770-63-R680Ω	770-61-R680Ω	770-83-R680Ω	770-81-R680Ω	—	770-101-R680Ω
1KΩ	770-63-R1KΩ	770-61-R1KΩ	770-83-R1KΩ	770-81-R1KΩ	770-103-R1KΩ	770-101-R1KΩ
1.5KΩ	—	770-61-R1.5KΩ	—	770-81-R1.5KΩ	—	770-101-R1.5KΩ
2.2KΩ	770-63-R2.2KΩ	770-61-R2.2KΩ	770-83-R2.2KΩ	770-81-R2.2KΩ	—	770-101-R2.2KΩ
3.3KΩ	770-63-R3.3KΩ	770-61-R3.3KΩ	770-83-R3.3KΩ	770-81-R3.3KΩ	770-103-R3.3KΩ	770-101-R3.3KΩ
4.7KΩ	770-63-R4.7KΩ	770-61-R4.7KΩ	770-83-R4.7KΩ	770-81-R4.7KΩ	—	770-101-R4.7KΩ
5.6KΩ	—	—	—	—	—	770-101-R5.6KΩ
6.8KΩ	—	770-61-R6.8KΩ	—	770-81-R6.8KΩ	—	770-101-R6.8KΩ
10KΩ	770-63-R10KΩ	770-61-R10KΩ	770-83-R10KΩ	770-81-R10KΩ	770-103-R10KΩ	770-101-R10KΩ
15KΩ	—	770-61-R15KΩ	—	—	—	—
22KΩ	770-63-R22KΩ	—	770-83-R22KΩ	770-81-R22KΩ	770-103-R22KΩ	770-101-R22KΩ
33KΩ	—	770-61-R33KΩ	—	770-81-R33KΩ	—	—
47KΩ	770-63-R47KΩ	770-61-R47KΩ	770-83-R47KΩ	770-81-R47KΩ	770-103-R47KΩ	770-101-R47KΩ
100KΩ	770-63-R100KΩ	770-61-R100KΩ	770-83-R100KΩ	770-81-R100KΩ	770-103-R100KΩ	770-101-R100KΩ
220KΩ	—	—	770-83-R220KΩ	770-81-R220KΩ	—	—

* NOTE: Additional resistance values are constantly being added. Please contact your local CTS Industrial Distributor to check availability of values not shown above.

ORDERING INFORMATION: Place orders using following address:
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For More Information. Circle No. 385

CTS® CORPORATION*
BERNE DIVISION

NEW FOR '85

SMD RESISTOR NETWORKS DEVELOPMENT ENGINEER'S KIT

10 PIECES EACH STYLE RANDOM VALUES

.100" CENTERS REG. $79.95
INTRODUCTORY AT ONLY $49.95
MAXIMUM 3 KITS/ENGINEER

.050" CENTERS REG. $99.95
INTRODUCTORY AT ONLY $69.95
MAXIMUM 3 KITS/ENGINEER

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* In Indiana, dba CTS Electronics Corporation

CTS® CORPORATION
BERNE DIVISION

SURFACE MOUNT RESISTOR NETWORKS

SPECIFICATIONS

*Resistance Range	Standard 33 ohm to 1.0 Megohm
Resistance Tolerance:	Standard: ±2% Special: 0.5% or 0.5 ohm (whichever greater)
*Max. Operating Voltage:	50V not to exceed rated power
*Temp. Coefficient:	±100 PPM @ −55°C to +125°C
*Operating Temp. Range:	−55°C to +125°C
Storage Temp. Range:	−55°C to +125°C
Dielectric Strength:	100V
*Power Rating:	

	Resistor Power	Total Network Power			
		8P	14P	16P	18P
@ 70°C	.07	.25w	.4w	.5w	.62
@ 25°C	.1	.38w	.6w	.75	.9w

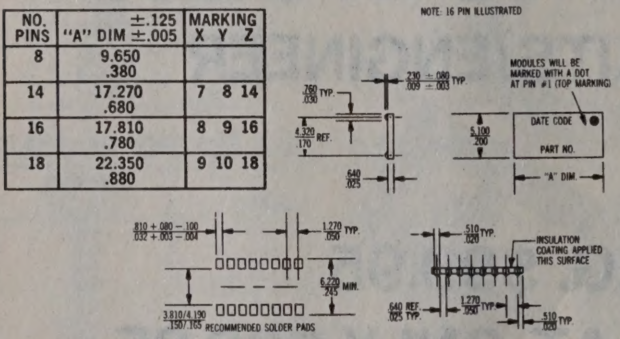
* Custom networks can usually be designed to exceed resistance range, individual resistor power, maximum operating temperature and maximum operating voltage standards. TCR may be affected by some custom network requirements.

ENVIRONMENTAL PERFORMANCE SPECIFICATIONS

Test	Max. % △ R	Mil Std. 202 Method	Test Cond.	Test Description
Thermal Cycling	0.5%	107	B	5 cycles −65°C to +125°C
Short Time Overload	0.5%	—	—	2½ x rated voltage 5 sec. (Series 770: 100V max.)
Moisture Resistance	0.5%	106	—	240 hours .1 rated load −10°C to +65°C 90% RH
Load Humidity	1.0%	—	—	1000 hours .1 rated load 65°C 90-98% RH
High Temp Exposure	1.0%	—	—	240 hours no load @ 125°C
Load Life	1.0%	—	—	1000 hours @ 70°C rated load
Resistance to Solder Heat	.25%	210	A	350°C sec dwell
Mechanical Shock	.25%	213	D	500g 1 msec 3/shocks ea plane
Vibration	.25%	204	D	20g 10-2000 Hz 4 hours/plane
Terminal Strength	.25%	—	—	2.0 Kg pull 30 sec two 45° bends
Low Temp Storage	.25%	—	—	24 hours @ −65°C no load
Low Temp Operation	.25%	—	—	1 hour @ −65°C full load
Resistance to Solvents		215	—	Isopropyl alcohol, 1-1-1 Trichloroethane, Freon TMC
Solderability		208	—	RMA flux 230°C 5 sec dip 95% coverage

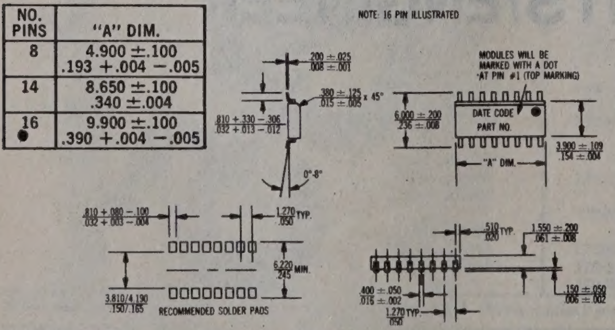
FLAT MOUNTED PACK TYPE 4M-760-3790-2
ALUMINA SUBSTRATE

NO. PINS	"A" DIM ±.125 ±.005	MARKING X Y Z
8	9.650 .380	
14	17.270 .680	7 8 14
16	17.810 .780	8 9 16
18	22.350 .880	9 10 18


NOTE: 16 PIN ILLUSTRATED
MODULES WILL BE MARKED WITH A DOT AT PIN #1 (TOP MARKING)
.230 ±.080 / .009 ±.003 TYP.
.760 / .030 TYP.
4.320 / .170 REF.
.640 / .025
5.100 / .200
DATE CODE
PART NO.
"A" DIM.
.810 + .080 − .100 / .032 + .003 − .004
1.270 / .050 TYP.
6.220 / .245 MIN.
3.810/4.190 / .150/.165
RECOMMENDED SOLDER PADS
.510 / .020 TYP.
INSULATION COATING APPLIED THIS SURFACE
.640 REF. / .025 TYP.
1.270 / .050 TYP.
.510 / .020 TYP.

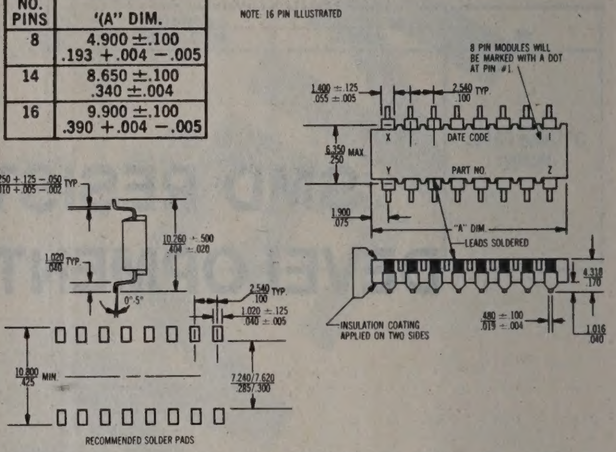
FLAT MOUNTED PACK TYPE 4M-760-3790-3 (SO PAC)
ALUMINA SUBSTRATE

NO. PINS	"A" DIM.
8	4.900 ±.100 .193 +.004 −.005
14	8.650 ±.100 .340 ±.004
16 ●	9.900 ±.100 .390 +.004 −.005


NOTE: 16 PIN ILLUSTRATED
.200 ±.025 / .008 ±.001
.380 ±.125 / .015 ±.005 x 45°
.810 + .330 − .306 / .032 + .013 − .012
0°-8°
MODULES WILL BE MARKED WITH A DOT AT PIN #1 (TOP MARKING)
6.000 ±.200 / .236 ±.008
DATE CODE
PART NO.
"A" DIM.
3.900 ±.109 / .154 ±.004
.810 + .080 − .100 / .032 + .003 − .004
1.270 / .050 TYP.
6.220 / .245 MIN.
3.810/4.190 / .150/.165
RECOMMENDED SOLDER PADS
.510 / .020 TYP.
1.550 ±.200 / .061 ±.008
.400 ±.050 / .016 ±.002
1.270 / .050 TYP.
.150 ±.050 / .006 ±.002

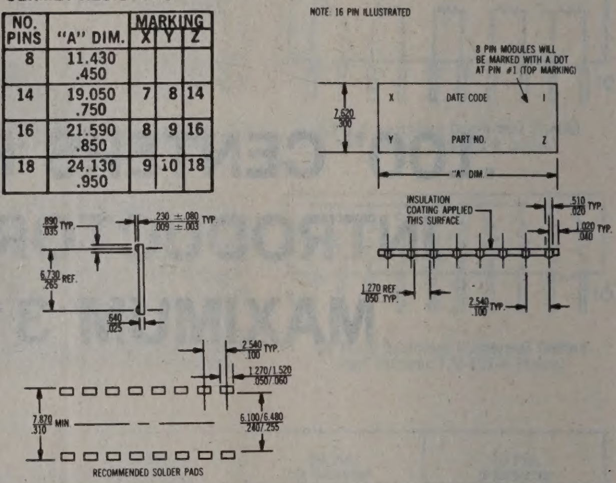
FLAT MOUNTED PACK TYPE 4M-760-3790

NO. PINS	"A" DIM.
8	4.900 ±.100 .193 +.004 −.005
14	8.650 ±.100 .340 ±.004
16	9.900 ±.100 .390 +.004 −.005


NOTE: 16 PIN ILLUSTRATED
8 PIN MODULES WILL BE MARKED WITH A DOT AT PIN #1
1.400 ±.125 / .055 ±.005
2.540 / .100 TYP.
6.350 / .250 MAX
X
DATE CODE
1
Y
PART NO.
Z
1.900 / .075
"A" DIM.
LEADS SOLDERED
4.318 / .170
INSULATION COATING APPLIED ON TWO SIDES
.480 ±.100 / .019 ±.004
1.016 / .040
.250 + .125 − .050 / .010 + .005 − .002 TYP.
10.260 ±.500 / .404 ±.020
1.020 / .040 TYP.
0°-5°
2.540 / .100 TYP.
1.020 ±.125 / .040 ±.005
10.800 / .425 MIN
7.240/7.620 / .285/.300
RECOMMENDED SOLDER PADS

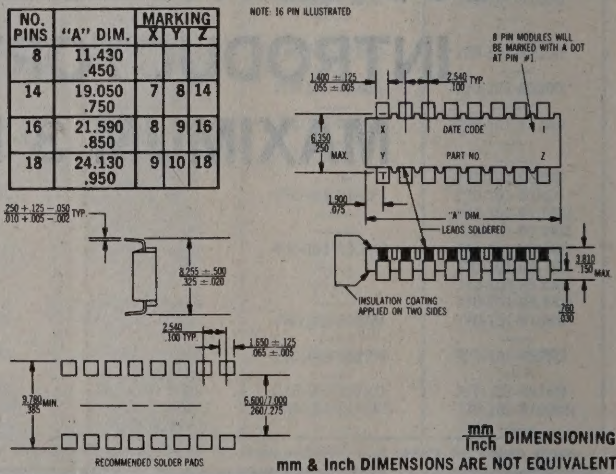
DUAL IN-LINE FLAT PACK TYPE 4M-760-3790-1
ALUMINA SUBSTRATE
CERMET RESISTORS

NO. PINS	"A" DIM.	MARKING X	Y	Z
8	11.430 .450			
14	19.050 .750	7	8	14
16	21.590 .850	8	9	16
18	24.130 .950	9	10	18


NOTE: 16 PIN ILLUSTRATED
8 PIN MODULES WILL BE MARKED WITH A DOT AT PIN #1 (TOP MARKING)
7.620 / .300
X
DATE CODE
1
Y
PART NO.
Z
"A" DIM.
INSULATION COATING APPLIED THIS SURFACE
.510 / .020 TYP.
1.020 / .040 TYP.
1.270 REF / .050 TYP.
2.540 / .100 TYP.
.890 / .035 TYP.
.230 ±.080 / .009 ±.003 TYP.
6.730 / .265 REF.
.640 / .025
2.540 / .100 TYP.
1.270/1.520 / .050/.060
7.870 / .310 MIN
6.100/6.480 / .240/.255
RECOMMENDED SOLDER PADS

DUAL IN-LINE FLAT PACK TYPE 4M-760-3790-4
ALUMINA SUBSTRATE
CERMET RESISTORS

NO. PINS	"A" DIM.	MARKING X	Y	Z
8	11.430 .450			
14	19.050 .750	7	8	14
16	21.590 .850	8	9	16
18	24.130 .950	9	10	18


NOTE: 16 PIN ILLUSTRATED
8 PIN MODULES WILL BE MARKED WITH A DOT AT PIN #1
1.400 ±.125 / .055 ±.005
2.540 / .100 TYP.
6.350 / .250 MAX.
X
DATE CODE
1
Y
PART NO.
Z
1.900 / .075
"A" DIM.
LEADS SOLDERED
3.810 / .150 MAX.
INSULATION COATING APPLIED ON TWO SIDES
.760 / .030
.250 + .125 − .050 / .010 + .005 − .002 TYP.
8.255 ±.500 / .325 ±.020
2.540 / .100 TYP.
1.650 ±.125 / .065 ±.005
9.780 / .385 MIN.
6.600/7.000 / .260/.275
RECOMMENDED SOLDER PADS

$\frac{\text{mm}}{\text{Inch}}$ DIMENSIONING
mm & Inch DIMENSIONS ARE NOT EQUIVALENT

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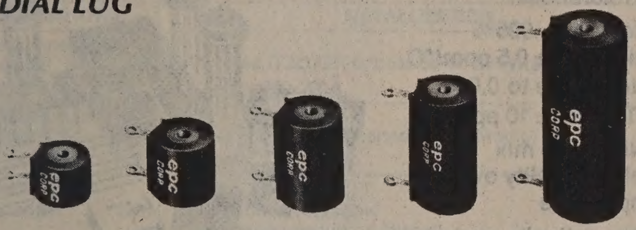
For More Information, Circle No. 385

epc
CORPORATION

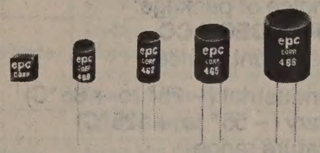
MANUFACTURERS OF PRECISION WIRE-WOUND RESISTORS ● RESISTOR NETWORKS CURRENT SHUNTS AND HIGH VOLTAGE DIVIDERS ● NO ORDER TOO SMALL OR LARGE

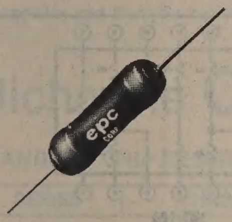
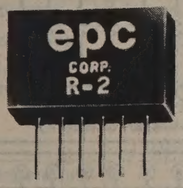
EPC DEVICES	DESCRIPTION	Mil Equiv. MIL	 EPC	CONDENSED SPECIFICATIONS
TYPE CA	Encapsulated precision wire-wound resistors offering exceptional resistance stability, T.C. 5 ppm std. and low thermal EMF's. Designed to meet MIL-R-93/MIL-R-39005. Group encapsulization, Radial-lug four terminal and special physical configurations available. ***Request CA Brochure***	RBR-08 RBR-16 RBR-17 RBR-18 RBR-19 RBR-56 RBR-55 RBR-54 RBR-53 RBR-52 RBR-71 RBR-70	610 630 640 650 660 680 690 710 750 760 460 465	Power: .02 to 2.5W Range: 1Ω to 20MΩ depending on size Tolerance: .005%, .01%, .025%, .05%, .1% and 1% Temp. Coef.: 5 PPM/°C std. on values over 100Ω Stability: ±35ppm/YR

RADIAL LUG

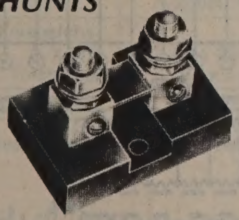


PRINTED CIRCUIT



TYPE SP 	Silicone coated precision wire-wound power resistors, offering exceptional stability and performance under severe environmental conditions of MIL-R-26/MIL-R-39007. Also available utilizing Beryllium oxide cores. For greater power-size ratio and stability. ***Request SP Bulletin***	RWR-70 RWR-69 RWR-70 RWR-74 RWR-55 RWR-78 RWR-68 RWR-56	SP-1 SP-2A SP-5 SP-6 SP-7A SP-10A SP-10B SP-12	Power: .25W to 12.5W Range: .1Ω to 275KΩ depending on size Tolerance: 1% is std. Available to .01% Temp. Coef.: 20 PPM/°C. Slightly higher for lower values. Special T.C.'s available
NETWORKS 	*RC NETWORKS OUR SPECIALITY* Resistor networks to customer specification utilizing ultra precision wire-wound, metal film, carbon film, or wire-wound power resistors. All networks assembled on printed circuit boards. ***FAST DELIVERY ON PROTOTYPE AND LARGE ORDERS***			Power: .1W to 10W Range: .1Ω to 5MΩ Nominal Resistance Tolerance: To ±.005% D.C. W-W Resistance Ratio Tolerance: To .001% D.C. W-W Long Term Stability: .001% Response Time: 100MS

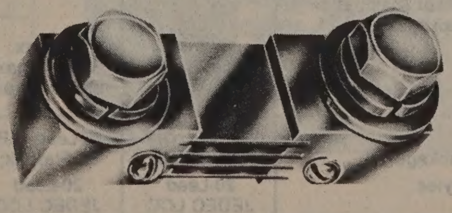
LIGHTWEIGHT SHUNTS



Standard D.C. current shunts from .001Ω to 1Ω. Accuracy ±.25%, available to .01%. Also external portable and switchboard shunts for use with D.C. Ammeters. 1 to 200 amp. with a 50MV or 100MV drop. Accuracy ±1%.

SPECIAL OEM CURRENT SHUNT RANGING FOR PANEL METERS

METER SHUNTS



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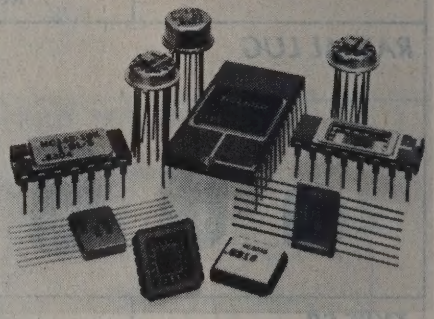
11 SANDFORD BLVD. ● MOUNT VERNON, N.Y. 10550 ● TELEPHONE: (914) 664-2333

Today's New HyComp Delivers Advanced Thin-Film Products.

Precision, Standard and Custom
RESISTOR NETWORKS

FEATURES:

- Hundreds of standard networks or your unique design
- Your choice of package: **SIP, DIP, JEDEC, LCC** (surface mount device)
- Either industrial (−25° to +85°C) or military (−55° to +125°C) temperature range
- Screening to MIL R-83401D or 883C
- Outstanding tolerances:
  - — Ratio matching to .005%
  - — Ratio tracking to ±0.5 ppm/°C
  - — Absolute tolerance to 0.05%
  - — Absolute TCR to ±10 ppm/°C
- Proprietary Nichrome mix resulting in high stability over time and temperature
- Passivated, hermetically-sealed, low moisture

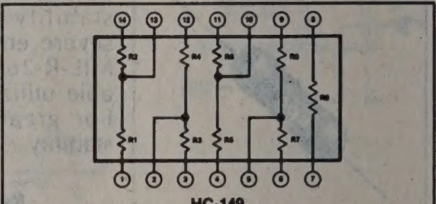


A SAMPLING OF PACKAGED NETWORKS

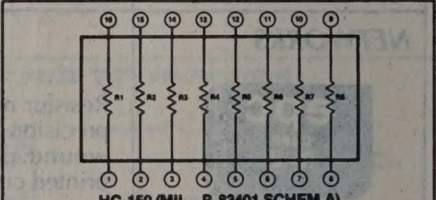
SERIES → / PARAMETERS	HC-149 Quad Divider Network (Equal R's)	HC-150 8 Equal Isolated Resistors	HC-170 12 Equal Isolated Resistors	HC-180 Binary Weighted Divider
Resistance Range	10K-100KΩ	2K-100KΩ	2K-100KΩ	5K-100KΩ
Tolerance Absolute Ratio	Standard: ±5% ±0.01%		Custom: To 0.05% To 0.005%	
Thermal Stability Absolute (TCR) Standard Custom Tracking (TCRT) Standard Custom	±25ppm/°C To ±10ppm/°C ±5ppm/°C To 0.5ppm/°C			±25ppm/°C To ±5ppm/°C ±5ppm/°C To ±1ppm/°C
Power Dissipation Package Total LCC, JEDEC LCC, DIP, Flatpak Per Resistor	1W max. 500mW max. 100mW, max.	1W max. 500mW max. 100mW, max.	1.5W max. 1W max. 80mW, max.	1W max. — 50mW, max.
Package[1] Styles	14-Lead, DIP or Flatpak; 20-Lead JEDEC LCC	16-Lead DIP, or Flatpak; 20-Lead JEDEC LCC	24-Lead DIP, or Flatpak; 28-Lead JEDEC LCC	14-Lead DIP, or Flatpak; 20-Lead JEDEC LCC

NOTES:

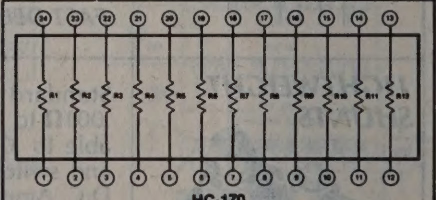
1. LCC denotes leadless chip carrier packages that are available in JEDEC and non-JEDEC versions.



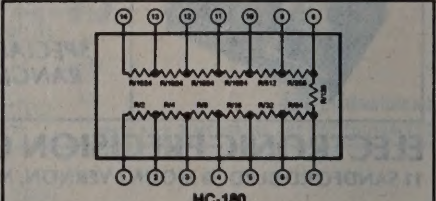
HC-149



HC-150 (MIL-R-83401 SCHEM A)



HC-170

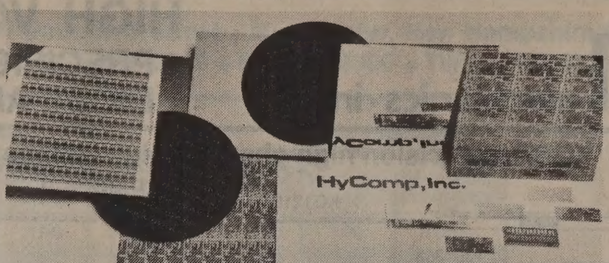


HC-180

For More Information. Circle No. 387

Metallized WAFERS & SUBSTRATES

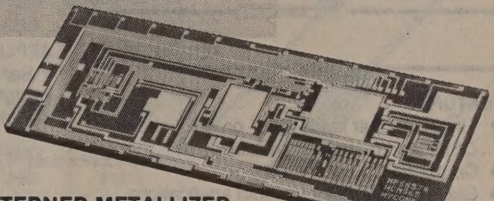
With or without pattern



METALLIZED WAFERS

SUBSTRATE CHARACTERISTICS	SUBSTRATE MATERIALS*			
	Silicon	Ceramic	Glass	Units
Formulation	100% Pure	99.6% Alumina	Corning 7059	—
Dimensions Length x Width	Standard: 2 x 2 to 3 x 3 Optional: To 4 x 4			Inch
Thickness	0.012	0.010-0.025	0.022	Inch
Finish (As-Fired)	NA	4-6, 2-3 opt.	NA	μinch
Surfaces Coated	1 or 2	1 or 2	1 or 2	—
DEPOSITIONS	**METALLIZATION**			
Resistance Layer Material Thickness	Nichrome (Vacuum-deposited on substrate) Typically 100-200Å			
Diffusion Barrier Material Thickness	Nickel (Vacuum-deposited on Nichrome) Typically 1000-3000Å			
Bonding Layer Material	High ductility 24K gold (Vacuum-deposited on Nickel)			
Thickness	Typically 1200Å; Electroplated to a minumum of 40 microinches, a maximum to customer specification			

*** Sapphire and Beryllia substrates are available on request.**



PATTERNED METALLIZED WAFERS AND SUBSTRATES

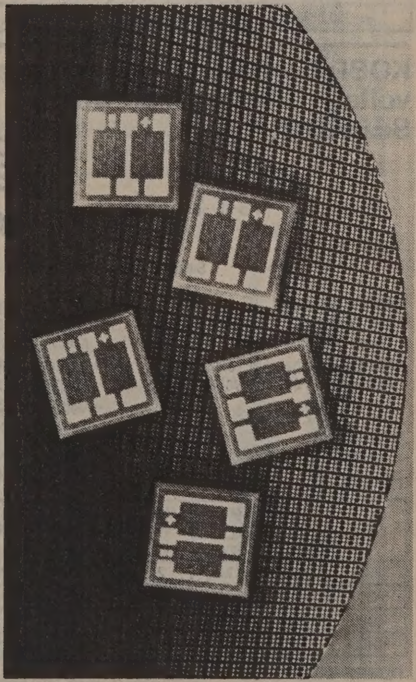
PATTERN PARAMETER	PARAMETER RANGE
MECHANICAL	
Lines and Spaces	Standard: Down to 1 mil Optional: Down to 0.25 mil
Form Factor	Wafers or individual substrates
Bonding Methods	HyComp's standard gold bonds are compatible with ultrasonic, thermo-compression ball and wedge, and thermosonic bonding techniques.
ELECTRICAL	
Sheet Resistivity	50 to 300 Ohms per square
Absolute TCR	10 to 50ppm/°C
Levels of Fabrication	HyComp will attach active or passive devices on request.

Nichrome CHIP RESISTORS

STANDARD CHIP RESISTOR PRODUCTS

SERIES	HC30CT		HC20C		HC20BC
PARAMETERS					
Package	Top-Contact Center-Tapped		Top-Contact Non-Tapped		Top and Back Contact Non-Tapped
Substrate	Silicon	Ceramic	Silicon	Ceramic	Silicon
Resistance[1]	10Ω-1.2MΩ		10Ω-1.2MΩ	10Ω-510KΩ	10Ω-1.2MΩ
Tolerance Absolute	0.1%, 0.5%, 1%, 2%, 5%, 10%, 20%				1, 2, 5, 10, 20%
Ratio	0.1%, 0.05% 0.025%, 0.01%		—		—
Temperature TCR	±10ppm/°C typ. ±50ppm/°C max.				±25ppm/°C typ. ±50ppm/°C max.
TCRT	±1ppm/°C typ. ±2ppm/°C max.		—		—
Dimensions (L x W) Thickness	30 x 30 mils 10 ±3 mils		20 x 20 mils 10 ±3 mils		20 x 20 mils 10 ±3 mils
Power, max.	250mW		250mW	100mW	100mW

1. Available in standard RETMA values. Other values available on request.



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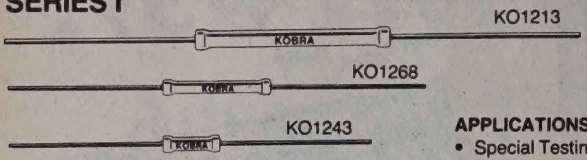
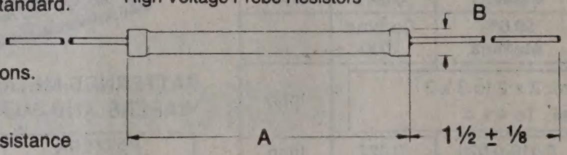
HIGH VOLTAGE
• PRECISION RESISTORS
• DIODE ARRAYS

KOBRA precision high ohmage, high voltage power resistors

SERIES I



APPLICATIONS
- Special Testing, Mil-R-14293, Mil-R-10509
- High Resistance Standards
- High Voltage Probe Resistors



FEATURES
- Tinned copper leads .020″ or .032″ standard. Other lead materials available.
- Conformal epoxy coated
- Glass overglaze for vacuum applications.
- Voltage coefficient is dependent on resistance value. Typically less than 5 PPM/V in mid-resistance values.
- Burn-in and other preconditioning options available
- Tolerance to ½% on request
- ±50 PPM/°C TCR available on request

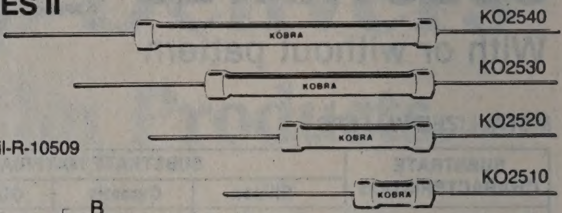
TYPES —

Type	Resistance Ohms		Power at 70°C Watts	Maximum Operating Voltage	Tolerance at 25 VDC	Max. Surface Temp.	Dimensions Max. Inches	
	Min.	Max.					A	B
KO1040	1 Meg	5K Meg	.75	2000V	1,2 & 5%	220°C	.460	.145
KO1243	1 Meg	10K Meg	1.0	2500V	1,2 & 5%	220°C	.500	.170
KO1268	1 Meg	20K Meg	1.5	5000V	1,2 & 5%	220°C	.750	.170
KO1213	1 Meg	100K Meg	2.0	10,000V	1,2 & 5%	220°C	1.500	.170

TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KO1040 Megohms	KO1243 Megohms	KO1268 Megohms	KO1213 Megohms
± 100 PPM/°C	1-100	1-100	1-200	1-400
± 200 PPM/°C	100-3K	100-3K	200-6K	400-15K
± 100 PPM/°C	3K-5K	3K-10K	6K-20K	15K-100K

SERIES II



FEATURES
- Tinned copper leads .020″ or .032″ standard. Other lead materials available.
- Conformal epoxy coated
- Voltage coefficient is dependent on resistance value. Typically less than 5 PPM/V in mid-resistance values
- Burn-in and other preconditioning options available
- Tolerance to ½% on request
- ±50 PPM/°C TCR available on request

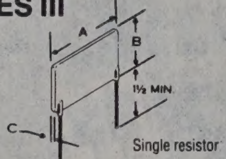
TYPES —

Type	Resistance Ohms		Power at 70°C Watts	Maximum Operating Voltage	Tolerance at 25 VDC	Max. Surface Temp.	Dimensions Max. Inches	
	Min.	Max.					A	B
KO2510	1 Meg	5K Meg	4	8,000V	1,2 & 5%	220°C	1.125	.325
KO2520	1 Meg	10K Meg	7	16,000V	1,2 & 5%	220°C	2.125	.325
KO2530	1 Meg	15K Meg	10	24,000V	1,2 & 5%	220°C	3.125	.325
KO2540	1 Meg	20K Meg	12	32,000V	1,2 & 5%	220°C	4.125	.325

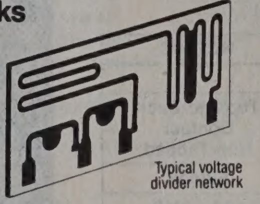
TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KO2510 Megohms	KO2520 Megohms	KO2530 Megohms	KO2540 Megohms
± 100 PPM/°C	1-500	1-1000	1-1500	1-2000
± 200 PPM/°C	500-5K	1000-10K	1500-15K	2000-20K

KOBRA precision high voltage flat resistors, voltage dividers & networks
SERIES III



Single resistor



Typical voltage divider network

APPLICATIONS
- Bleeder Resistors For High Voltage Power Supplies
- Divider Resistors For Feedback Applications on High Voltage Power Supplies

FEATURES
- Tolerances: 1%, 2%, 5%, 10%, 15%
- Conformal epoxy coated
- .032 in. tinned copper leads or nickel ribbon leads for welding
- Available without leads with solderable termination pads
- Voltage dividers and networks designed to your specifications.
- Resistor ratios to 10,000:1 (size dependent). TCR Tracking 25PPM/°C. Ratios to 1%.

TYPES —

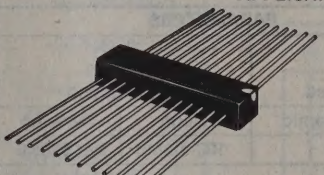
Type	Resistance Ohms		Max. Power	Max. Operating	Max. Surface	Dimension Max. Inches		
	Min.	Max.	at 70°C	Voltage	Temp.	A	B	C
KF315	1 Meg	5K Meg	2	12,000V	150°C	1.550	.350	.110
KF510	1 Meg	5K Meg	2	10,000V	150°C	1.050	.550	.110
KO520	1 Meg	5K Meg	4	20,000V	150°C	2.050	.550	.110
KO1020	1 Meg	10K Meg	6	30,000V	150°C	2.050	1.050	.110

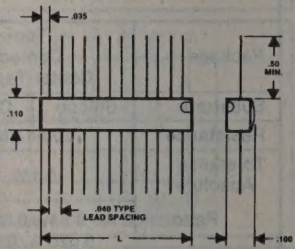
TEMPERATURE COEFFICIENT —

Temperature Coefficient +25°C to +125°C	KF315 Megohms	KF510 Megohms	KF520 Megohms	KF1020 Megohms
± 100 PPM/°C	1-500	1-500	1-500	1-1000
± 250 PPM/°C	500-5K	500-5K	500-5K	1,000-10K

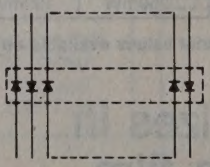
KOBRA
Miniature high voltage diode array

APPLICATIONS • Miniature high voltage multipliers





FEATURES (Electrical)
- PIV = 1200 VDC
- IR @ 23°C 500 VDC 10 nano amps Max.
- Junction Capacitance @ 23° 0.35 pF Max. @ 500 VDC
- Recovery Time @ 23°C 1.5 micro sec. @ 1F = 10 ma
- Recovery Time @ 23°C 0.5 micro sec. @ 1F = 2.0 ma
- Operating Temp + 55°C To -54°C
- Storage Temp +85°C To -70°C



MECHANICAL
- Lead Diameter .015 Max.
- Lead Material – Silver
- Encapsulant – Epoxy

SPECIFICATIONS:

K & M PART NO.	NO. OF DIODES	DIM L
107-031-12	12	.510
107-032-10	10	.430
107-033- 8	8	.350
107-034- 6	6	.270
107-035- 4	4	.190
107-036- 2	2	.110

MINIATURE HIGH VOLTAGE POWER SUPPLIES & COMPONENTS

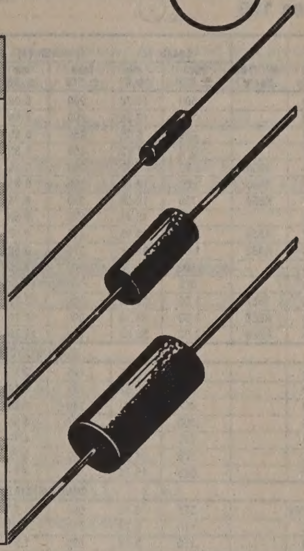
K M electronics · inc 123 Interstate Drive • West Springfield • Mass • 01089 • (413) 781-1350 • TWX 710-350-6463

For More Information. Circle No. 388

KRL electronics, inc.

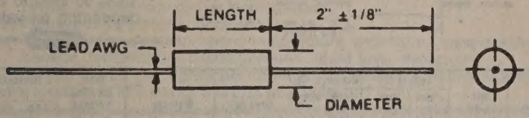
160 Bouchard Street • Manchester, New Hampshire 03103
Tel. (603) 668-3210 • 800-257-3300 • TWX (710) 220-1662

KRL Precision Wire Wound . . . Axial Lead Resistors **500 SERIES**



KRL STYLE	MIL-R-93	MIL-R-39005	DIMENSIONS LENGTH ±.015	DIAMETER ±.015	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
532			.200	.100	24	.025	.050	100	100K
†533			.260	.100	24	.050	.100	100	150K
†534			.300	.100	22	.050	.100	100	150K
†535			.250	.125	22	.065	.125	150	300K
536			.312	.125	22	.075	.150	200	400K
537			.375	.125	22	.100	.200	200	500K
†538			.375	.187	22	.125	.250	300	600K
†540		RBR-74	.500	.187	22	.175	.350	300	1 Meg
550		RBR-75	.295	.250	22	.125	.250	200	900K
555	RB-56	RBR-56	.375	.250	20	.175	.350	300	1 Meg
†560	RB-55	RBR-55	.500	.250	20	.250	.500	400	2 Meg
†565	RB-54	RBR-54	.750	.250	20	.375	.750	500	3.5 Meg
570	RB-53	RBR-53	.750	.375	20	.450	.900	600	4 Meg
575	RB-52	RBR-52	1.00	.375	20	.750	1.50	750	5 Meg
578			.500	.500	20	.330	.660	400	2 Meg
580	RB-57	RBR-57	1.00	.500	20	.850	1.75	850	10 Meg
585	RB-58		1.50	.500	20	1.00	2.00	1.5V	15 Meg

†Indicates Most Popular Types.



TOLERANCES AVAILABLE:

Absolute accuracy for— 1. Precision Resistors from ±5% to ±.0025%
2. Power Resistors from ±10% to ±.01%
Ratio Matching in resistor sets available as close as ±.001%

TEMPERATURE COEFFICIENTS

1. Standard temperature coefficient is ±10PPM/ °C, slighty higher for low ohmic values.
2. Temperature coefficients are available as low as ±1PPM/ °C, over a limited range.
3. T.C. Matching available as close as ±0.5PPM/ °C at +25 °C for matched sets.
4. T.C. TRACKING available as close as ±1PPM/ °C over a limited range.
5. Special temperature coefficients available from +80PPM/ °C to +6000PPM/ °C.

STABILITY:

Precision Resistors—0.001% for the first year, 0.0025% over a three year period.
Power Resistors—0.003% for the first year, 0.005% over a three year period.

ENVIRONMENTAL REQUIREMENTS:

All KRL wire wound resistors meet or exceed the requirements of—
1. MIL-R-93 and MIL-R-39005 for Precision Resistors
2. MIL-R-26, MIL-R-39007 and MIL-R-18546 for Power Resistors.

KRL Precision Economy Line Resistors

KRL STYLE	DIMENSIONS LENGTH ±.062	DIAMETER ±.032	LEAD AWG‡	POWER in WATTS COMM	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
EC-10	.390	.100	24	.50	150	100K
EC-12	.530	.100	24	.50	150	120K
†EC-20	.390	.140	20	1.0	200	100K
†EC-22	.530	.140	20	1.2	200	120K
†EC-30	.390	.187	20	1.5	250	100K
†Ec-32	.530	.187	20	1.7	250	150K
†EC-34	.560	.187	20	1.8	250	150K
EC-36	.812	.187	20	2.0	300	240K
†EC-40	.500	.250	20	2.0	300	200K
EC-42	.625	.250	20	2.5	300	220K
EC-42	.812	.250	20	2.7	350	250K
EC-50	.875	.312	18	2.8	350	300K
EC-55	1.00	.312	18	3.0	350	500K

†Indicates Most Popular Types

‡Lead diameter may vary by one gauge depending on requirement.

KRL WIRE WOUND POWER RESISTORS:

KRL STYLE	MIL-R-26	MIL-R-39007	WATTAGE RATING U	V	MAX. WORKING VOLTAGE(2) U	V	MAXIMUM RESISTANCE IN OHMS(3)	DIMENSIONS LENGTH ±.062	DIAMETER ±.032	LEAD AWG(1)
P-½A			.5	1.0	18	20	3.4K	.250	.094	24
P-½			.75	1.2	30	35	4.5K	.280	.094	24
P-1A	RW-70		1.0	1.5	50	55	10K	.406	.094	24
P-1B			1.1	1.6	62	67	12K	.530	.094	24
P-1C			1.0	1.5	28	33	5K	.330	.094	24
†P-2			1.5	2.0	72	79	10K	.385	.187	20
†P-2A	RW-79		3.0	3.75	135	148	22K	.560	.187	20
P-2B		RWR-71	3.25	4.75	185	220	42K	.812	.187	20
†P-2C			3.0	3.5	138	157	32K	.500	.250	20
†P-2D	RW-69		2.5	3.0	135	148	20K	.500	.187	20
†P-3			4.0	5.5	210	250	45K	.625	.250	20
†P-5	RW-74	RWR-74	5.0	6.0	325	375	90K	.875±.094	.312±.062	18
P-6	RW-67		6.0	6.5	360	400	95K	1.000±.094	.312±.062	18
P-7			7.0	8.0	360	400	100K	1.200±.094	.312±.062	18
P-7A	RW-55		7.5	9.0	510	580	150K	1.375±.094	.375±.062	18
†P-10			10.0	13.0	800	930	250K	1.815±.094	.375±.062	18
P-10A	RW-78	RWR-78	10.0	12.0	800	930	240K	1.780±.094	.375±.062	18
†P-10B	RW-68		10.5	14.0	800	930	275K	1.875±.094	.375±.062	18

†Indicates Most Popular Types.

CHARACTERISTIC V:
Coated resistors are available in 3% and 5% tolerance only.

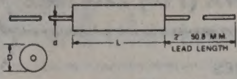
CHARACTERISTIC U:
Coated of Molded resistors are available in any tolerance.

For More Information. Circle No. 389

MICRO-OHM
CORPORATION
4900 SANTA ANITA DRIVE, EL MONTE, CA 91731
PHONE (818) 442-3310 • (213) 686-0535 • TWX: 910-587-3425

QUALITY PRECISION RESISTORS

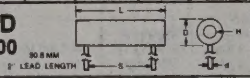
AXIAL LEAD
Series 100



Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive

MO Style	Mil R-83 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.015	Diameter (D) mm ±.30	Lead (d) AWG	Lead (d) mm	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0004 Wire)
133		.500	12.70	.200	5.08	22	.64	.30	300	600K
139		.700	17.78	.200	5.08	22	.64	.40	300	1.2M
144		.250	6.35	.250	6.35	22	.64	.25	150	400K
115		.312	7.92	.250	6.35	22	.64	.25	200	1M
156	RB56	.375	9.52	.250	6.35	20	.81	.25	200	700K
143	RB55	.500	12.70	.250	6.35	20	.81	.30	300	900K
137	RB54	.750	19.05	.250	6.35	20	.81	.50	300	1.2M
136		.610	15.49	.375	9.52	20	.81	.50	400	3M
132	RB53	.750	19.05	.375	9.52	20	.81	.66	500	3M
138	RB52	1.00	25.40	.375	9.52	20	.81	1.0	750	5M
134		.500	12.70	.500	12.70	20	.81	.66	300	3M
170		.625	15.88	.500	12.70	20	.81	.75	400	3M
146	RB57	1.00	25.40	.500	12.70	20	.81	1.5	750	7M
180	RB58	1.50	38.10	.500	12.70	20	.81	2.0	1000	15M
190	RB59	2.00	50.80	.500	12.70	20	.81	2.5	1200	20M
SUBMINIATURES										
140		.250	6.35	.125	3.18	24	.51	.10	100	150K
112		.375	9.52	.125	3.18	24	.51	.125	200	125K
113		.312	7.92	.160	4.06	22	.64	.15	150	300K
150		.500	12.70	.160	4.06	22	.64	.20	200	400K
114		.312	7.92	.187	4.75	22	.64	.20	200	300K
135		.375	9.52	.187	4.75	22	.64	.25	300	300K
160		.625	15.88	.187	4.75	20	.81	.30	300	600K
MICRO-MINIATURES										
XP101		.375	9.52	.050	1.27	30	.25	.02	50	10K
100		.110	2.79	.070	1.78	30	.25	.03	50	11K
105		.155	3.94	.075	1.91	30	.25	.04	50	11K
110		.200	5.08	.093	2.36	28	.32	.05	75	30K
130		.312	7.92	.093	2.36	28	.32	.06	100	60K
142		.185	4.70	.120	3.05	28	.32	.06	100	30K
141		.180	4.06	.125	3.18	28	.32	.06	100	30K

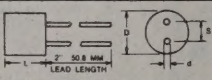
RADIAL LEAD
Series 200 & 600



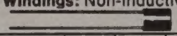
Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive

MO Style	Mil R-93 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±0.15	Diameter (D) mm ±.38	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.032	Lead Spacing (S) mm ±.81	Mounting Hole (H) Inch ±.010	Mounting Hole (H) mm ±.35	Comm'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
*221		.490	12.45	.365	9.27	24	.51	.390	9.91	.140	3.56	.50	300	2.5M
*211		.325	8.26	.375	9.52	24	.51	.245	6.22	.120	3.05	.50	300	1.5M
*226		1.000	25.40	.375	9.52	20	.81	.855	21.72	.089	2.26	1.00	600	5M
222		.668	17.48	.420	10.69	20	.81	.555	14.10	None		1.00	600	3M
236		1.125	28.59	.435	11.05	20	.81	.960	24.38	None		1.25	600	5M
*220	RB17	1.000	25.40	.500	12.70	20	.81	.845	21.46	.140	3.56	1.00	600	10M
*228	RB73	2.000	50.80	.500	12.70	20	.81	1.750	44.45	.140	3.56	2.00	1200	20M
*227	RB08	.500	12.70	.550	13.97	20	.81	.235	5.97	.140	3.56	.50	300	1M
*224	RB16	.612	15.54	.550	13.97	20	.81	.475	12.06	.140	3.56	.50	300	12M
*230	RB18	1.250	31.75	.750	19.05	20	.81	1.125	28.59	.140	3.56	2.00	600	20M
SUBMINIATURES														
225		.500	12.70	.160	4.06	24	.51	.385	9.78	None		.20	200	500K
*202		.250	6.35	.312	7.92	24	.51	.180	4.57	.089	2.26	.25	200	500K
243		.500	12.70	.250	6.35	22	.64	.290	7.37	None		.25	300	300K
MICRO-MINIATURES														
**206		.200	5.08	.105	2.67	30	.25	.100	2.54	None		.30	100	30K
210		.250	6.35	.100	2.54	28	.32	.200	5.08	None		.05	100	30K
205		.165	4.19	.075	1.90	30	.25	.150	5.81	None		.04	50	11K

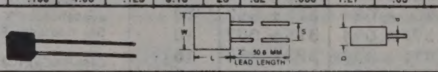
PRINTED CIRCUIT LEAD Series 400



Tolerances: .001% to 1%
T.Cs: 1 PPM to 6000 PPM
Windings: Non-inductive



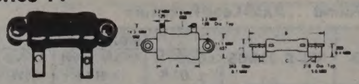
MO Style	Mil R-93 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.032	Diameter (D) mm ±.81	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.010	Lead Spacing (S) mm ±.25	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
440		.250	6.35	.125	3.18	24	.51	.050	1.27	.10	100	120K
412		.375	9.52	.125	3.18	24	.51	.050	1.27	.125	200	55K
413		.312	7.92	.160	4.06	24	.51	.080	2.03	.15	150	300K
414		.312	7.92	.187	4.75	22	.64	.100	2.54	.20	200	300K
435		.375	9.52	.187	4.75	22	.64	.100	2.54	.25	300	300K
415	RB71	.312	7.92	.250	6.35	22	.64	.200	5.08	.25	300	500K
416		.375	9.52	.250	6.35	22	.64	.200	5.08	.25	300	800K
443		.500	12.70	.250	6.35	22	.64	.125	3.18	.30	300	1M
437		.750	19.05	.250	6.35	22	.64	.125	3.18	.50	300	1M
417	RB70	.500	12.70	.375	9.52	20	.81	.200	5.08	.50	300	1.5M
436		.610	15.49	.375	9.52	20	.81	.250	6.35	.50	450	3M
438		1.00	2.54	.375	9.52	20	.81	.250	6.35	1.00	750	5M
434		.500	12.70	.500	12.70	20	.81	.300	7.62	.50	300	3M
MICRO-MINIATURES												
405		.155	3.94	.075	1.91	30	.25	.030	.76	.04	50	11K
430		.312	7.92	.093	2.36	28	.32	.040	1.02	.05	100	50K
401		.175	4.44	.105	2.67	28	.32	.040	1.02	.05	75	30K
442		.185	4.70	.120	3.05	28	.32	.050	1.27	.05	100	30K
441		.160	4.06	.125	3.18	28	.32	.050	1.27	.05	100	30K



RECTANGULAR

MO Style	Length (L) Inch ±.032	Length (L) mm ±.81	Width (W) Inch ±.015	Width (W) mm ±.38	Depth (D) Inch ±.015	Depth (D) mm ±.38	Lead (d) AWG	Lead (d) mm	Lead Spacing (S) Inch ±.010	Lead Spacing (S) mm ±.25	Com'l Wattage	Max. Voltage DC	Max. Resistance (.0006 Wire)
450	.250	6.35	.250	6.35	.125	3.18	20	.81	.125	3.18	.125	100	1M
460	.250	6.35	.500	12.70	.125	3.18	20	.81	.250	6.35	.250	100	2M

POWER RESISTORS
Series FP



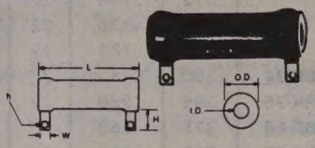
SEND FOR CATALOG

Tolerances: .05% to 10%

T.Cs: PPM/°C	Resistance
20	10Ω & over
30	1Ω — 10Ω
90	under 1Ω

MO Style	Core Length (A) Inch ±.032	Core Length (A) mm ±.01	Length Inch Hdwe. (D) Inch ±.015	Length Inch Hdwe. (D) mm ±.38	Mounting Hole Spacing (C) Inch ±.015	Mounting Hole Spacing (C) mm ±.38	Wattage Rating	Maximum Working Voltage	Resistance Range (Ohms)
FP-10	.750	19.05	1.218	30.94	1.00	25.4	10	300	.1-15K
FP-20	2.062	52.37	2.625	66.68	2.313	58.75	20	1000	.1-15K

Series TL



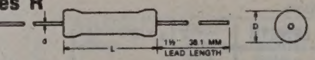
Tolerances: .05% to 10%
T.Cs: 90 PPM to 20 PPM depending on value

TERMINAL DIMENSIONS

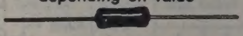
M.O. Series	TL-5 Inch	TL-5 mm	TL-10 25 & 30 Inch	TL-10 25 & 30 mm	TL-60 & 100 Inch	TL-60 & 100 mm
Width (W)	.125	3.2	.187	4.8	.250	6.4
Height (H)	.250	6.4	.406	10.3	.750	19.1
Hole Dia. (h)	.062	1.57	.093	2.4	.154	3.9

No. Style	Length (L) Inch ±.062	Length (L) mm ±1.57	Diameter O.D. Inch ±.032	Diameter O.D. mm ±.81	Diameter I.D. Inch ±.032	Diameter I.D. mm ±.81	Wattage Rating	Maximum Working Voltage	Resistance Range (Ohms)
TL-6	1.00	25.40	.250	6.35	.156	3.96	5	230	.1-12K
TL-10	1.00	25.40	.438	11.12	.312	7.92	10	400	.1-22K
TL-25	2.00	50.80	.563	14.30	.312	7.92	25	1300	.1-100K
TL-50	4.00	101.60	.563	14.30	.312	7.92	50	1900	.1-250K
TL-60	4.00	101.60	.750	19.05	.500	12.70	60	2100	.1-350K
TL-100	6.50	165.10	.750	19.05	.500	12.70	100	2500	.1-550K

Series R

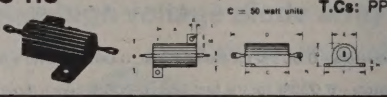


Tolerances: .05% to 10%
T.Cs: 90 PPM to 20 PPM depending on value



MO Style	Mil R-26 Equiv.	Length (L) Inch ±.032	Length (L) mm ±.81	Diameter (D) Inch ±.032	Diameter (D) mm ±.81	Lead (d) AWG	Lead (d) mm	Wattage U	Wattage V	Max. Working Voltage U	Max. Working Voltage V	Resistance Ranges (ohms) .05% .1% .25%	Resistance Ranges (ohms) .5% 1% 3% 5%
R-¼		.250	6.35	.078	1.98	24	.51	.40		20		10-950	.1-3.4K
R-½		.312	7.92	.078	1.98	24	.51	.75		29		10-1.3K	.1-4.9K
R-1A	RW70	.406	10.31	.093	2.36	22	.64	1.00		52		1-2.7K	.1-10.4K
R-1		.531	13.49	.093	2.36	22	.64	1.10		62		1-4.0K	.1-15K
R-2½	RW69	.500	12.70	.210	5.33	20	.81	2.50	3.25	138	157	1-8.6K	.01-32.2K
R-3A	RW79	.562	14.27	.210	5.33	20	.81	3.00	3.75	135	148	1-6.5K	.01-34.5K
R-3		.812	20.62	.210	5.33	20	1.02	3.25	4.75	185	220	1-11.4K	.01-42.1K
R-4		.625	15.88	.300	7.62	18	1.02	4.00	5.50	210	250	1-12.7K	.01-47-1K
R-5	RW67 RW74	.875	22.22	.300	7.62	18	1.02	5.00	6.50	330	376	.5-24.5K	.01-91.0K
R-7		1.218	30.94	.375	9.52	18	1.02	7.00	9.00	504	576	.5-41.4K	.01-154K
R-10	RW68 RW78	1.780	45.21	.375	9.52	18	1.02	10.00	13.00	799	911	.5-71.3K	.01-265K

SERIES HS
(Heat Sink)

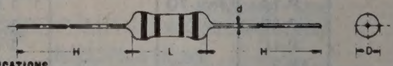


Tolerances: .05% to 10%

T.Cs: PPM/°C	Resistance
20	10Ω & over
30	1Ω — 10Ω
90	under 1Ω

MO Style	Mil-R 18546	Com'l Watt	Max. Work. Volt.	Max. Res.	A Inch ±.005	A mm ±.013	B Inch ±.005	B mm ±.013	C Inch ±.032	C mm ±.81	D Inch ±.062	D mm ±1.57	E Inch ±.015	E mm ±.38	F Inch ±.015	F mm ±.38	G Inch ±.015	G mm ±.38	H Inch ±.010	H mm ±.25	J Inch ±.010	J mm ±.25	K Inch ±.010	K mm ±.25	L Inch ±.005	L mm ±.013	M Inch ±.015	M mm ±.38	N Inch ±.005	N mm ±.013	Mtg. Hole Size
HS-5	RE60	5	160	20K	.444	11.28	.490	12.45	.600	15.24	1.125	28.58	.334	8.48	.646	16.41	.317	8.05	.075	1.91	.145	3.68	.078	1.98	.093	2.36	.078	1.98	.050	1.27	#2
HS-10	RE65	10	265	30K	.562	14.27	.625	15.88	.750	19.05	1.375	34.93	.438	11.13	.812	20.62	.406	10.31	.100	2.54	.203	5.16	.093	2.36	.093	2.36	.094	2.39	.086	2.18	#2
HS-25	RE70	25	550	75K	.719	18.26	.781	19.84	1.062	26.97	1.938	49.23	.500	12.70	1.094	27.79	.563	14.30	.094	2.39	.250	6.35	.171	4.34	.125	3.18	.125	3.18	.086	2.18	#2
HS-50	RE75	50	1234	200K	1.563	39.70	.844	21.44	1.968	49.99	2.781	70.64	.625	15.88	1.156	29.36	.625	15.88	.094	2.39	.281	7.14	.196	4.98	.125	3.18	.125	3.18	.086	2.18	#4

DEPOSIT CARBON FILM
Fixed Resistors Type
M 50, 25, 12



SPECIFICATIONS

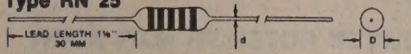
Type	M-50	M-25	M-12
Wattage Rating at 70°C	0.5W	0.25W	0.125W
Max. Working Voltage	350V	250V	150V
Max. Over Load Voltage	700V	500V	300V
Resistance Tolerance	±2% (G), ±5% (J)	±2% (G), ±5% (J)	±5% (J)
Resistance Range 5% 2%	1Ω to 10MΩ 10Ω to 910K	1Ω to 13MΩ 10Ω to 910K	1Ω to 5MΩ 51Ω to 220K
Temperature Range	−55°C to +155°C	−55°C to +155°C	−55°C to +155°C

Type	Body Length (L) inch	Body Length (L) mm	Body Diameter (D) inch	Body Diameter (D) mm	Leadwire Length (H) inch	Leadwire Length (H) mm	Leadwire Diameter (d) inch	Leadwire Diameter (d) mm	Net Weight
M-50	.350±.020	8.9±0.5	.146±.008	3.7±0.2	1.125±.1	30±3	.031±.001	0.8±0.03	500 grms (1.1 lb.)
M-25	.245+.020 −.010	6.7 max.	.098 max.	2.5 max.	1.125±.1	30±3	.024±.005	0.6±0.05	200 grms (.44 lb.)
M-12	.160+.020 −.010	4.6 max.	.068 max.	1.7 max.	1.125±.1	30±3	.020±.005	0.5±0.05	135 grms (.30 lb.)

For More Information. Circle No. 390

MICRO-OHM
CORPORATION
4900 SANTA ANITA DRIVE, EL MONTE, CA 91731
PHONE (818) 442-3310 • (213) 686-0535 • TWX: 910-587-3425

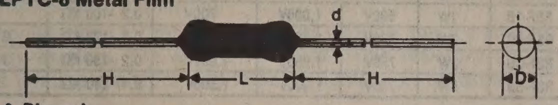
METAL FILM
Type RN 25



RN55 Size: ¼w rating

MO Style	Length (L) Inch ±0.39	Length (L) mm ±1.0	Diameter (D) Inch ±.02	Diameter (D) mm ±0.5	Lead (d) Tin Cu. AWG	Lead (d) Tin Cu. mm	Wattage @ 70°C	Max. Working Voltage	Max. Overload Voltage	Resistance Range (Ω)
RN25	.25	6.4	.09	2.3	22	0.5	¼	250	500	1-1.1Meg

HIGH STABILITY LINEAR POSITIVE T.C. RESISTORS
Type LPTC-8 Metal Film



Rating & Dimensions:
(in inches)

Max. Power Rating @ 70°C	L ±.020	D ±.020	1	d
⅛ W	.250	.090	1.0	22 ga.

Resistance Range: 10 ohm — 20K ohm (T1 and T2)
10 ohm — 1K ohm (T3 and T4)
Resistance Tolerance: ±2% (G) and ±5% (J)
Resistance Temperature Coefficient: T1 (±2500 PPM)
T2 (±3000 PPM)
T3 (±3500 PPM)
T4 (±4000 PPM)

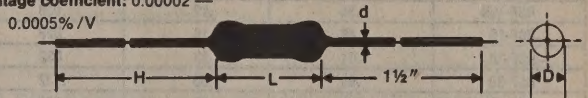
Features: a) Linear resistance change vs. temperature, which cannot be obtained in a semiconductor or thermister.
b) Positive temperature coefficient

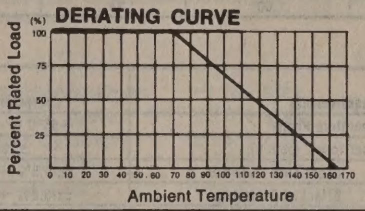
Application: Temperature compensation, temperature indication, temperature control, temperature protection and liquid level detection.

Markings: First two bands are significant digits, third band the multiplier, and the fourth and fifth bands are first two digits of T.C.R.

This high resistance component has been developed to be used as a precision or power resistor for X-ray equipment, measuring equipment and statistic electric equipment. It has high reliability in its shelf life, T.C.R. and other characteristics.

CHARACTERISTICS:
T.C.R.: 100 PPM
Load life: 3000 Hrs. ±1%
Anti moisture load life: ±1% after 250 Hrs. at 40°C 90-95% RH
Voltage coefficient: 0.00002 — 0.0005%/V
Shelf life: ±1% after 10,000 Hrs. at room temp.
Max. Temperature: 220°C
Temperature range: −55°C — +165°C

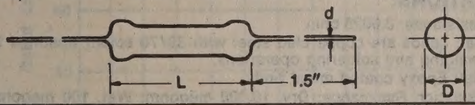




Style	Rated Wattage (W)	Max. Working Voltage (KV)	Pulse Voltage (KV)	Resistance Range	Dimensions (inches) D ±.04	L ±.06	d ±.004
MG-25	0.25	0.10	0.30	1Meg- 100Meg	.09	.256	.025
MG-50	0.50	0.35	0.70	1Meg- 200Meg	.126	.393	.028
MG-1	1.0	1.00	1.00	1Meg-1000Meg	.165	.472	.032
MG-2	2.0	5.00	7.50	1Meg-2000Meg	.217	.630	.032

Resistance Tolerance: F = ±1% G = ±2% J = ±5% Markings: EIA color coding system or Digital marking.

FLAME-PROOF METAL OXIDE POWER RESISTORS



Style	Dimension (inches) L ±.02	D ±.02	d (nominal)
RSF-½B	.35	.12	.028
RSF-1B	.46	.16	.028
RSF-2B	.61	.23	.032
RSF-3B	.98	.33	.032
RSF-5B	1.60	.33	.032

Style	Power Rating @ 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range	Resistance Tolerance
RSF-½B	0.5W	250V	400V	500V	0.2 -100KΩ	
RSF-1B	1W	500V	1,000V	700V	0.2 -100KΩ	
RSF-2B	2W	500V	1,000V	700V	0.2 -120KΩ	G*
RSF-3B	3W	750V	1,000V	1,000V	0.2 -150KΩ	J
RSF-5B	5W	750V	1,000V	1,500V	0.47-240KΩ	

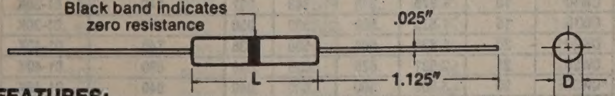
* G 5.1Ω and over

CHARACTERISTICS

Requirements		Characteristics	Test Method JIS C 5202	Test Method Mil-R-22684B
Operating Temperature Range		−55°C to +275°C		
Temperature Coefficient (ppm C)		±200	5.2	4 6 11
Max. Resistance Change	Short Time Overload	±(0.5% +0.05Ω)	5.5	4 6 5
	Effect of Soldering	±(0.5% +0.05Ω)	6.4 350°C 3 sec	4 6 9
	Temperature Cycling	±(0.5% +0.05Ω)	7.4 −55°C/85°C	4 6 3
	Moisture Resistance	±5%	7.9 1,000 hr	4 6 10
	Load Life	±5%	7.10 1,000 hr	4 6 12
Dielectric Withstanding Voltage		±(0.5% +0.05Ω)	5.7	4 6 7
Insulation Resistance		over 10⁴ MΩ	5.6	4 6 8
Non-Combustibility		The resistor shall withstand Overload test in accordance with Article UL492, 213 without producing a fire hazard.		
Resistance to Solvents		The resistor shall withstand Solvents test in accordance with Article MIL-STD-202 E 215 without producing any mechanical or electrical damage.		

JUMPER WIRE ZERO OHM RESISTORS
Type 104, 106, 108

DIMENSIONS:



FEATURES:

- Sizes equal to ⅛, ¼ and ½W carbon film
- Economical
- Straight-through zero ohm continuity
- Conformal multilayer epoxy coating
- Welded cap and lead construction
- Packing: Tape & reeled or bulk

Type	Equivalent Wattage	Body Inch Length (L) ±.010	Body Inch Diameter (D) ±.005
104	⅛	.150	.080
106	¼	.245	.085
108	½	.500	.095

SPECIFICATIONS:
Maximum Resistance: 0.0025 ohm
Lead Material: Leads are copperclad steel with 30/70 solder coatings to allow both welding and soldering operations.
Body material: Epoxy coated metal body
Minimum Insulation Resistance: Dry, 10,000 megohm; Wet, 100 megohm
Minimum Dielectric Withstanding Voltage: Atmospheric, 500V RMS; Reduced, 325V RMS
Insulation Flammability: Resistor insulation is self extinguishing within 10 seconds after externally applied flame is removed.
Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C
Reel Capacity: 5000 pcs

APPLICATIONS
Jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a PC board.
Generally they are used for the following reasons:

- Inability to connect two points on a PC board due to other circuit paths which must be crossed over.
- An after-the-fact design change that requires new point connections.
- Circuit tuning by changing point connections.

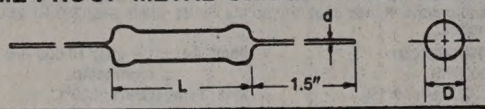
For More Information. Circle No. 390

MICRO-OHM CORPORATION

4900 SANTA ANITA AVENUE, EL MONTE, CA 91731
(818) 442-3310 / (213) 686-0535 • TWX: 910-587-3425

QUALITY PRECISION RESISTORS

FLAME-PROOF METAL OXIDE POWER RESISTORS



Style	Dimension (inches)		
	L ±.02	D ±.02	d (nominal)
RSF-½B	.35	.12	.028
RSF-1B	.46	.16	.028
RSF-2B	.61	.23	.032
RSF-3B	.98	.33	.032
RSF-5B	1.60	.33	.032

Style	Power Rating @ 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range	Resistance Tolerance
RSF-½B	0.5W	250V	400V	500V	0.2 -100 KΩ	
RSF-1B	1W	500V	1,000V	700V	0.2 -100 KΩ	
RSF-2B	2W	500V	1,000V	700V	0.2 -120 KΩ	G*
RSF-3B	3W	750V	1,000V	1,000V	0.2 -150 KΩ	J
RSF-5B	5W	750V	1,000V	1,500V	0.47-240 KΩ	

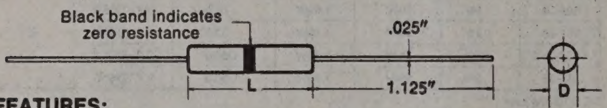
* G 5.1Ω and over

CHARACTERISTICS

Requirements		Characteristics	Test Method	
			JIS C 5202	MIl-R-22684B
Operating Temperature Range		−55°C to +275°C		
Temperature Coefficient (ppm C)		±200	5.2	4 6 11
Max. Resistance Change	Short Time Overload	±(0.5% +0.05Ω)	5.5	4 6 5
	Effect of Soldering	±(0.5% +0.05Ω)	6.4 350°C 3 sec	4 6 9
	Temperature Cycling	±(0.5% +0.05Ω)	7.4 −55°C/85°C	4 6 3
	Moisture Resistance	±5%	7.9 1,000 hr	4 6 10
	Load Life	±5%	7.10 1,000 hr	4 6 12
Dielectric Withstanding Voltage		±(0.5% +0.05Ω)	5.7	4 6 7
Insulation Resistance		over 10^4 MΩ	5.6	4 6 8
Non-Combustibility		The resistor shall withstand Overload test in accordance with Article UL492, 213 without producing a fire hazard.		
Resistance to Solvents		The resistor shall withstand Solvents test in accordance with Article MIL-STD-202 E 215 without producing any mechanical or electrical damage.		

JUMPER WIRE ZERO OHM RESISTORS

Type 104, 106, 108



FEATURES:

- Sizes equal to ⅛, ¼ and ½W carbon film
- Economical
- Straight-through zero ohm continuity
- Conformal multilayer epoxy coating
- Welded cap and lead construction
- Packing: Tape & reeled or bulk

Type	Equivalent Wattage	Body	
		Inch Length (L) ±.010	Inch Diameter (D) +.005
104	⅛	.150	.080
106	¼	.245	.085
108	½	.500	.095

SPECIFICATIONS:

Maximum Resistance: 0.0025 ohm
Lead Material: Leads are copperclad steel with 30/70 solder coatings to allow both welding and soldering operations.
Body material: Epoxy coated metal body
Minimum Insulation Resistance: Dry, 10,000 megohm; Wet, 100 megohm
Minimum Dielectric Withstanding Voltage: Atmospheric, 500V RMS; Reduced, 325V RMS
Insulation Flammability: Resistor insulation is self extinguishing within 10 seconds after externally applied flame is removed.
Current Rating: 25 amps at 25°C, derating to 0 amps at 150°C
Reel Capacity: 5000 pcs

APPLICATIONS

Jumper wires or crossovers, as they are sometimes called, are basically interconnection devices between points on a PC board.

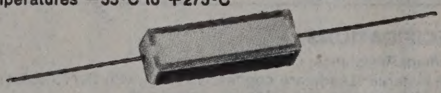
Generally they are used for the following reasons:

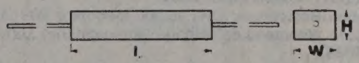
- Inability to connect two points on a PC board due to other circuit paths which must be crossed over.
- An after-the-fact design change that requires new point connections.
- Circuit tuning by changing point connections.

BATHTUB TYPE RESISTORS

CW SERIES

- √ Economical
- √ 1 watt to 50 watt
- √ 5 & 10% Tolerances
- √ Fireproof
- √ Operating temperatures −55°C to +275°C





CONSTRUCTION

Premium grade resistance wire is wound on a woven fiberglass core. Tinned copper terminals are tightly crimped or welded (depending on resistance value) to the banded core. The wound unit is potted in a high quality Steatite Ceramic case using a high temperature, high thermal conducting inorganic potting compound. This results in a completely fireproof inorganic package, highly resistant to solvents and impervious to moisture.

Stand off or feet type available in sizes 3 Watt and larger. Specify by inserting letter "F" after type number. Example: CW5F

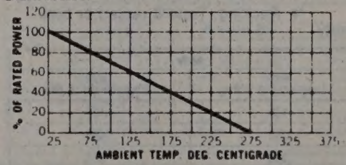
- ▪ Temperature coefficients (Typical) Below 1Ω 0 ±800 ppm; Over 1Ω 0 ±400 ppm
- ▪ Applicable specification to EIA Standard RS-344 Type
- ▪ Fuse type available
- ▪ Terminal strength: 5 lbs minimum
- ▪ Non-Inductive types available

CW SERIES - AXIAL LEAD

Type	Wattage	DIMENSIONS (inches)				Maximum Working Voltage	Resistance Range (Ω)
		Length (L)	Width (W)	Height (H)	Lead (d)		
CW1	1	.594	.219	.250	.032	60	.01-.27
CW2	2	.688	.250	.250	.032	65	.01-.35
CW3	3	.875	.312	.312	.032	150	.01-10K
CW5	5	.875	.375	.375	.032	200	.01-10K
CW7	7	1.406	.375	.343	.032	350	.01-27K
CW10	10	1.875	.375	.343	.032	540	.01-30K
CW15	15	1.875	.500	.500	.036	670	.01-30K
CW20	20	1.875	.500	.500	.036	740	.01-40K
CW25	25	2.531	.625	.625	.036	890	.01-40K
*CW50F	50	3.500	.500	.500	.040	940	.01-45K

* Available with stand off feet only.

DERATING



HOW TO ORDER:

CW5 10 ohms 5%
TOLERANCE
RESISTANCE VALUE
TYPE & WATTAGE

For More Information. Circle No. 390

MICRO-OHM CORPORATION
4900 SANTA ANITA AVENUE, EL MONTE, CA 91731
(818) 442-3310 / (213) 686-0535 • TWX: 910-587-3425

QUALITY PRECISION RESISTORS

THICK FILM RESISTOR NETWORKS

Single-In-Line SIP Resistors

INTRODUCTION

These conformal coated single-in-line (SIP) resistor networks are designed to meet a variety of application requirements in a compact, highly reliable package.

All SIP networks are quality tested for both resistance and tolerance before shipping.

Applications for resistor networks include: pull up and pull down resistors, TTL & ECL line terminating resistors, LED current limiting resistors and telecommunication networks.

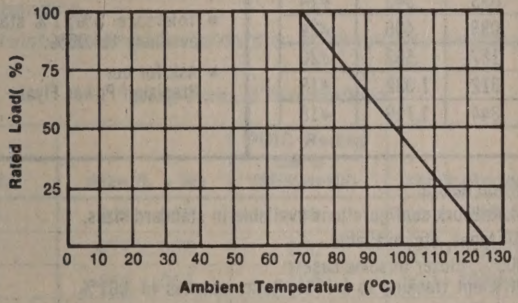
FEATURES

- Substrate Material — 96% alumina provides superior thermal properties and cooler operation.
- Resistors and Conductors — thick film materials with proven reliable performance.
- Lead Pull Strength: 5 lbs.
- Lead Material: Tinned plated copper alloy.
- Provides high electrical conductivity and thermal transfer.
- Encapsulation: Conformal coating ensure reliable performance.

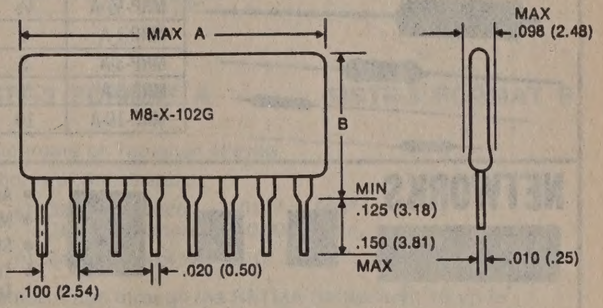
PERFORMANCE SPECIFICATIONS

Temperature Coefficient:	±250 PPM Std., ±100 PPM avail.
TCR Tracking:	50 PPM Max.
Operating Temperature:	−55°C to +125°C
Max. Working Voltage:	200V
Thermal Shock:	±.5% Max.
Moisture Resistance:	±.5% Max.
Terminal Strength:	±.25% Max.
Resis. to Soldering Heat:	±1.0% Max.
Load Life (1000 hours):	±3.0% Max.
Temperature Cycling:	±1.0% Max.
Shock and Vibration:	±.25% Max.
Solvent Resistance:	Resists industrial cleaning agents per MIL-STD-202E
Lead Solderability:	Meets MIL-STD-202 Method 208

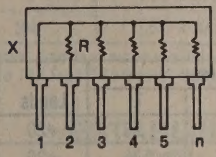
DERATING CURVE

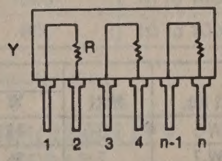


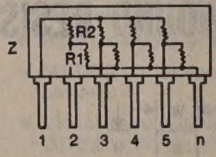
DIMENSIONS



STANDARD CIRCUITS







	No. Pins	STD Circuit			Dimensions	
		X	Y	Z	mm	in.
A	5	4	—	—	13.5	.531
	6	5	—	8	16.0	.630
	7	6	—	—	18.5	.728
	8	7	4	12	21.0	.827
	9	8	—	14	23.5	.925
	10	9	5	16	26.5	1.04
	11	10	—	—	29.0	1.14
	12	11	6	—	31.5	1.24
	13	12	—	—	34.0	1.34
B	Low Profile				5.08	.200
	Medium Profile				6.35	.250
	High Profile				8.90	.350

POWER RATING

Profile	Circuit: X Parallel	Circuit: Y Discrete	Circuit: Z Double Termination
Low	.125W	.200W	.200W $(R_1 + R_2)$
Medium	.150W	.250W	.250W $(R_1 + R_2)$
High	.250W	.350W	.350W $(R_1 + R_2)$

STANDARD RESISTANCE (Ω)

33	220	1K	5.6K	47K
47	270	1.2K	6.0K	68K
56	330	1.5K	6.8K	82K
68	390	1.8K	8.2K	100K
82	470	2.2K	10K	220K
100	510	2.7K	12K	390K
120	560	3.3K	15K	470K
150	680	3.9K	22K	680K
180	820	4.7K	33K	1M

DOUBLE TERMINATION (R1/R2) (Ω)

81/130
120/195
160/260
220/270
180/390
220/330
330/390
330/470
3K/6.2K

PART NUMBERING

M 8 X 102 G

SINGLE IN-LINE RESISTOR NETWORK
L = Low profile
M = Medium profile
H = High Profile

NO. OF PINS

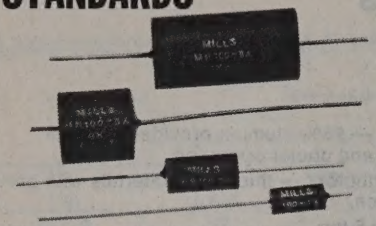
CIRCUIT TYPE
X = Parallel Y = Discrete
Z = Double Termination

RESISTANCE CODE
First two digits are significant.
Last digit specifies number of zeros.

RESISTANCE TOLERANCE
G = ±2% J = ±5% K = ±10% M = ±20%

MR PRECISION WIREWOUND RESISTORS

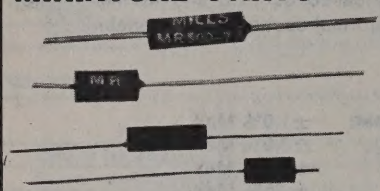
STANDARDS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR100-1	.15	100K	.187	.375	#22
MR100-2	.25	1.5M	.250	.500	#22
MR100-3	.30	2.75M	.250	.750	#22
MR100-4	.35	3.0M	.375	.625	#20
MR100-5	.50	4.0M	.375	.828	#20
MR100-6	.50	5.0M	.50	.50	#20

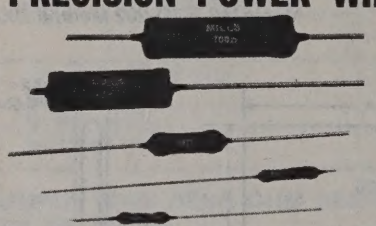
- Lead Configuration:
  "A" after Part No. 1 Axial Leads
  "R" for Radial Leads
  "L" for Lugs
- For high speed applications (minimum distributed L and C) specify MR200 Series.
- For high stability applications specify MR300 Series.
- Tolerance: .005% and up; to .002% in some cases.
- Metric sizes available, ask for our Metric Flyer.

MINIATURE PARTS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR500-1	.04	100K	.080	.210	#20
MR500-2	.05	125K	.080	.375	#24
MR500-3	.04	100K	.125	.125	#24
MR500-4	.05	125K	.100	.210	#24
MR500-5	.10	125K	.125	.187	#24
MR500-6	.10	125K	.125	.250	

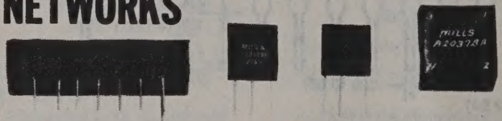
PRECISION POWER WIREWOUND RESISTORS



Part No.	Watt	Max. R	Dia.	Length	Lead
MRP-½-A	½	4.9K	.093	.343	#24
MRP-1-A	1	10.4K	.093	.406	#24
MRP-3-A	3	18K	.187	.562	#20
MRP-5-A	5	90K	.312	1.032	#18
MRP-10-A	10	370K	.344	1.719	#18

- To 10 watts.
- Silicone covered for maximum heat transfer.
- Tolerance: 5%, 1% standard, available to .05%.
- Ask for our Precision Power Flyer.

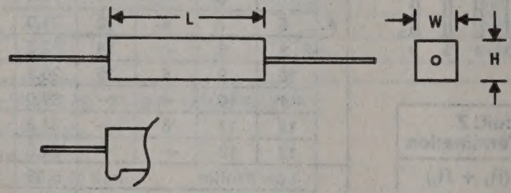
NETWORKS



- Any configuration you desire.
- Matched 2, 3 or 4 Network configurations available in standard sizes.
- Standard R, 2R, 4R types, etc. available.
- Tolerances: To .005%, closer in some cases;
  Temperature Coefficient tracking to 1 PPM; Ratio matches to .001%.
- Ask for our Network Flyer.

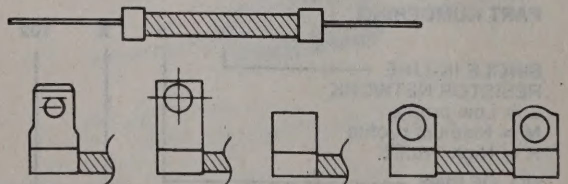
FIBERGLASS CORE WIREWOUND RESISTORS

CERAMIC-CEMENT ENCASED RESISTORS



Part No.	Watt	Dimensions			Leads
		W	H	L	
MRW-5	5	⅜	⅜	⅞	#20
MRW-7	7	⅜	⅜	1⅜	#20
MRW-10	10	⅜	⅜	1⅞	#20
MRW-15	15	½	½	1⅞	#18
MRW-20	20	½	½	2½	#18
MRW-25	25	⅝	⅝	2½	#18

UNCASED RESISTORS



ELECTRICAL SPECIFICATIONS

Tolerance ±10%, ±5″ available
Wattage to 20 watts
Positive temperature coefficient parts are available

MECHANICAL INFORMATION

Variety of terminals available
Tin plated steel or brass lug terminal material
Axial leads — tinned copper or copperweld
Core is silicone impregnated fiberglass
Most dimensions per your requirements

MR MILLS RESISTOR COMPANY, INC.

3840 CATALINA STREET
LOS ALAMITOS, CA 90720
(213) 598-2454

7000 FRANKLIN BLVD.
SUITE 1070
SACRAMENTO, CA 95823
(916) 422-5461

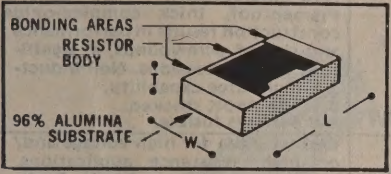
For More Information. Circle No. 391

MSI

MINI-SYSTEMS, INC

20 David Road, P.O. Box 69, North Attleboro, MA 02761
TELEPHONE: (617) 695-0203 • TWX NO. 710-348-0564

PRECISION THICK/THIN FILM CHIP RESISTORS



MINI-SYSTEMS, INC., thick/thin film chip resistor components are ideally suited for the fabrication of microelectronic circuits where tight resistance tolerance, wide range of resistance values, or short production runs make the conventional screening and firing of thick/thin film resistance networks too costly. MINI-SYSTEMS, INC., chip resistors are made from a carefully engineered selection of materials. Geometries are mechanically precise and uniform. Careful testing and inspection result in the highest quality resistors.

STANDARD "MSR" SERIES

- Sizes Available: .035″ x .035″ up to .661″ x .494″.
- PDIS Rating (25°C free air): 40 mW to 15 W.
- Resistors manufactured with palladium silver or platinum gold.
- Tolerances available: ±.5%, 1%, 2%, 5%, 10%, and 20% for most resistance values.
- All types available in untinned versions for conductive epoxy attachment.
- Hi-Rel screening available on all resistor types.
- Backside metalization available upon request.
- "Flip-Chip" resistors are solder tinned (SN-62).
- Wire bond resistors have gold metalization optimized for wire bonding.
- Sandwich metalization standard on all wrap-around resistors.

***Wrap-Around Terminations**

WA-	Size (L x W)	PDIS Rating 25°C (Milliwatts)	Ohmic Range
10	.040 x .037	35	1Ω to 75MΩ
4	.057 x .052	250	1Ω to 100MΩ
13	.083 x .052	400	1Ω to 100MΩ
9	.110 x .052	500	1Ω to 100MΩ
7	.110 x .102	1000	1Ω to 100MΩ
24	.160 x .052	600	1Ω to 100MΩ

* Other standard sizes available.
Write for free literature with detailed resistor chart.

ESTABLISHED RELIABILITY QPL MIL-R-55342 CHIP RESISTORS FOR ALL CRITICAL APPLICATIONS

- Sizes 55342/1 through /6
- Terminations Available: S, R, W, T, U
- Tolerances Available: F, G, J, K
- Meet or exceed Characteristic M
- Delivery: Typically 4 weeks ARO

NEW LOW COST "JR" SERIES COMPUTER/INDUSTRIAL GRADE WRAP AROUND CHIP RESISTOR

TYPE #JR13 — .075(L) x .050(W) x .017(T)

- Resistance Range: 10Ω to 10MΩ to standard EIA/MIL/IEC resistance decade values.
- PDIS Rating (25°C free air): 200 milliwatts.
- Untinned for either epoxy or solder attachment.
- Delivery typically 2 weeks ARO.

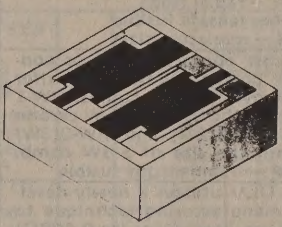
THIN FILM

MSTF-2 SERIES (.020″ x .020″)

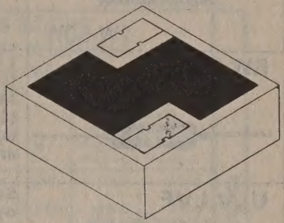
MSTF-3 SERIES (.030″ x .030″)

MSTF-4 SERIES (.040″ x .040″)

CUSTOM NETWORKS



MSTF-3 FORMAT A



MSTF-3 FORMAT B

- Nichrome or Tantalum Nitride
- Choice of Substrates:
  - a) Oxidized Silicon — .010″ ±.003″ Oxide Thickness — 10,000 Å min.
  - b) Ceramic, 99.6% — .010″ ±.001″
- Values range through the RETMA Series from 1Ω up to 10 megohm, depending on chip size.
- Tolerances: ±20%, 10%, 5%, 2%, 1%, 0.5% and 0.1% for most values.
- Backside gold available (3,000 Å typ.) on request.
- MSTF-3 series includes standard center tap dual resistor pattern.
- Visual requirements designed to meet MIL-STD-883 Method 2010.6 with full lot traceability of material and processing.
- Bond pad size: .005″ x .005″ minimum. Bond pad conductor material: Gold (20,000 Å typ.) standard. Bondable with normal wire bonding methods, such as thermocompression, thermosonic, or ultrasonic.
- Nichrome resistors passivated with silicon dioxide (5,000 Å typ.) for moisture protection and reliability. TCR (absolute) can be provided from 0-25 ppm. Special TCR's available on request.
- Noise: −30 to −35 dB typical for most values.
- Stability: 0.05% max. 0.02% typical. ± .003% typical Ratio. (After 1000 hours @ + 125°C.)
- Trimmable: Designed for later active trimming with Xenon or YAG Laser.
- Chip or Packaged

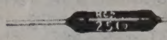
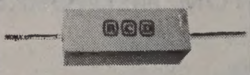
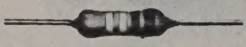
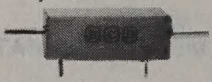
FOR ANY CUSTOM REQUIREMENTS, CONTACT FACTORY

THICK/THIN MULTILAYER SUBSTRATES/ HYBRID MICROCIRCUITS

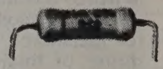
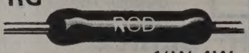
MINI-SYSTEMS, INC. has the latest materials technology processing capabilities for thick film multilayer substrates/monolithic thick film substrates, and custom resistor networks coupled with complete facilities for hybrid assembly, packaging, and testing. Fully automatic wire bonders and fully automatic laser trim systems give substantial production quantity capabilities.

RCD Quick Reference Guide

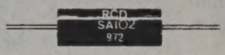
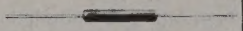
POWER WIREWOUND RESISTORS

STOCK	**100,100X,100R,100B**  ¼W-20W	Silicone coated, all-welded, per MIL-R-26(RW), MIL-R-39007 (RWR). .001Ω to 300KΩ, tolerances to ±0.01%, TCR to 5PPM. 100X — non-inductive 100BEO — increased power 100R — radial leads 100F — flameproof coating
STOCK	**600,600X,600B** 5W-300W	Silicone molded in an aluminum housing. High wattage capability with chassis mounting, per MIL-R-18546(RE), MIL-R-39009(RER). .005Ω to 200KΩ, tolerances to ±0.01%, TCR to 5PPM. 600X — non-inductive 600BEO — increased power
	PW,PWA,PWR,PWF  2W-50W	Low cost general purpose wirewounds. Ceramic encased, completely flameproof. PWX — non-inductive PWA — standoffs PWR — radial leads PWF — failsafe fusible PWS — miniature sizes
STOCK	**RW,RWF** 	Low cost epoxy molded or conformal coated wirewounds offer savings over carbon comps. RW-1 (1-watt) is the size of a ½-W carbon comp. RW-2(2W) and RW-3(3W) are both the size of a 1W comp. RWF — Flameproof fusible
	ULV,LVF 	Series ULV utilizes a newly-developed manufacturing technique to obtain very low values (to 0.002Ω), with precision accuracy at lowest cost. LVF — four terminal construct.

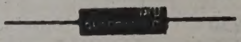
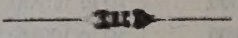
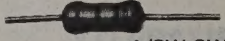
THICK FILM RESISTORS

STOCK	**RSF,BW**  1W-9W	New development! Flameproof, thick complex-oxide construction results in performance and size of wirewounds, at significant price reductions. Non-inductive, high-surge capability. 0.1Ω to 240K stocked. BW Series is fusible.
	RG  ¼W-4W	Cermet glaze for high voltage and/or high resistance applications. Voltage capability to 50KV. Resistance to 10,000 Meg. Tolerances to 0.5%, TCR to 50PPM.
STOCK	**MG** 1W	1-watt molded resistor in a ¼-watt carbon comp size. High density due to thickest cermet glaze. 6.2Ω to 1 Meg, TCR to 50PPM, tolerances to ±1.0%. LOW COST.
	MC 1/16-1/4W	High-stability thick film chip resistors. 4.7Ω to 2000 Meg. Wrap-around termination available.
	MR 1/4W	Cermet micro-resistors offer highest performance in smallest possible size. Only 0.1" long! 4.7Ω to 8.2 Meg. ±5%, ±10%.
	DIP,SIP	Thick film resistor networks offer premium performance per MIL-R-83401. SIP packages are 4 to 12 pin. DIP's are 14 or 16 pin. Variety of standard and custom configurations, hybrids available.

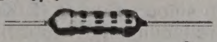
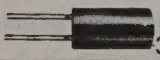
PRECISION WIREWOUND RESISTORS

SA,MA  .1W-2W	Epoxy encapsulated, non-inductive precision bobbin wirewounds per MIL-R-93(RB), MIL-R-39005 (RBR). 0.1Ω to 25 Meg, tolerances to ±0.005%, TCR from ±1PPM to +6700PPM
PC,PC451 .1W-1W	Same as Series SA, MA but feature radial leads for easy PCB insertion and space savings per MIL-R-93, MIL-R-39005. PC451 (rectangular) is direct low-cost replacement for ultra-precision films.
Q 	Wirewound substitutes for precision metal film's RN55, RN60, RN65, RN70, RN75. Better stability, lower price. TCR as low as ±2PPM. Tolerances to ±0.01%.

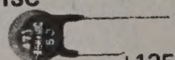
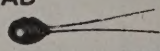
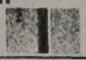
THIN FILM RESISTORS

STOCK	**MF**  .1W-1W	Precision metal film per MIL-R-10509, RN55,60,65,70,75 and MIL-R-55182(RNR,RNC). 10Ω to 5.1 Meg, tolerances to ±0.05%. Outstanding TC's to 5PPM.
STOCK	**GP**  .1W-1W	Commercial metal film with MIL-spec performance at half the price! Exceeds MIL-R-10509(RN),-22684 (RL),-39017(RLR). Values to 22.1 Meg, TC's to 25PPM, tolerances to ±0.5%.
STOCK	**CF,CFF**  1/8W-2W	General purpose carbon film feature highest grade core for extended life stability and overload dissipation. 1ohm to 22 Meg, 7 standard sizes. Series CFF is flame prof

TEMPERATURE SENSORS

	LP 1/4  +150°C	Low cost metal film with linear positive TCR. 33Ω to 30K, tolerances to ±1.0%. Available in any T.C. up to +5000PPM (.5%/°C). Only ¼" long.
	ATB,PTB,ATS,ATC  375°C	Precision wirewound, axial or radial. Interchangeable TCR, 1Ω to 1 Meg, tolerances to ±0.05%. Available in any T.C. up to +6720 PPM.
STOCK	**PTC,PTS** +600°C	Ceramic encased RTD elements or stainless steel RTD problems. Platinum, Nickel, Nife elements stocked. Tolerances to +0.1%.

THERMISTORS (NTC & PTC)

DISC  +125°C	Epoxy coated NTC and PTC thermistors. Available in 3 standard sizes from 5Ω to 100K. Tolerance to ±5%.
BEAD  +450°C	Bead type NTC thermistors feature sizes as small as .03" dia. Values to 1 Meg. Glass probes standard, epoxy or stainless steel available.
CHIP  +150°C	Precision NTC and PTC chips offer fastest response. Sizes as small as .03" x .03" Values to 20KΩ.

INDUCTORS

STOCK	**AL**	Low cost color banded inductors per MIL-C-15305. Special core results in high Q and SRF, low DCR. .22μH to 56000μH. Axial or radial leads.

CUSTOM

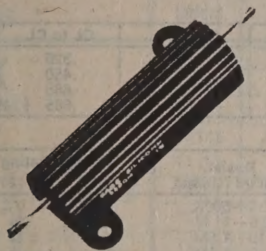
RCD custom produces a series of solid ceramic resistors for high surge applications; a series of disc-type varistors for transient protection; fuse resistors from 1/8-10W; hybrid networks, RC networks, Res/diode networks, voltage dividers, coils, trimmers, potentiometer

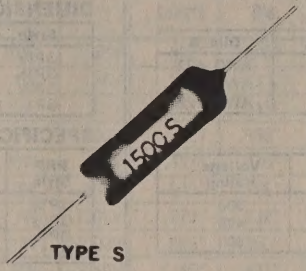
Don't forget our 'SWIFT' service (Ship With In Fifty Two hours) when you require fast delivery of a non-stock item!

RCD Components Inc. • 330 Bedford Street. Manchester. NH 03101 • (603) 669-0054 Tlx: 943512

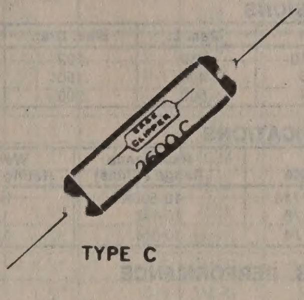
Nytronics Components Group, Inc.
ORANGE STREET, DARLINGTON, S. C. 29532
(803) 393-5421 — TWX 810-665-2182

SAGE/NYTRONICS RESISTORS


TYPE M



TYPE S



TYPE C

MIL-R-18546D TYPE DESIGNATIONS

Example:

RE65	G	1001
Style	Characteristic, 275°C Max. G for regular inductive winding N for non-inductive winding	Nominal resistance, Ω. ±1% only. Three significant digits plus fourth indicating number of zeros. Below 100Ω R = decimal and following digits are significant.

T.C. ±30 ppm/°C 2000Ω and above
±50 ppm/°C under 2000Ω

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE Min.	DEFINED OHMIC RANGE Max. (.001 wire)
RE60G	3105M	5	.1	3320
RE60N	3105NM	5	1.0	1650
RE65G	3010M	10	.1	5620
RE65N	3010NM	10	1.0	2800
RE70G	3225M	20	.1	12100
RE70N	3225NM	20	1.0	6040
RE75G	3550M	30	.1	39200
RE75N	3550NM	30	1.0	19600

CONSIDER THESE RESISTOR FEATURES:

- Wattage Rating, ½ to 50 watts
- T.C. 20 ppm/°C or 10 ppm/°C
- 1000 volt rms body insulation
- Characteristic U or V wattage rating: to 275°C or 350°C
- Power load life stability <.5%/1000 hours
- Weldable leads when specified
- Non-inductive winding when specified

TYPC C CLIPPER METAL SHEATHED RESISTORS

Similar in all respects to Type S, fully insulated plus addition of metal sleeve for heat sink mounting in spring clip holders.
Full heat sink rating.

TYPE S, NS SILICONE COATED POWER RESISTORS

Meet or exceed MIL-R-26E requirements.
N designates non-inductive.

STYLE	Rating Watts		STYLE	Char.U Rating Watts	Nominal Size Length*	Nominal Size Dia.**	Lead Dia	Maximum Standard Range Ω Regular Winding	Maximum Standard Range Ω Non Inductive	
	Full heat sink rating		100S	1	.400	.094	.020	8400	3000	MINIATURE SERIES
			200S	2	400	.125	.020	11000	3900	
			300S	3	.400	.187	.020	15000	5300	
			250S	.5	.250	.078	.020	3800	1350	
			500S	.8	.312	.078	.020	5000	1750	
			750S	1	.531	.094	.020	12000	4200	
			1000S	1	.406	.094	.020	8400	3000	
			1100S	2	.500	.125	.032	15000	5500	
2200C	6	→	1200S	3	.500	.187	.032	20000	7000	REGULAR S SERIES
			1240S	3	.562	.187	.032	24000	8400	
2250C	6	→	1250S	3	.812	.187	.032	40000	14000	
			1300S	3	.625	.250	.040	30000	10500	
			1500S	5	.875	.312	.040	71000	25000	
2550C	11	→	1550S	5	1.000	.312	.040	88000	31000	
2600C	14	→	1600S	7	1.219	.312	.040	114000	40000	
			1700S	10	1.781	.375	.040	230000	80000	
			1900S	10	1.375	.431	.040	210000	73000	
			1950S	11	2.000	.431	.040	314000	110000	

Min. Res. Tol. Available is ±1% on the NS Styles.

*On 100S, 200S and 300S L is max.
*On 250S, 500S and 750S L is ±.031.
*On all others L is ±.062.
**On 250S and 500S D is ±.016.
**On all others D is ±.031.
**For styles 1100S or smaller add .016 for non-inductive (NS) types or ohmic values less than 0.1 ohms.

MIL-R-26E TYPE DESIGNATIONS

EXAMPLE:

RW69	V	471
Body Style	Characteristic, V only (350°C max.)	Nominal resistance, Ω. Two significant digits plus third indicating number of zeros. Below 10ΩR = decimal and last digit is significant.

TOLERANCE: ±5% for values 1Ω and up; ±10% below 1Ω.
TC: ±260 ppm/°C 20Ω and up; 400 ppm/°C below 20Ω.

MIL STYLE	SAGE STYLE	MIL WATTS	DEFINED OHMIC RANGE (Single layer wound .00175 min. wire dia.	DEFINED OHMIC RANGE .001 Min. Wire Dia.
RW55V	1900S	7	.1—5100	
RW56V	1950S	14	.1—9100	
RW67V	1550S	6.5	.1—3600	.1—8200
RW68V	1700S	11	.1—8200	.1—20K
RW69V	1200S	3	.1—910	.1—2K

EXAMPLE:

RW70	U	49R9	F
Body Style	Characteristic, U only (275°C max.)	Nominal resistance, Ω. Three significant digits plus fourth indicating number of zeros. Below 10CΩR decimal and following digits are significant	Tolerance ± % B = .1% D .5% F = 1.0%

TC: ±30 ppm/°C 10Ω and above
±50 ppm/°C 1Ω to 10Ω
±90 ppm/°C below 1Ω

MIL STYLE	SAGE STYLE	MIL WATTS	VOLTAGE Max.	DEFINED OHMIC RANGE Min	DEFINED OHMIC RANGE Max for .001" wire (Navy)	DEFINED OHMIC RANGE Max for .0008" wire (all other)
RW70U	1000S	1	——	.1	1210	3160
RW74U	1500S	5	300	1	12100	38300
RW78U	1700S	10	720	.1	40200	90900
RW79U	1240S	3	135	1	3570	10500
RW80U	1000SB	2	——	1	1240	3160
RW81U	250SB	1	25	1	649	——

1984/85 Product Catalog with complete details upon request – Dept. G

PRECISION RESISTIVE PRODUCTS, INC.

HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637 (319) 394-9131

PR-SERIES ULTRA PRECISION METAL FILM RESISTORS

- Low Temperature Coefficients
- Tight Tolerances • High Stability • Low Noise

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
PR1/10	.280	.102	.300	AWG #22
PR1/8	.400	.150	.450	AWG #22
PR1/4	.600	.200	.685	AWG #22

SPECIFICATIONS

Style	Resistance Range (Ohms)	Wattage Rating @ 85°C	Voltage Rating
PR1/10	10-500K	1/10	300
PR1/8	10-1M	1/8	400
PR1/4	10-1M	1/4	500

TYPICAL PERFORMANCE

	%ΔR
1000 Hr. Load Life 85°C	0.02
Humidity	0.04
Temperature Cycling	<0.01
Short Time Overload	<0.01
Dielectric Withstanding	<0.01
Noise	<−30dB
Insulation Resistance	>10000 M. Ohm
Shelf Life	<50 PPM/YR.

TEMPERATURE COEFFICIENTS

TC25 = 0 ±25 PPM/°C −20 to +85°C
TC20 = 0 ±20 PPM/°C −20 to +85°C
TC15 = 0 ±15 PPM/°C −20 to +85°C
TC10 = 0 ±10 PPM/°C −20 to +85°C
TC5 = 0 ± 5 PPM/°C −20 to +85°C

RESISTANCE TOLERANCES

±1.0%, ±0.5%, ±.25% & ±0.1%, ±0.5%, ±.02%, ±.01%

LEAD MATERIAL

OFHC with 60/40 Tin/Lead Coating

RL-SERIES ULTRA PRECISION METAL FILM RESISTORS

- Radial Leads • Small Size
- Low TC • High Stability

DIMENSIONS (INCHES)

H	Height	.365
L	Length	.260
W	Width	.140
LS	Lead Spacing Lead Gage #22	.150

SPECIFICATIONS

Style	Temperature Coefficient	Resistance Range (Ohms)	Standard Tolerance	Wattage @ 85°C
RL 1	20 PPM/°C 15 10 5	20 thru 100K	1%, 5%, .25%, .10%, .05%, & .02% .01%	.1
RL 3	20 PPM/°C 15 10 5	20 thru 100K	1%, .5%, .25%, .1% .05% & .02% .01%	.3

TEMPERATURE COEFFICIENTS

TC20 = 0 ±20 PPM/°C −20 to +85°C
TC15 = 0 ±15 PPM/°C −20 to +85°C
TC10 = 0 ±10 PPM/°C −20 to +85°C
TC5 = 0 ± 5 PPM/°C −20 to +85°C

TYPICAL ENVIRONMENTAL PERFORMANCE

	%ΔR
1000 Hr. Load Life	±0.02%
Humidity	±0.04%
Temperature Cycling	±0.01%
Short Time Overload	±0.01%
Insulation Resistance	>1000 Megohms
Noise Index	<−30dB
Voltage Coefficient	<0.05 PPM/Volt
1 Year Shelf Life	±50 PPM

MATCHED SETS AND NETWORKS

Customized resistance and temperature coefficient matching is available.

Resistance matching to .01% and T. C. tracking of 1 PPM/°C are standard.

Please consult the factory for details on your requirements.

GP-SERIES GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- Economical • High Performance
- Very Stable • Low Noise

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
GP¼	.280	.102	.325	AWG #22
GP½	.400	.150	.450	AWG #22
GP¾	.600	.200	.685	AWG #22
GP1	.600	.200	.685	AWG #20

SPECIFICATIONS

PRP Style	Mil. Style	Resist. Range (Ohms)	Wattage Rating @ 70°C	Wattage Rating @ 125°C	Voltage Rating
GP¼	RN55	2.5—500K	¼	1/10	300
GP½	RN60	2.5—1 M	½	⅛	500
GP¾	RN65	10—1.5M	¾	¼	500
GP1	RN70	10—1.5M	1	½	500

TYPICAL PERFORMANCE

	%ΔR
Temperature Cycling	0.05
Low Temperature Operation	0.03
Terminal Strength, 5 Lb. Load	0.02
Resistance To Soldering Heat	0.02
Dielectric Withstanding Voltage	0.02
Short Time Overload	0.05
Moisture Resistance	0.20
1000 Hour Load Life @ 125°C	0.15

TEMPERATURE COEFFICIENTS

TC25 = 0 ±25 PPM/°C −20 to +85°C
TC50 = 0 ±50 PPM/°C −20 to +85°C
T100 = 0 ±100 PPM/°C −20 to +85°C
T250 = 0 ±250 PPM/°C −20 to +85°C

RESISTANCE TOLERANCES

±5.0%, ±2.0%, ±1.0%, ±0.5%, ±.25%, & ±0.1%

LEAD MATERIAL

OFHC with 60/40 Tin/Lead Coating

NOTE: The GP-Series of resistors is conformally coated and fully protected against moisture by a multi-paint coat system and a hard epoxy outer coating.

Marking is alpha-numeric and meets the most demanding marking requirements. Special marking is available upon request.

Consult the factory concerning failsafe, flameproof, and fusing requirements.

LCR¼-SERIES GENERAL PURPOSE NON-PRECISION METAL FILM RESISTORS

- Low Cost • Taped and Reel Package
- Color Band Marking • Exceeds Mil-R-22684B & Mil-R-10509F Performance Requirements

DIMENSIONS

Max. L	Max. Dia.	Lead L.	Lead Dia.
.270″	.098″	1¼″	.025

GENERAL SPECIFICATIONS

Resist. Tolerance	Resist. Range	Temp. Coef. of Resist.	Power Rating	Max. Volt.
1% 2% 5%	10Ω through 1M	50 & 100 PPM/°C	¼W (70°C)	250 VRMS

Performance Characteristics		PRP	Mil-R-22684B	Mil-R-10509F
Type No. (Style)		LCR¼	RL07	RN55D
Size: inch	Body Length	.270 Max.	.243 ±.038	.250 ±.031
	Body Diameter	.098 Max.	.090 ±.008	.109 ±.031
	Lead Diameter	.024 ±.002	0.23 ±.004	.025 ±.002
Power Rating		0.25W at 70°C 0.125W at 125°C	0.25W at 70°C 0.078W at 125°C	0.125W at 70°C 0.0625W at 25°C
Max. Rated Continuous Working Voltage		250V	250V	200V
Max. Ambient Temperature		165°C	150°C	165°C
TCR		±50 & ±100 PPM/°C	±200 PPM/°C	+200 −500 PPM/°C
Nominal Resistance Range		10Ω to 1MΩ	47Ω to 150kΩ	10Ω to 301kΩ
Standard Tolerances		1%, 2% & 5%	5% & 2%	1%
Dielectric Withstanding Voltage	ΔR	0.25%	0.5%	0.5%
Insulation Resistance		10,000 MΩ	1,000 MΩ	10,000 MΩ
Temperature Cycling	ΔR	0.25%	1.0%	0.5%
Short-Time Overload	ΔR	0.25%	0.5%	0.5%
Moisture Resistance	ΔR	0.5%	1.5%	1.5%
Load Life	ΔR	1.0%	2.0%	1.0%
Terminal Strength	ΔR	0.2%	0.5%	0.2%
Resistance to Soldering Heat	ΔR	0.5%	0.5%	0.5%
Shock	ΔR	0.2%	0.5%	0.5%
Vibration	ΔR	0.2%	0.5%	0.5%
Low Temperature Operation	ΔR	0.25%	0.5%	0.5%
Shelf Life	ΔR	0.2%	0.2%	N.A.

For More Information Circle No. 395

PRECISION WIREWOUND RESISTORS

ELECTRICAL AND PHYSICAL SPECIFICATIONS

Partial listing of popular axial lead resistor types

TYPE TX
(ECONOMY LINE)

Partial listing of
TX features:

- Resistance range; any ohmic value desired.
- Res. tolerance; to ± 0.05%
- TCR char: (std. 0 ± 20 ppm/°C)
- Ratings: from 40 mw thru 5 W to +85°C

P.R.C. Type Mil-Style		Max. Watts ≠ 1 % Res. Tol.	Max. Volts	Body Dimensions Tol. Generally ± .031"		Lead Dia. Tinned Copper	Lead Lgth. ±.125"	Resistance (Ohms)		
Induct.	Non-Ind.			Length	Dia.			Min.	Max. Std.	Max. Special
TX073	TX073N	.07W	65V	.332"	.090"	.020"	1.5"	0.1	30K	65K
TX093	TX093N	.1W	85V	.332"	.115"	.0253"	1.5"	0.1	35K	75K
TX095	TX095N	.125W	125V	.457"	.115"	.0253"	1.5"	0.1	60K	180K
TX143	TX143N	.2W	200V	.332"	.160"	.0285"	1.5"	0.1	50K	130K
TX155	TX155N	.25W	250V	.457"	.176"	.0285"	1.5"	0.1	100K	300K
TX158	TX158N	.5W	500V	.645"	.176"	.0285"	1.5"	0.1	450K	600K
TX3110	TX3110N	1W	1000V	.770"	.332"	.032"	1.5"	0.1	750K	1.6MEG
TX2812	TX2812N	1.25W	1000V	.895"	.300"	.032"	1.5"	0.1	1MEG	1.8MEG
TX3716	TX3716N	.2W	1250V	1.145"	.437"	.032"	1.5"	0.5	2MEG	3.5MEG
TX3724	TX3724N	3W	1250V	1.645"	.437"	.032"	1.5"	0.5	3MEG	5MEG

TYPE SX
(HIGH PRECISION)

- Resistance range; any ohmic value desired.
- Res. tolerance: to ± 0.05% (see TYPE HR for closer tol.)
- TCR char.: (std. for SX zero ± 5 to 20ppm/°C
- Temp. range: from —55°C thru +150°C
- Stability: ± 0.005 %/yr. to ± 0.001 %
- Power ratings: 40 mw thru 5W to +125°C

P.R.C. Type Mil-Style		Max. Watts ≠ 1 % Res. Tol.	Max. Volts	Body Dimensions Tol. Generally ± .031"		Lead Dia. Tinned Copper	Lead Lgth. ±.125"	Resistance (Ohms)		
Induct.	Non-Ind.			Length	Dia.			Min.	Max. Std.	Max. Special
SX062	SX062N	.04W	35V	.270"	.080"	.020"	1.5"	1.0	17K	30K
TX072	SX072N	.06W	45V	.270"	.090"	.020"	1.5"	0.1	25K	35K
SX093	SX093N	.1W	85V	.332"	.115"	.0253"	1.5"	0.1	35K	75K
SX143	SX143N	.2W	200V	.332"	.160"	.0285"	1.5"	0.1	50K	130K
SX154	SX154N	.25W	250V	.395"	.176"	.0285"	1.5"	0.1	100K	200K
SX174	SX174N	.33W	330V	.395"	.190"	.0285"	1.5"	0.1	130K	220K
SX186	SX186N	.5W	500V	.520"	.207"	.0285"	1.5"	0.01	150K	480K
SX2210	SX2210N	.8W	800V	.770"	.240"	.032"	1.5"	0.1	511K	1.1MEG
SX3110	SX3110N	1W	1000V	.770"	.332"	.032"	1.5"	0.1	750K	1.6MEG
SX3114	SX3114N	1.33W	1000V	1.020"	.332"	.032"	1.5"	0.1	1.25MEG	2MEG
SX3716	SX3716N	2W	1250V	1.145"	.437"	.032"	1.5"	0.5	2MEG	3.5MEG
SX3724	SX3724N	3W	1250V	1.645"	.437"	.032"	1.5"	0.5	3MEG	5MEG

TYPE HR
(ULTRA PRECISION)

- Resistance: any value to ± 0.005 % tol.
- Stability: to 0.001 %/yr. at 25° C
- TCR char: zero ± 5 ppm/°C or better
- Protective Epoxy Seal
- Thermal EMF: < +2 microvolts per °C

P.R.C. Type Mil-Style		Max. Watts ≠ 1 % Res. Tol.	Max. Volts	Body Dimensions Tol. Generally ± .031"		Lead Dia. Tinned Copper	Lead Lgth. ±.125"	Resistance (Ohms)		
Induct.	Non-Ind.			Length	Dia.			Min.	Max. Std.	Max. Special
HR175	HR175N	.2W	100V	.312"	.156"	.020"	1.5"	0.1	80K	100K
HR256	HR256N	.25W	200V	.375"	.250"	.032"	1.5"	0.1	127K	200K
	RB56	.25W	200V	.395"	.250"	.032"	2.0"	0.1	127K	220K
HR258	HR258N	.33W	300V	.500"	.250"	.032"	1.5"	0.1	226K	500K
	RB55	.33W	300V	.520"	.250"	.032"	2.0"	0.1	127K	480K
HR2512	HR2512N	.5W	300V	.750"	.250"	.032"	1.5"	0.1	511K	1MEG
	RB54	.5W	300V	.800"	.250"	.032"	2.0"	0.1	511K	1.1MEG
HR3712	HR3712	.66W	300V	.750"	.375"	.032"	1.5"	0.1	750K	2MEG
	RB53	.66W	300V	.800"	.375"	.032"	2.0"	0.1	750K	1.6MEG
HR3716	HR3716N	1W	600V	1.000"	.375"	.032"	1.5"	0.1	1.5MEG	3MEG
	RB52	1W	600V	1.060"	.375"	.0253"	2.0"	0.1	1.5MEG	2.8MEG

TYPE SM
(PRECISION POWER)

,,SM'' The sub-miniature TYPE SM is encapsulated in a tough solvent resistant high temperature silicone protective coating per MIL-R-26. Partial listing of SM features:

- Resistance range: specify any ohmic value within range listed
- Resistance tolerance: (± 1% std.) to ± 0.05%
- TCR char: zero ± 20ppm/°C or better
- Power ratings: ¼ watt thru 10 watts at 25°C

P.R.C. Type Mil-Style		Max. Watts ≠ 1 % Res. Tol.	Max. Volts	Body Dimensions Tol. Generally ± .031"		Lead Dia. Tinned Copper	Lead Lgth. ±.125"	Resistance (Ohms)		
Induct.	Non-Ind.			Length	Dia.			Min.	Max. Std.	Max. Special
SM062	SM0623N	.25W	65V	.250"	.080"	.020"	1.5"	0.1	17K	30K
SM063	SM063N	.5W	110V	.312"	.080"	.020"	1.5"	0.1	24K	50K
SM094	SM094N	1W	200V	.406"	.115"	.0253"	1.5"	0.1	40K	80K
RW70		1W	200V	.406"	.115"	.020"	1.5"	0.1	40K	80K
SM186	SM186N	3W	500V	.500"	.207"	.0285"	1.5"	0.025	80K	480K
RW69		3W	500V	.500"	.207"	.0285"	1.5"	0.025	80K	480K
SM177	SM177N	3W	500V	.562"	.190"	.0285"	1.5"	0.1	80K	540K
RW79		3W	500V	.562"	.190"	.0285"	1.5"	0.1	80K	540K
SM2812	SM2812N	5W	100V	.875"	312"	.032"	1.5"	0.02	200K	1MEG
RW74		5W	1000V	.875"	.312"	.032"	1.5"	0.02	200K	1MEG
SM3726	SM3726N	10W	1250V	1.780"	.437"	.032"	1.5"	0.07	156K	4MEG
RW78		10W	1250V	1.780"	.395"	.032"	1.5"	0.07	156K	4MEG

PURCHASING INFORMATION. When ordering P.R.C. Resistors, please specify: qty./type/res. value/ tol. and special features. Small quantity lots are delivered with amazing speed. Large production quantities are shipped to meet critical schedules.

Request General Catalog which also illustrates:

Precision Power
4 terminal designs to 0.005 ohms.

Precision Positive (+) temperature coefficient types to +6000 ppm/°C

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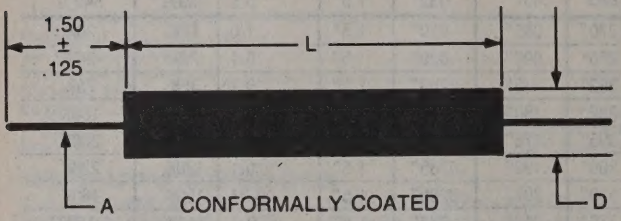
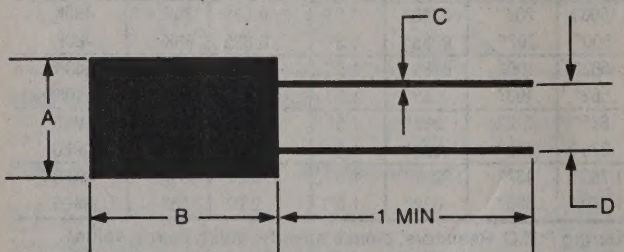
Demand Quality.

PRECISION METAL FILM RESISTORS



Tel Labs Style	Mil R	RR	W	VR	BL(L)	BD(D)	LD(A)
LA45	N/A	10-25K	1/40	100	.130 ±.005	.047 ±.005	.016(#26)
LA50	RNC50	10-200K	1/20	200	.150 ±.020	.070 ±.010	.016(#26)
LA55	RNC55	10-604K	1/10	200	.250 ±.020	.080 ±.015	.025(#22)
LA60	RNC60	10-1.0M	1/8	250	.375 ±.060	.100 ±.015	.025(#22)
LA65	RNC65	10-3.0M	1/4	300	.562 ±.031	.180 ±.015	.025(#22)
LA70	RNC70	10-4.02M	1/2	350	.640 ±.031	.210 ±.015	.032(#20)
LA75	RNC75	10-5M	1	750	1.000 ±.031	.340 ±.015	.032(#20)
LA80	N/A	10-10M	2	750	2.062 ±.031	.275 ±.015	.032(#20)

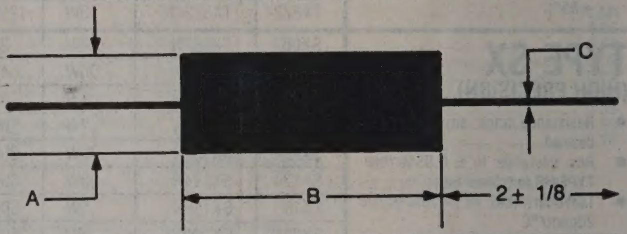
TYPE PW SERIES



Mil R93D Desig.	Tel Labs Style	A ± .015	B ± .032	C	D ± .015	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. V. Mil.	MAX. V. Comm.
RB71	PW1	.250	.312	.025	.200	100K	125K	.125W	.15W		300
	PW2	.250	.406	.025	.200		175K		.2W		600
RB70	PW20	.375	.500	.032	.200,.250	301K	375K	.250W	.33W	150	600
	PW40	.468	.625	.032	.250,.300		500K		.3W		600
	PW31	.500	.625	.032	.250,.300		1.75 Meg		.6W		600
	PW10	.406	1.250	.032	.250,.300		1.0 Meg		1.0W		1200
	PW50	.531	1.000	.032	.250,.300		3.0 Meg		1.0W		1200

TYPE SA EPOXY

Meets or exceeds MIL-R-93D



Tel Labs Style	Mil R93D Desig.	Diam. A ± .015	Length B ± .031	Lead Diam. C.	MAX. VALUE Mil.	MAX. VALUE Comm.	WATTAGE Mil.	WATTAGE Comm.	MAX. VOLTAGE Mil.	MAX. VOLTAGE Comm.
SA1	RB55	.250	.500	.032	226 K	1.1 Meg	.15W	.3W	400	400
SA2	RB54	.250	.750	.032	448 K	2 Meg	.25W	.4W	300	400
SA3	RB53	.375	.750	.032	750 K	8 Meg	.333W	.5W	300	400
SA4	RB52	.375	1.000	.032	1.5 Meg	10 Meg	.5W	.75W	600	800
SA5	RB57	.500	1.000	.032	2 Meg	16 Meg	.75W	1.0W	800	1000
SA6	RB58	.500	1.531	.032	3 Meg	24 Meg	1.0W	1.5W	900	1200
SA7	RB59	.500	2.031	.032	5.11 Meg	24 Meg	1.25W	2.0W	1200	1800
SA11		.250	.625	.032		400 K		.33W		800
SA13		.312	.937	.032		1.2 Meg		.5W		800
SA16	RB56	.250	.375	.032	127 K	205 K	.125W	.25W	200	200
SA19		.250	.250	.032		500 K		.2W		200
SA18		.500	.500	.032		3 Meg		.5W		500

SUBMINIATURES

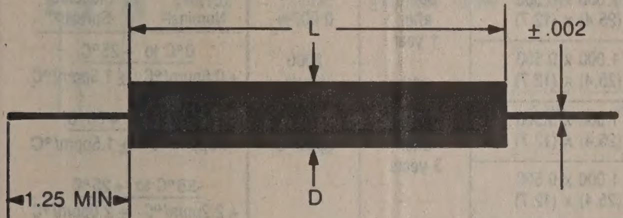
Tel Labs Style	Diameter A ± .015	Length B ± .031	Lead Diam. C.	Maximum Value	Maximum Wattage	Maximum Voltage
SA9	.135	.312	.025	400K	.08W	100
SA10	.185	.500	.025	500K	.2W	100
SA20	.165	.500	.025	400K	.150W	100,200
SA21	.187	.375	.025	500K	.125W	100,200
SA22	.150	.400	.025	190K	.07W	100
SA24	.125	.250	.020	75K	.05W	100
SA25	.110	.300	.020	85K	.05W	100
SA26	.125	.375	.025	140K	.05W	100
SA29	.100	.300	.025	80K	.05W	100
SA30	.200	.405	.025	550K	.13W	100
SA31	.100	.220	.020	70K	.04W	100

For More Information. Circle No. 397

Specify Tel Labs.

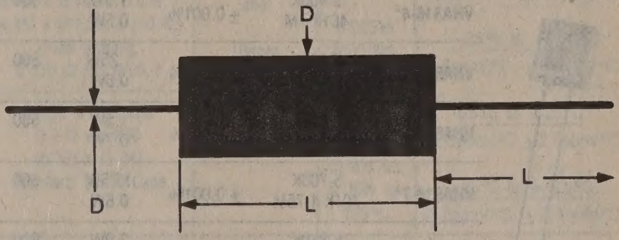
TYPE EL SILICONE POWER

Meets or exceeds MIL-R-26



Tel Labs Style	Mil Desig RW	Wattage		Dimensions — Inches		Max Res.		Lead Dia. IN.
		U 275°	V 350°	Dia.	LN	.05% to .05%	1% to 5%	
EL¼		.5W	1.0W	.090 ± .031	.215 ± .031	500Ω	500Ω	.020
EL½		.75W	1.0W	.094 ± .031	.280 ± .031	1K	1.5K	.020
EL1A	RW70	1.0W	1.25W	.094 ± .031	.406 ± .031	2K	6K	.020
EL1B		1.0W	1.50W	.094 ± .031	.530 ± .031	4K	9K	.020
EL1C		1.0W	2.0W	.135 ± .031	.335 ± .031	2K	4.4K	.025
EL2F		2.5W	3.0W	.188 ± .031	.500 ± .062	4K	12K	.032
EL2H		2.5W	3.0W	.188 ± .031	.385 ± .062	2K	5.7K	.032
EL2G		2.5W	3.0W	.188 ± .031	.430 ± .062	2K	8K	.032
EL2B		3.0W	3.5W	.188 ± .031	.625 ± .062	8K	16K	.032
EL2A		3.25W	4.5W	.188 ± .031	.825 ± .062	10K	28K	.032
EL2E	RW59	2.5W	3.5W	.195 ± .031	.500 ± .062	8K	15.4K	.032
EL2E	RW69	2.5W	3.5W	.195 ± .031	.500 ± .062	8K	15.4K	.032
EL2I	RW79	3.0W	3.5W	.195 ± .031	.560 ± .062	8K	19K	.032
EL2D		3.0W	4.0W	.250 ± .031	.500 ± .062	7.5K	19K	.032,.040
EL2C		3.0W	4.0W	.250 ± .031	.562 ± .062	8K	22K	.032,.040
EL2		3.5W	4.5W	.250 ± .031	.625 ± .062	12K	31K	.032,.040
EL3		3.5W	5.0W	.295 ± .031	.500 ± .062	8.3K	23K	.032,.040
EL5	RW74	5.0W	7.0W	.290 ± .062	.925 ± .093	22K	56K	.032,.040
EL7		6.0W	8.0W	.290 ± .062	1.200 ± .093	35K	90K	.032,.040
EL5A	RW57	5.0W	6.5W	.350 ± .062	1.000 ± .093	35K	90K	.040
EL5A	RW67	5.0W	6.5W	.350 ± .062	1.000 ± .093	35K	90K	.040
EL7A		7.0W	9.0W	.350 ± .062	1.360 ± .093	45K	100K	.040
EL10A	RW58	10W	11W	.350 ± .062	1.815 ± .093	75K	175K	.040
EL10A	RW68	10W	11W	.350 ± .062	1.815 ± .093	75K	175K	.040
EL12	RW56	12W	14W	.469 ± .062	2.00 ± .093	90K	235K	.040

ULTRA LOW OHM POWER RESISTORS



Tel Labs Style	LENGTH	DIAMETER	Lead L	Lead D	Resistance Measurement Points from body
TL01	.406 ± .015	.094 ± .015	1.5 Min.	.025 ± .002	.375 each side
TL03	.560 ± .015	.210 ± .015	1.5 Min.	.032 ± .002	.375 each side
TL05	.920 ± .015	.330 ± .015	1.5 Min.	.040 ± .002	.375 each side

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TYPE EH - Aluminum Housed
TYPE BL - Beryllium Oxide
TYPE PR - Subminiature Printed Circuit
TYPE Q81 - Special Temperature Compensation
TYPE Q239 – Special 4-Terminal Device

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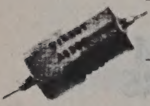
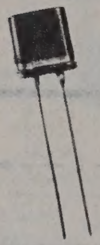
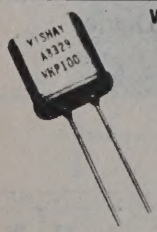




Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) Length x Diameter	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance
VHA412	5-100K 101K-250K	±0.001%	0.3W 0.2W	250	0.625 x 0.375 (15.88) x (9.53)	5ppm after 1 year and 10ppm after 3 years	0.002% 2000 hours 0.1W @60°C	Nominal[2] Standard Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
VHA414	5-200K 201K-500K	±0.001%	0.5W 0.3W	350	1.000 x 0.375 (25.4) x (9.53)			
VHA512*	5-300K 301K-750K	±0.001%	0.75W 0.4W	350	0.625 x 0.375 (15.88) x (9.53)			
VHA516-4*	5-400K 401K-1M	±0.001%	1.0W 0.5W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA516-5*	5-500K 501K-1.25M	±0.001%	1.25W 0.6W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA516-6*	5-600K 601K-1.5M	±0.001%	1.5W 0.7W	500	1.000 x 0.500 (25.4) x (12.7)			
VHA518-7*	5-700K 701K-1.75M	±0.001%	1.75W 0.8W	600	1.000 x 0.500 (25.4) x (12.7)			
VHA518-8*	5-800K 801K-2.0M	±0.001%	2.0W 0.9W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-9*	5-900K 901K-2.25M	±0.001%	2.25W 1.0W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-10*	5-1M >1M-2.5M	±0.001%	2.5W 1.1W	600	1.500 x 0.500 (38.1) x (12.7)			
VHA518-11*	5-1.1M >1M-3.3.M	±0.001%	2.5W 1.2W	600	1.500 x 0.500 (38.1) x (12.7)			
VHP202	5-100K 101K-250K	±0.001%	0.3W 0.2W	300	W x L x H (max) 0.195 x 0.445 x 0.430** (4.95) x (11.30) x (10.92) Lead Spacing 0.150 (3.81) nom. †			

Hermetically Sealed "0" TCR Resistor



Model Number	Resistance (Ohms)	Tolerance[1] @+25°C	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (2000h) (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance
VHP100	100-150K	To ±0.005%	.3W	.15W	300V	W 0.185 ±.020 (4.70 ±0.51) L 0.435 ±.020 (11.05 ±0.51) H 0.430**± .020 (10.92 ±0.51) Lead Spacing 0.150 (3.81) nom. †	5ppm after 1 year and 10ppm after 3 years	0.02% max R 0.3W @ 70°C and 0.02% maxΔR 0.15W @ 125°C	-55°C to +125°C < 1ppm/°C

* Number of chips is designated after dash i.e., VHA516-4 (4 chips). Also available in a four terminal lead. ** .375H (9.53mm) available on special order † 0.200 (5.08mm) lead spacing available

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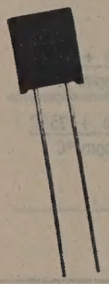
Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance
VHS555[4]*	1-250K	±0.005%	0.6W	0.3W	300	0.195 x 0.445 x 0.430 (4.95) x (11.30) x (10.92) Lead spacing 0.150 (3.81) Nom.	5ppm after 1 year and 10ppm after 3 years	0.0025% 2000 hrs. 0.1W @ 60°C	Nominal[2] / Standard Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
VHS102	1-250K	±0.005%	0.6W	0.3W	300	0.195 x 0.445 x 0.430** (4.95) x (11.30) x (10.92) Lead spacing 0.150 (3.81) Nom.†		0.015% 2000 hrs. 0.3W @ 125°C	
VHM-1	5-33K	±0.01%	0.2W	0.1W	45	Height x Diameter 0.210 x 0.230 (5.33) x (5.84) Standard TO-18 Case		0.01% 10,000 hrs. 0.05W @ 125°C	

Established Reliability Resistors — MIL Style RNC90Y (MIL-R-55182/9, Char. Y)



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance
RNC90Y[4]	4.99-100K	±0.005%	0.6W	0.3W	300	0.105 x 0.310 x 0.326 (2.67) x (7.87) x (8.28) Lead spacing 0.150 (3.81) Nom. *Dim. Tol. ±0.010 (0.25)	25ppm after 1 year and 50ppm after 3 years	0.015% 2000 hrs. 0.3W @ 125°C	Nominal[2] / Standard Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
S555	1-100K 101K-150K	±0.005%	0.6W	0.3W 0.2W	300	0.105 x 0.310 x 0.326 (2.67) x (7.87) x (8.28) Lead spacing 0.150 (3.80) Nom. Dim. Tol. ±0.010 (0.25)			

* Within the resistance range of 4.99 Ω to 100KΩ, this unit contains an RNC90Y inside the hermetically-sealed unit.

** .375H (9.53mm) available on special order

† .200 (5.08mm) lead spacing available

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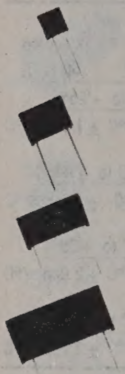
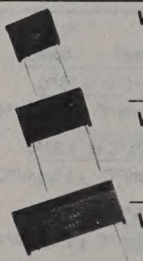


Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)	Temperature Coefficient of Resistance
S102C™[4]	1-100K 101K-250K	±0.005%	0.6W	0.3W 0.2W	300	0.105 x 0.302 x 0.326 (2.67) x (7.67) x (8.28) Dim. Tol. ±0.010 (0.25) Lead Spacing 0.150 (3.81) Nom.	25ppm after 1 year and 50ppm after 3 years	0.005% 2000 hrs. 0.1W @70°C	Nominal[2] / Standard Spread[2] 0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
S104D	1-200K 201K-500K	±0.005%	1.0W	0.5W 0.3W	350	0.160 x 0.575 x 0.530 max* (4.06) x (14.61) x (13.46) Lead Spacing 0.400 (10.16) Nom.		0.015% 2000 hrs. 0.3W @125°C	
S105D	1-300K 301K-750K	±0.005%	1.5W	0.75W 0.4W	350	0.160 x 0.820 x 0.530 max* (4.06) x (20.83) x (13.46) Lead Spacing 0.650 (16.51) Nom.		0.05% 10,000 hrs. 0.3W @125°C	
S106D	.5-400K 401K-1M	±0.005%	2.0W	1.0W 0.5W	500	0.260 x 1.190 x 0.530 max* (6.60) x (30.23) x (13.46) Lead Spacing 0.900 (22.86) Nom.			

Value Engineered and Standard Stock Precision Resistors



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. ΔR)[3]	Load-Life Stability (Max. ΔR)[3]	Temperature Coefficient of Resistance (Limits)
VSR4	1-200K 201K-500K	.005%	.5	0.4W 0.2W	350	0.160 x 0.575 x 0.530 max* (4.06) x (14.61) x (13.46) Lead Spacing 0.400 (10.16) Nom.	25ppm after 1 year	—	0°C to +60°C ±4ppm/°C -55°C to +125°C ±8ppm/°C
VSR5	1-300K 301K-750K	.005%	.75	0.6W 0.3W	350	0.160 x 0.820 x 0.530 max* (4.06) x (20.83) x (13.46) Lead Spacing 0.650 (16.51) Nom.			
VSR6	.5-400K 401K-1M	.005%	1.0	0.8W 0.4W	500	0.260 x 1.190 x 0.530 max* (6.60) x (30.23) x (13.46) Lead Spacing 0.900 (22.86) Nom.			

* .413H (10.49mm) available on request

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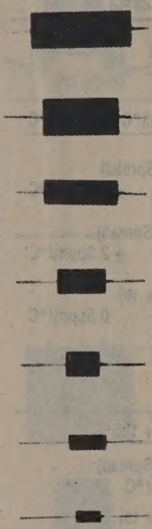
VISHAY RESISTIVE SYSTEMS GROUP

FIXED AXIAL LEAD RESISTORS

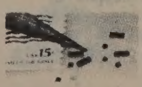
Value Engineered and Standard Stock Axial Lead Precision Resistors



Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 70°C	Power at 125°C	Max. Work. Voltage	Nominal Dimensions Inch (mm) L × D	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Temperature Coefficient of Resistance (Limits)
VTA52 (RBR52)	5-750K 25-750K	±.1 ±.01	1.0W	.5W	300	1.00 x 3.75 (25.4) x (9.53)	25ppm after 1 year	0.05% 2000 hrs. @ 125°C	0°C to +60°C ±4ppm/°C -55°C to +25°C ±8ppm/°C
VTA53 (RBR53)	5-500K 25-500K	±.1 ±.01	.66W	.33W	300	.750 x .375 (19.05) x (9.53)			
VTA54 (RBR54)	5-500K 25-500K	±.1 ±.01	.5W	.25W	300	.750 x .260 (19.05) x (6.60)			
(VTA55) (RBR55)	5-250K 25-250K	±.1 ±.01	.3W	.15W	300	.500 x .260 (12.70) x (6.60)			
VTA56 (RBR56)	5-250K 25-250K	±.1 ±.01	.25W	.125W	300	.356 x .260 (9.04) x (6.60)			
VMTA55 (RNC55)	5-30K 50-30K	±.1 ±.01	.2W	.1W	200	.270 x .120 (6.86) x (3.05)			
VMTA60 (RNC60)	5-30K 50-30K	±.1 ±.01	.25W	.125W	250	.375 x .125 (9.53) x (3.18)			
VMTB60 (RNC60)	5-60K 50-60K	±.1 ±.01	.25W	.125W	250	.375 x .160 (9.53) x (4.07)			
VSA100	5-250K 50-250K	±.1 ±.01	.6W	.3W	300	.305 (7.75) max T. .102 (3.60) max H. .250 (6.40) max			

CHIPS

Microchip (V5X5) and Minichip (V15X5) Resistors for Hybrid Microcircuits



Model Number	Resistance* (Ohms)	Trim Range	Tolerance[1] To	Power at 70°C	Max. Work. Voltage	Nominal Chip Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Nominal TCR[2]	Standard TCR Spread from Nominal[2]
V5X5	5-10K	0 To 1.2x the nominal prevalue	±0.02% or ±0.005%[5]	0.05W	40	0.050 x 0.050 x 0.020 (1.27) x (1.27) x (0.508)	0.005%/Yr. 0.0005%/Yr. Hermetically Packaged	0.05% 2000 Hrs. @70°C	0°C to +25°C: +0.6ppm/°C +25°C to +60°C: -0.6ppm/°C -55°C to +25°C: +2.2ppm/°C +25°C to +125°C: -1.8ppm/°C	±1.5ppm/°C ±1.5ppm/°C ±2.0ppm/°C ±2.0ppm/°C
V15X5	5-30K	0 To 1.3x the nominal prevalue	±0.02% or ±0.005%[5]	0.1W	40	0.150 x 0.050 x 0.020 (3.81) x (1.27) x (0.508)				

* Higher resistance ranges and larger size chips available

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VISHAY RESISTIVE SYSTEMS GROUP

UNITIZED RESISTOR NETWORKS AND VOLTAGE DIVIDERS

Model Number[9]	No. of Resistors	R. Value of Each Individual Resistor[10] (Ohms)	Tolerance Ratio Between Resistors at 25°C To	Maximum Dimensions (Excluding Leads) W x L x H x Inch (mm)	TCR Ratio Between Resistors (Tracking) (Ref. @ 25°C)
300190 300191	2	100-250K	.005%	0.160 x 0.575 x .413 (4.06) x (14.61) x (10.49)	0° to +60°C -55°C to +125°C (Standard Spread) ±1.5ppm/°C ±2.0ppm/°C (Maximum Spread) ±2.5ppm/°C ±2.3ppm/°C (Available to) 0.5ppm/°C 0.5ppm/°C
300192 300193 300194	3	100-250K	.005%	0.160 x 0.820 x .413 (4.06) x (20.83) x (10.49)	
300195 300196 300197 300198 300199	4	100-250K	.005%	0.260 x 1.190 x .413 (6.60) x (30.23) x (10.49)	
300210	3	100-250K	.005%	0.160 x 0.820 x .413 (4.06) x (20.83) x (10.49)	
300211 300212	4	100-250K	.005%	0.260 x 1.190 x .413 (6.60) x (30.23) x (10.49)	
300144	2	100-20K[11]	.005%	.105 x .302 x .320 (2.67) x (7.67) x (8.128)	−55°C to +125°C (Maximum Spread) 1.0ppm/°C (Available to) 0.1ppm/°C
300145	4	100-20K[11]	.005%	0.375 x 0.375 x 0.200 (9.525) x (9.525) x (5.080) Nom.	
VSR144	2	Any value from 100Ω-20KΩ with some derating of power	.005%	.105 x .302 x .320 (2.67) x (7.67) x (8.128)	To 3.0ppm/°C (absolute TCR to 5.0ppm/°C

Hermetically-Sealed Miniature Voltage Dividers

Model Number[9]	No. of Resistors	R. Value of Each Individual Resistor[10] (Ohms)	Tolerance Ratio Between Resistors at 25°C To	Maximum Dimensions (Excluding Leads) W x L x H x Inch (mm)	TCR Ratio Between Resistors (Tracking) (Ref. @ 25°C)
VHD200	1	100-20K	.005%	.195 x .445 x .430 (4.95) x (11.30) x (10.92)	To 0.1ppm/°C (absolute TCR to 0.6ppm/°C)
VHD144	2	Any value from 100Ω-20K Ω with some derating of power	.005%	.195 x .445 x .430 (4.95) x (11.30) x (10.92)	To 0.5ppm/°C (absolute TCR to 2.0ppm/°C)

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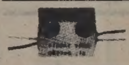
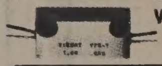
VISHAY RESISTIVE SYSTEMS GROUP

POWER RESISTORS AND PLATES

Precision Power Plate Resistors for Current Sensing and Power Surge Applications

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Max. Work. Voltage	Maximum Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max.ΔR)[3]	Standard TCR Spread from Nominal
VPR-5	1-100K	.01%	5W	300	.450 x .625 x .312 (11.43) x (15.88) x (7.93)	25ppm	Above 10 ohms ±5ppm/°C
VPR-7	1-100K	.01%	7W	300	.450 x 1.030 x .312 (11.43) x (26.16) x (7.93)		Below 10 ohms ±10ppm/°C

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C[6]	Nominal Plate Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max.ΔR)[3]	Load-Life Stability (Max.ΔR)[3]	Resistance Element Area Sq. In. (mm)	Nominal TCR[2]
V3PR-300589	10-5K	±0.005%[5]	3W in air; 10W on heat sink	1.000 x 1.000 x .025 (25.4) x (25.4) x (0.635)	25ppm after 1 year	0.03% 2000 hrs @ 125°C	100 (25.40) 0.98 (24.89) 0.658 (16.71) 11.20 (284.48)	±2ppm/°C
V3PR-300586 (2 R's)	0.25	±0.25%	25W*	1.600 x 1.700 x 0.025 (40.64) x (43.18) x (0.635)	25ppm after 1 year	0.03% 2000 hrs @ 125°C	100 (25.40) 0.98 (24.89) 0.658 (16.71) 11.20 (284.48)	±10ppm/°C
V3PR-300338	0.5	±0.25%	25W*					
V3PR-300571	1.0	±0.25%	20W*	1.750 x 1.20 x 0.025 (44.45) x (28.45) x (0.635)				
V3PR-300572	2.0	±0.25%	20W*	1.750 x 1.20 x 0.025 (44.45) x (28.45) x (0.635)				
V3PR-300610 (4 R's)[7]	2.0	±0.25	>100W*	4.000 x 5.000 x 0.025 (101.6) x (127.0) x (0.635)				

* Power is 10W/sq. in. when a heat sink, which keeps the foil temperature below 100°C, is used.

Hermetically Sealed Precision Power and Current Sensing Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C*	Max. Work. Voltage	Nominal Plate Dimensions Inch (mm) L x W x T	Load-Life Stability (Max.ΔR)[3]	Shelf-Life Stability (Max.ΔR)[3]	Nominal TCR[2]
VHP-3	1-400K	±0.01%	3W in air; 10 W on heat sink (3A max)	750	0.346 x 1.530 x 1.000 (8.79) x (38.86) x (25.4) (Standard TO-3 Case)	0.05% 2000 hrs @ 25°C	5ppm after 1 year	0°C to +25°C +0.6ppm/°C ±1.5ppm/°C +25°C to +60°C -0.6ppm/°C ±1.5ppm/°C -55°C to +25°C +2.2ppm/°C ±2.0ppm/°C +25°C to +125°C -1.8ppm/°C ±2.0ppm/°C
VHP-4**	1-400K							

* Below 5 ohms, TCR is ±15ppm/°C (-55°C to +125°C), ** 4 terminal model

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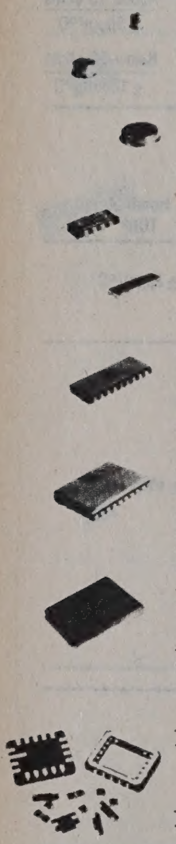
VISHAY RESISTIVE SYSTEMS GROUP

NETWORKS

Hermetically Sealed Miniature Precision Resistor Networks in DIP, TO and Other Packages



Model Number	Type Package	Max. No. of V5 x 5 Resistor	R Value of each Individual Resistor	Tolerance Ratio Between Resistors @25°C To	Maximum Dimensions (Excluding leads) Inch (mm) H x D - pin circle	TCR Ratio Between Resistors (Ref. @25°C)
1403	4 pin TO-18	5 1	10K or 30K	.005%	0.200 x 0.212 - 0.100 (5.08) x (5.38) - (2.54)	0° to +60°C -55°C to +125°C (Standard Spread) ±1.5ppm/°C +2.0ppm/°C (Maximum Spread) ±2.5ppm/°C ±2.3ppm/°C (Available To) 0.5ppm/°C 0.5ppm/°C
1413	8 pin TO-5	9	30K	.005%	0.200 x 0.370 - 0.200 (5.08) x (9.40) - (5.08)	
1417	8 pin TO-5	12	30K	.005%	0.200 x 0.362 - 0.230 (5.08) x (9.19) - (5.84)	
1419	10 pin TO-5	12	30K	.005%	0.200 x 0.362 - 0.230 (5.08) x (9.19) - (5.84)	
1421	12 pin TO-8	49	30K	.005%	0.200 x 0.602 - 0.400* (5.08) x (15.29) - (10.16)*	
1422	16 pin TO-8	49	30K	.005%	0.200 x 0.602 - 0.400* (5.08) x (15.29) - (10.16)*	
					H x L x W	
1442	8 pin DIP	12	30K	.005%	0.10 x 0.53 x 0.32 - 0.300 (2.55) x (13.47) x (8.16) - (7.62)	
1445	14 pin DIP	30	30K	.005%	0.100 x 0.778 x 0.296 - 0.300 (2.54) x (20.54) x (7.52) - (7.62)	
1446	16 pin DIP	36	30K	.005%	0.100 x 0.81 x 0.298 - 0.300 (2.54) x (20.57) x (7.57) - (7.62)	
1457	18 pin DIP	80	30K	.005%	0.150 x 1.007 x 0.5 - 0.300 (3.81) x (25.58) x (12.7) - (7.62)	
1460	20 pin 1" x 1" Plug-in	221	30K	.005%	0.220 x 1.01 x 0.90 - 0.900 (5.59) x (25.65) x (22.85) - (22.86)	
1476	30 pin 1" x 1" flat pack	225	30K	.005%	0.125 x 1.148 x 0.950 - 0.06** (3.17) x (29.16) x (24.13) - (1.52)**	
1485	16 pin leadless chip carrier	12†	10K	.005%		

* pin square ** axial lead pin spacing † 12 (5x5 chips) or 4 (15x5) chips

STANDARD AND CUSTOM RESISTANCE NETWORKS

Binary Networks and BCD Ladders

Besides designing completely custom precision networks to your most demanding specifications, Vishay offers standard binary R-2R ladder networks in 4-bit to 16-bit configurations (voltage-fed) with resistance values from 1 ohm to 50K Ω; 2R to 100K . Three basic package styles (nominal dimensions): **Profile 500,** 0.750" (19.05 mm) W x 0.500" (12.70 mm) H. **Profile 375,** 1.230" (31.24 mm) W x 0.365" (9.27 mm) H. Lengths dependent on number of bits: min. 0.700" (17.78 mm) for 4-bit Profile 500 to 2.14" (54.35 mm) for 16-bit ladder; min. 0.730" (18.54 mm) for Profile 375 to 2.59" (65.78 mm) for 15-bit package. **Profile 200,** 1.0" (25.4 mm) W x 1.0" (25.4 mm) L x 0.200" (5.08 mm) H only.

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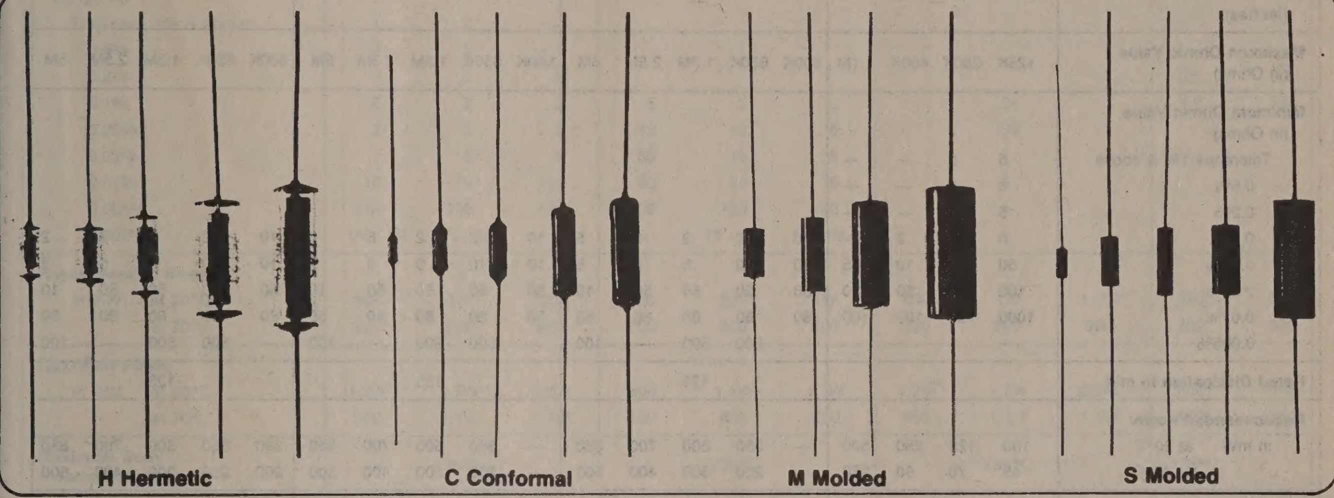
VISHAY-ANGSTROHM

precision metal film resistors to MIL-R-55182


H Hermetic
C Conformal
M Molded
S Molded

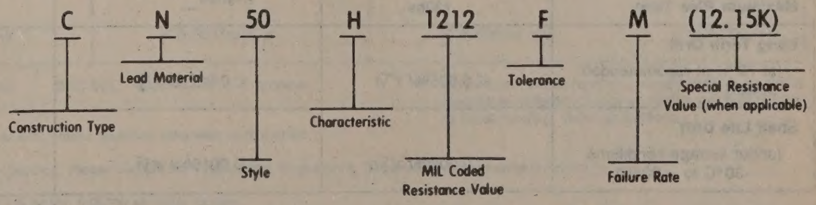
MIL-R-55182 APPROVED ITEMS

Mil Style	A° Part No.	Charac- teristic	Resistance Range	Tolerance	Failure Rate
RNR/RNC/RNN 50	CC/CC/CN 50	K	10 Ω - 100K	F, D	M, P, R
RNR/RNC/RNN 50	CC/CC/CN 50	H	49.9 Ω - 100K	F, D, B	M, P, R
RNR/RNC/RNN 50	CC/CC/CN 50	J	49.9 Ω - 100K	F, D, B	M, P, R
RNR/RNC/RNN 55	CC/CC/CN 55	K	10 Ω - 301K	F, D	M, P, R
RNR/RNC/RNN 55	CC/CC/CN 55	H	49.9 Ω - 200K	F, D, B	M, P, R
RNR/RNC/RNN 55	CC/CC/CN 55	J	49.9 Ω - 200K	F, D, B	M, P, R
RNR/RNN 55	HN/HN 55	C	49.9 Ω - 200K	F, D, B	M, P, R, S
RNR/RNN 55	HN/HN 55	E	49.9 Ω - 200K	F, D, B	M, P, R, S
RNR/RNN 57	HN/HN 57	C	49.9 Ω - 200K	F	M, P, R, S
RNR/RNN 57	HN/HN 57	E	49.9 Ω - 200K	F	M, P, R, S
RNR/RNC/RNN 60	MC/MC/MN 60	K	24.9 Ω - 499K	F, D	M, P
RNR/RNC/RNN 60	MC/MC/MN 60	H	49.9 Ω - 499K	F, D, B	M, P
RNR/RNC/RNN 60	MC/MC/MN 60	J	49.9 Ω - 499 K	F, D, B	M, P
RNR/RNN 60	HN/HN 60	C	49.9 Ω - 499K	F, D, B	M, P, R, S
RNR/RNN 60	HN/HN 60	E	49.9 Ω - 499K	F, D, B	M, P, R, S
RNR/RNN 65	HN/HN 65	K	49.9 Ω - 1M	F, D	M, P, R, S
RNR/RNN 65	HN/HN 65	H	49.9 Ω - 1M	F, D, B	M, P, R, S
RNR/RNN 65	HN/HN 65	J	49.9 Ω - 1M	F, D, B	M, P, R, S
RNR/RNN 65	HN/HN 65	C	49.9 Ω - 1M	F, D, B	M, P, R, S
RNR/RNN 65	HN/HN 65	E	49.9 Ω - 1M	F, D, B	M, P, R, S
RNR/RNN 70	HN/HN 70	K	49.9 Ω - 1M	F, D	M, P, R, S
RNR/RNN 70	HN/HN 70	H	49.9 Ω - 1M	F, D, B	M, P, R, S
RNR/RNN 70	HN/HN 70	J	49.9 Ω - 1M	F, D, B	M, P, R, S
RNR/RNN 70	HN/HN 70	C	49.9 Ω - 1M	F, D, B	M, P, R, S
RNR/RNN 70	HN/HN 70	E	49.9 Ω - 1M	F, D, B	M, P, R, S

NOTE: QPL 65 and 70 characteristics H, J, and K are available in hermetic construction only.

PART NUMBER INFORMATION

When ordering, specify military part number in accordance with MIL-R-55182 or MIL-R-10509 or Angstrohm part number as follows:


C
N
50
H
1212
F
M
(12.15K)
Lead Material
Tolerance
Special Resistance Value (when applicable)
Construction Type
Characteristic
Style
MIL Coded Resistance Value
Failure Rate

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VISHAY-MANN

PRECISION WIREWOUND RESISTORS

PART NUMBER:	MX				AX					PX					PC				
	100	125	250	500	125*	175*	250	350	400	125*	175*	250	350	400	125*	175*	250	350	400
Dimensions (inches) length	.236	.354	.374	.472	.378	.378	.591	.429	.654	—	.378	.591	.429	.654	.343	.378	.591	.429	.654
diameter	.118	.118	.185	.236	.25	.25	.25	.410	.410	—	.250	.250	.410	.410	.250	.250	.250	.410	.410
Terminations (inches) length	.984	.984	.984	.984	1.50	1.50	1.50	1.50	1.50	—	1.50	1.50	1.50	1.50	1.0	1.50	1.50	1.50	1.50
diameter	.020	.020	.020	.020	.020	.020	.020	.024	.024	—	.020	.020	.024	.024	.020	.020	.020	.024	.024
Lead spacing (inches)	—				—						0.15	0.15	0.3	0.3	0.2	0.2	0.2	0.4	0.4
Maximum Ohmic Value (in Ohms)	125K	250K	400K	1.1M	500K	650K	1.3M	2.5M	5M	500K	650K	1.3M	2.5M	5M	500K	650K	1.3M	2.5M	5M
Minimum Ohmic Value (in Ohms)																			
Tolerance 1% & above	5	5	—	—															
0.5%	5	5	—	—															
0.2%	5	5	—	—															
0.1%	5	5	2	—	10	2	2	5	5	10	2	2	5	5	10	2	2	2	2
0.05%	50	10	10	5	10	10	5	5	5	10	10	5	5	5	10	10	5	5	5
0.02%	100	50	50	50	50	50	50	50	10	50	50	50	50	10	50	50	50	50	10
0.01%	1000	100	100	100	80	80	80	80	50	80	80	80	80	50	80	80	80	80	50
0.005%						500	500	—	100	—	500	500	—	100	—	500	500	—	100
Rated Dissipation in mW	—				125					125					125				
Recommended Power in mW at 20°C	100	125	250	500	—	350	500	700	850	—	350	500	700	850	350	350	500	700	850
at 70°C	45	70	80	250	—	200	300	400	500	—	200	300	400	500	200	200	300	400	500
Maximum Power in mW at 20°C	180	250	350	650	—	800	1W	1	1.1W	—	800	1W	1W	1.1W	800	800	1W	1W	1.1W
at 70°C	100	150	200	350	—	450	550	600	650	—	450	550	600	650	450	450	550	600	650
Maximum Body Temperature	135°C				135°C					135°C					135°C				
Temperature Rise °C/W	600	400	300	200	140	140	120	110	100	140	140	120	110	100	140	140	120	110	100
Voltage Rating at 70°C	70	80	150	250	250	250	400	400	500	250	250	400	400	500	250	250	400	400	500
Temperature Coefficient																			
Standard	< 10ppm/°C				< 10ppm/°C					< 10ppm/°C					< 10ppm/°C				
Suffix B	< 5ppm/°C				< 5ppm/°C					< 5ppm/°C					< 5ppm/°C				
Suffix C	< 3ppm/°C				< 3ppm/°C					< 3ppm/°C					< 3ppm/°C				
Thermal EMF** (in Ohms)	above				above					above					above				
$<0.2\mu$V/°C	150	510	1.4K	2.2K	1.2K	1.2K	2.4K	8K	16K	1.2K	1.2K	2.4K	8K	16K	1.2K	1.2K	2.4K	8K	16K
$<0.4\mu$V/°C (optional)	not available				—	500 to 1.2K	1K to 2.4K	2.4K to 8K	4K to 16K	—	500 to 1.2K	1K to 2.4K	2.4K to 8K	4K to 16K	—	500 to 1.2K	1K to 2.4K	2.4K to 8K	4K to 16K
	below				below					below					below				
$<1.8\mu$V/°C	150	510	1.4K	2.2K	1.2K	500	1K	2.4K	4K	1.2K	500	1K	2.4K	4K	1.2K	500	1K	2.4K	4K
Inductance	—				For low Inductance specify suffix T					For low Inductance specify suffix T					For low Inductance specify suffix T				
Maximum Rise Time	130ns				—					—					—				
Long Term Drift (at 70°C at recommended power)	< 0.005%/ $\sqrt{\text{yr}}$.				< 0.002%/ $\sqrt{\text{yr}}$.					< 0.002%/ $\sqrt{\text{yr}}$.					< 0.002%/ $\sqrt{\text{yr}}$.				
Shelf Life Drift (under storage conditions -30°C to +60°C)	< 0.003%/ $\sqrt{\text{yr}}$.				< 0.0015%/ $\sqrt{\text{yr}}$.					< 0.0015%/ $\sqrt{\text{yr}}$.					< 0.0015%/ $\sqrt{\text{yr}}$.				

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VISHAY-MANN

PART NUMBER:	LT			UP			LR			ML	
	450	500	600	175	400	500	450	500	600	175	250
Dimensions (inches) **length**	.736	1.16	1.28	.630	.921	1.61	.736	1.16	1.28	—	
diameter	.543	.543	.823	.280	.441	.532	.543	.543	.823		
Terminations (inches) **length**	1.50	1.50	1.50	.984	.984	.984	1.50	1.50	1.50	—	
diameter	.039	.039	.039	.020	.024	.035	0.39	0.39	0.39		
Maximum Ohmic Value (in Ohms)	2.5M	5M	10M	650K	5M	6M	10	10	10	2	5
Minimum Ohmic Value (in Ohms)											
Tolerance 1% & above	1	1	—								
0.5%	2	2	1								
0.2%	2	2	2							0.1	0.1
0.1%	2	2	2	5	5	2		.01		1.0	1.0
0.05%	2	2	5	10	10	5		.05			
0.02%	5	5	5	50	10	5		.1			
0.01%	10	10	10	80	50	10		.5			
0.005%	100	100	100	500	100	100		—			
0.002%	1K - 1M	1K - 1M	—	—	1K - 1M	1K- 1M		—			
Recommended Power in mW at 20°C	800	1W	1.2W	350	850	1W	800	1W	1.2W	350	500
at 70°C	500	600	800	200	500	600	500	600	800	200	300
Maximum Power in mW at 20°C	1.2W	1.7W	2.2W	800	1.1W	1.1W	1.2W	1.7W	2.2W	800	1W
at 70°C	800	1.1W	1.4W	450	650	650	800	1.1W	1.4W	450	550
Maximum Body Temperature		135°C			135°C			135°C		135°C	
Temperature Rise °C/W	90	65	50	120	100	45	90	65	50	140	120
Voltage Rating at 70°C	750	1000	1500	250	500	1000		—		—	
Temperature Coefficient											
Standard		10ppm/°C			5ppm/°C			10ppm/°C		10ppm/°C	
Suffix B		5ppm/°C						5ppm/°C		5ppm/°C	
Suffix C		3ppm/°C			3ppm/°C			3ppm/°C			
Suffix D					2ppm/°C						
Suffix F					1ppm/°C						
Thermal EMF** (in Ohms)		above									
<0.2 µV/°C	16K	32K	64K		all ohmic values		—	—	—	—	—
<0.4 µV/°C	5K	10K	20K								
(optional)	to	to	to	—	—	—	—	—	—	—	—
	16K	32K	64K								
		below									
<1.8 µ V/°C	5K	10K	20K	—	—	—		all ohmic values		all ohmic values	
Inductance		For low Inductance specify suffix T			—		U	U	U	—	
Long Term Drift (at 70°C at recommended power)		<0.002%/√yr.			Note A <0.0015%/√yr.			<0.016%/√yr.		<0.01%/√yr.	
Shelf Life Drift (under storage conditions -30°C to +60°C)		<0.0015%/√yr.			Note A <0.001%/√yr.			<0.006%/√yr.		<0.002%/√yr.	

*AX125 AX175 PC125 PC175 BSC ECC 40301/00 J + K approval BSC ECC 40301/004 J + K approval

U These components have four section bobbins wound in opposition. Inductance may be further reduced by use of bifilar winding. Order as Suffix U.

**All resistors have Thermal EMF of 1.8µV/°C with respect to copper at 0°C unless specified otherwise in this chart.

Note A: For certain ohmic values, drift rates are considerably lower than specified. Please contact the Applications Engineering Department for complete information.

Other features available include tolerance matching to 0.01% on MX and LR series, 0.002% on other ranges.
Temperature Coefficient matching to 1ppm°C.
Inductance can be reduced by reversal of winding at half turns point. Order as Suffix T on types AX, PX, PC and LT.
Types AX125 and PC125 are type approved to BSC ECC 40 301-001 and -004 respectively.
All Dimensions in inches.

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CDE CORNELL-DUBILIER	X		X			X						
CORNING	X						X	X				
DALE		X	X	X	X		X	X	X		X	
Components ITT	X											
MALLORY	X		X									
Mepco/Electra A NORTH AMERICAN PHILIPS COMPANY	X						X	X			X	
muRata/ERIE	X		X				X			X	X	
nichicon	X											
Panasonic	X						X	X		X	X	X
RCL/shallcross								X				
ROHM							X	X				X
SFE TECHNOLOGIES	X				X							
SANGAMO	X											
Spectrol											X	
STACKPOLE							X	X			X	
Tansitor ELECTRONICS, INC.	X									X		
TECHNO							X				X	
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CARTER POTENTIOMETERS

RECTILINEAR / WIRE WOUND / CONDUCTIVE PLASTIC

Carter Manufacturing Corp. is an organization of engineers and craftsmen specializing in the unusual in potentiometers and switch engineering and their manufacture. Since our founding in 1955 we have developed full capability in wire wound and conductive plastic potentiometers. We welcome the opportunity to work with you for your unique requirements as well as standard commercial or mil types.

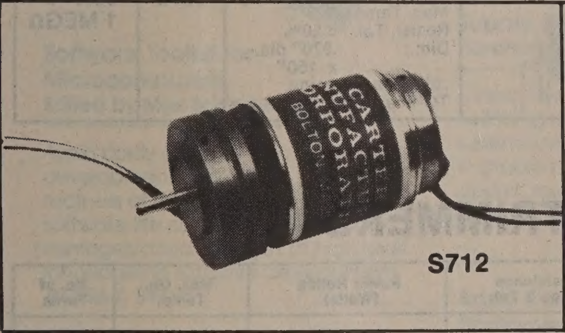
RECTILINEAR POTENTIOMETERS / WIRE OR CONDUCTIVE PLASTIC

ST476, ST510
MOUNTING—
THREADED BUSHING STD.
CLAMPS-SPECIAL
ST632
ST403

Carter manufactures many custom variations of rectilinear potentiometers. When requesting quotations please specify stroke, resistance, linearity, any taps, any switching, environmental requirements and quantity.
Wire wound and conductive plastic elements can also be furnished for special requirements.

Type	Size	Stroke	Res.Ω	Std.Lin.	C.P. Spl.Lin.	Elements	Watts 25 C
ST476	½" Dia.	To 8"	50K/" Max.	2% Stroke	.25% Stroke	1 or 2	1
ST510	¾" Dia.	To 12"	100K/" Max.	2% Stroke	.25% Stroke	1 or 2	1.5
ST403	1¼" x 1¼"	To 48"	150K/" Max.	2% Stroke	.25% Stroke	1 or 2	2
ST632	5/16" x ½"	To 4"	60K/" Max.	2% Stroke	.25% Stroke	1	.25
ST646	½" x ½"	To 6"	50K/" Max.	2% Stroke	.25% Stroke	1 or 2	1

TORQUER POTENTIOMETERS



These torquer-potentiometers are compact integral motorized potentiometers featuring conductive plastic resistance elements for long life and infinitesimal resolution. Their compact size make them an ideal choice for driving engine and flight instrument dials, meters, pointers plus many other applications.

TYPE S712

WITH SERVO MOUNT

TYPE S713

WITH TAPPED HOLE MOUNT

STANDARD SPECIFICATIONS

MOTOR (depending on motor selected)
Voltage: 6 to 24 VDC
Stall Torque: 0.33 to 1.5 oz-in
Back EMF: 1.0 to 2.0 V/10³ RPM
Torque Constant: 1.37 to 2.68 oz-in/A
Terminal Resist: 5.7 to 75 Ω
Armature Inertia: .09 to 0.5 oz-in-s² (10-4)

POTENTIOMETER
Resistances: 1K, 5K, & 10K Ω
Electrical Angle: 335°
Linearity: ±0.5% independent
Temp. Coefficient: ±300 PPM/°C
Power Dissipation: 0.25 watts @120°C
Resolution: Infinitesimal

TORQUER-POT
Mechanical Angle: 360° continuous
Starting Toque: 0.2 oz-in max
Shaft Radial Play: 0.003" max
Shaft End Play: 0.005 max
Shaft Runout: 0.003 max
Rotational Life: 10(10⁶) revs min
Load Life: 2000 hours
Temperature Range: −30°C to +100°C
Starting Voltage: 0.5 volts max
Weight: 1.8 oz max

Carter also manufactures a complete line of precision potentiometers which meet or exceeds the requirements of MIL-R-12934 (wire wound) and MIL-R-39023 (conductive plastic).

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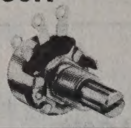
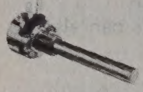
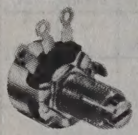
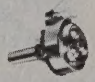
CTS® CORPORATION
BERNE DIVISION

INDUSTRIAL CERMET POTS & TRIMMERS

CTS Series	Description	Data Sheet	Resistance Range
550R 	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ dia. Bushing: ⅜″ FMS Shaft: ⅞″ FMS x .250″ dia., slotted	3550 E	50Ω- 1 MEGΩ
550S 	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim.: ¾″ Dia. Bushing: ⅜″ FMS Shaft: 2″ FMS x .250″ dia.	3550 E	50Ω- 1 MEGΩ
550LT 	Power: 2 @ 70°C Max. Temp: 175°C Resist. Tol: ±10% Dim: ¾″ Dia. Bushing: ½″ FMS, locking Shaft: ⅝″ FMS x .250″ dia., slotted	3550 E	50Ω- 1 MEGΩ
375E	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing Cent. Term: .400″	3375	50Ω- 1 MEGΩ
375V	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .350″ dia. x .150″ .172″ lead spacing Cent. Term: .156″	3375	50Ω- 1 MEGΩ
375S	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing	3375	50Ω- 1 MEGΩ
375T	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x 150″ .100″ lead spacing	3375	50Ω- 1 MEGΩ
375X	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ 100″ lead spacing TO-5 lead spacing	3375	50Ω- 1 MEGΩ
375Y	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing TO-5 lead spacing	3375	50Ω- 1 MEGΩ
375Z	Power: ½ @ 70°C Max. Temp: 125°C Resist. Tol: ±20% Dim.: .370″ dia. x .150″ .100″ lead spacing TO-5 lead spacing	3375	50Ω- 1 MEGΩ

INDUSTRIAL CARBON POTS & TRIMMERS

	CTS Series	Description	Resistance Range & Tol.	Power Rating (Watts)	Max. Op. Temp.	No. of Turns
	**VA-45** (Vernier Adjust)	1 5/16″ Panel Mount Shaft: ¼″ dia. x 1″ FMS. Slotted	100Ω- 1 Meg ±10%	½ to 10K ⅓ Above 10K to 100K ¼ Above 100K @ 55°C	85°C	10¼
	U201	1 9/32″ Knob. Dia. Snap-in self-supporting mounting, parallel to PC board	100Ω- 1 Meg ±20%	¼ to 5K @ 40°C ¼ 5K & Up @ 55°C	85°C 100°C	1
	X201	1 9/32″ Knob. Dia. Snap-in self-supporting mounting, perpendicular to PC board	100Ω- 1 Meg ±20%	¼ to 5K @ 40°C ¼ 5K & Up @ 55°C	85°C 100°C	1
	U260	10 mm (.394″) Dia. Mounts horizontally, knob parallel to PC board	500Ω- 1 Meg ±20%	.2 @ 55°C	100°C	1
	X260	10 mm (.394″) Dia. Mounts vertically, knob perpendicular to PC board	500Ω- 1 Meg ±20%	.2 @ 55°C	100°C	1

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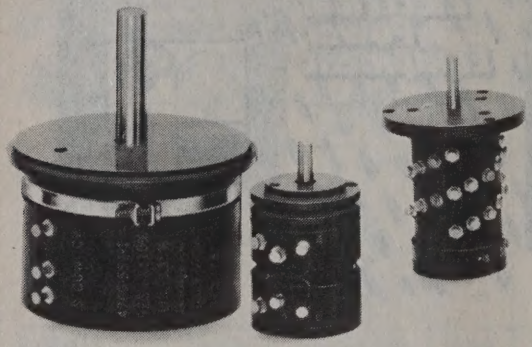


PRECISION POTENTIOMETERS

A COMPLETE SELECTION OF WIREWOUND, HYBRID, AND CONDUCTIVE PLASTIC UNITS, INCLUDING COMMERCIAL AND INDUSTRIAL MODELS AND SPECIAL CAPABILITIES.

COMPARISON OF RESISTIVE CHARACTERISTICS

PARAMETER	RESISTIVE TECHNOLOGY		
	Wirewound	Hybrid	Conductive Plastic
Resistance Range	Full Range	Limited Range	Full Range
Std. Resistance Tolerance	± 3%	± 5%	± 10%
Effective Travel Range	Up To 10-Turns	Up To 10-Turns	360° Maximum
Temp. Coefficient of Resistance	± 20 PPM/°C	± 70 PPM/°C	– 300 PPM/°C
Power Dissipation	High	High	Moderate
Resolution	Finite	Infinite	Infinite
Adjustability/Setability	Fair	Good	Excellent
Linearity/Conformity	Very Good	Good	Excellent
Contact Resistance	Low	High	Moderately High
Rotational Life (Rev.)	2 × 10⁸	10 × 10⁶	50 × 10⁶
Moisture Stability	Excellent	Good	Fair
Non-Linear Functions	Excellent	Good	Excellent
Rheostat Applications	Excellent	Poor	Fair
AC Circuit Applications	Poor	Fair	Excellent
Relative Cost	Low	Medium	High

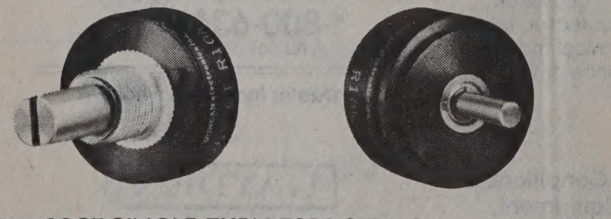
SINGLE TURN

Element Type/ Series No.	Dia.	Resistance Range (Ω)	Linearity (%) Standard	Best Practical	Max. Power @ 70°C (Watts)	Mounting Style
WIREWOUND						
1200	7/8"	15-75K	±0.5	±0.2	1.25	Servo/Bushing
(1230)[3]	7/8"	15-50K	±0.5	±0.25	1.25	(Bushing)
1300	1 1/16"	25-100K	±0.4	±0.15	2.0	Servo/Bushing
1500	1 7/16"	25-125K	±0.3	±0.12	3.0	Servo/Bushing
1600	1 3/4"	25-150K	±0.25	±0.09	4.0	Servo/Bushing
(1630)	1 3/4"	25-100K	±0.3	±0.15	4.0	(Bushing)
1700	2"	25-200K	±0.2	±0.08	5.0	Servo/Bushing
1800	3"	25-250K	±0.15	±0.05	7.0	Servo/Bushing
CONDUCTIVE						
1220	7/8"	400-75K	±0.5	±0.2	0.5	Servo/Bushing
1320	1 1/16"	500-100K	±0.4	±0.15	0.75	Servo/Bushing
1520	1 7/16"	500-125K	±0.3	±0.10	1.0	Servo/Bushing
1620	1 3/4"	500-150K	±0.25	±0.075	1.5	Servo/Bushing
1720	2"	600-200K	±0.2	±0.06	2.0	Servo/Bushing
1820	3"	750-300K	±0.15	±0.04	3.0	Servo/Bushing
HYBRID						
2200	7/8"	200-10K	±0.5	±0.25	1.25	Servo/Bushing
2230	7/8"	500-7K	±0.5	±0.3	1.25	(Bushing)
2300	1 1/16"	200-15K	±0.4	±0.2	2.0	Servo/Bushing
2500	1 7/16"	500-20K	±0.3	±0.15	3.0	Servo/Bushing
2600	1 3/4"	500-25K	±0.25	±0.12	4.0	Servo/Bushing
2630	1 3/4"	1K-17.5K	±0.5	±0.2	4.0	(Bushing)
2700	2"	500-30K	±0.2	±0.1	5.0	Servo/Bushing
2800	3"	750-50K	±0.15	±0.07	7.0	Servo/Bushing

MULTI-TURN

Element Type/ Series No.	Dia.	Resistance Range (Ω)	# of Turns	Linearity (%) Standard	Best Practical	Max. Power @ 70°C (Watts)	Mounting Style
WIREWOUND							
3200	7/8"	3-250K	3/5/10	±0.5/ 0.35/0.25	±0.1/ 0.07/0.05	1.5/2.0/2.5	Servo/Bushing
(3233)	7/8"	10-200K	10	±0.25	±0.1	2.5	Bushing
(3250/M3250)	7/8"	10-150K	3/5/10	±0.5/ 0.5/0.25	±0.3/ 0.2/0.1	1.0/1.5/2.0	Bushing
3500	1 7/16"	5-500K	3/5/10	±0.25/ 0.2/0.15	±0.5/ 0.04/0.03	3.0/4.0/5.0	Servo
3600		5-600K	3/10	±0.35/0.25	±0.1/0.05	5.0/7.0	Bushing
3700	2"	5-830K	3/10	±0.2/0.1	±0.04/0.02	5.0/7.0	Servo/Bushing
HYBRID							
4200	7/8"	500-100K	3/5/10	±0.5/ 0.35/0.25	±0.15/ 0.1/0.075	1.5/2.0/2.5	Servo/Bushing
(4250/M4250)	7/8"	500-100K	10	±0.25	±0.15	2.0	Bushing
4500	1 7/16"	500-200K	3/5/10	±0.25/ 0.2/0.15	±0.075/ 0.06/0.05	3.0/4.0/5.0	Servo
4600	1 3/4"	1K-250K	3/10	±0.35/0.25	±0.15/0.08	5.0/7.0	Bushing
4700	2"	1K-250K	3/10	±0.2/0.1	±0.06/0.03	5.0/7.0	Servo/Bushing

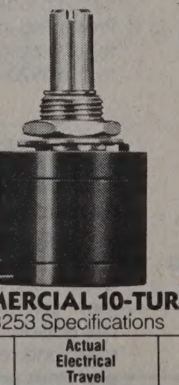
NOTES:
1. All Wirewound models are manufactured to meet or exceed applicable characteristics of MIL-R-12934.
2. All Conductive Plastic and Hybrid models are manufactured to meet or exceed applicable characteristics of MIL-R-39023.
3. Models in parenthesis ( ) are available through authorized Duncan Distributors.

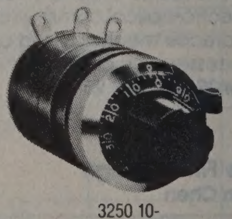


LOW-COST SINGLE-TURN 5250 SERIES

The 5250 Series conductive plastic potentiometers combine high reliability, low cost for commercial/industrial applications and instrumentation systems. Available in bushing and servo mount styles.

Model	Theoretical Electrical Travel	Normal Resistance Range (Ω)	Extended Resistance Range (Ω)	Resistance Tolerance	Linearity (%) Std. %	Best Practical %
5253 Bushing Mount	340°	1K to 50K	500 to 100K	±20 ±5	±2.0	±0.25
5251 Servo Mount	340°	1K to 50K	500 to 100K	±20 ±5	±1.0	±0.25





3250 10-turn/Model 62 Dial Combination

COMMERCIAL 10-TURN POTENTIOMETER

Model 3253 Specifications

Model	Actual Electrical Travel	Normal Resistance Range (Ω)	Extended Resistance Range (Ω)	Resistance Tolerance Standard %	Best Practical %
3253	3600° +10° –0°	100 to 100K	25 to 150K	±5	±2

For More Information. Circle No. 402

POSITION SENSING PRODUCTS

SLIDELINE® CONTROLS

FOR INSTRUMENTATION AND AUDIO BROADCAST APPLICATIONS

Duncan 400 Slideline® Potentiometers provide an ideal, human-factored solution for instrumentation and audio/broadcast controls, combining unusually accurate electrical characteristics with a wide variety of output options, fingertip controls, and faceplate alternatives to meet exacting customer applications requirements.

Infinite resolution, virtually noise-free operation and a reputation for failure-free performance (rated for 5 million traverses without degradation), is coupled with a 600Ω to 250KΩ resistance range (±20%; ±10% available) and linearities from ±2% to ±0.1%. Stroke is 2¾″ or 4¼″.

The 500 Series includes linear and audio taper slideline controls with an operating temperature range from 0° to 85°C.

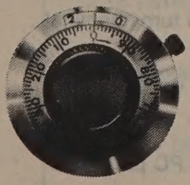
MINIATURE LINEAR MOTION POTENTIOMETERS

Designed for position sensing applications requiring miniature size and accuracy, the 9600 is a complete line of spring-loaded, linear-motion conductive plastic potentiometers.

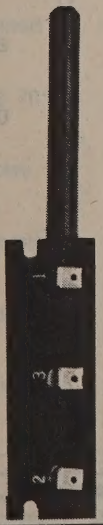
SPECIFICATION RANGES

Electrical Travel (inches)	0.50″, 1.00″ and 1.50″
Resistance Ω	1K to 75K per inch of stroke ±20%
Linearity	±2%
Best Practical Linearity up to	0.3%
Operating Life	5 x 10^5 actuation cycles min.
Operating Temperature	−50°F to 250°F
Power Rating	⅓ W per inch of stroke

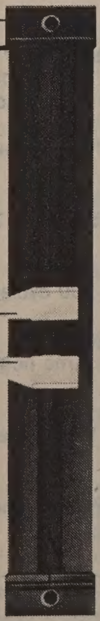
Model 62 Dial
15 Turn



Model 82 Dial
20 Turn



9600 Series



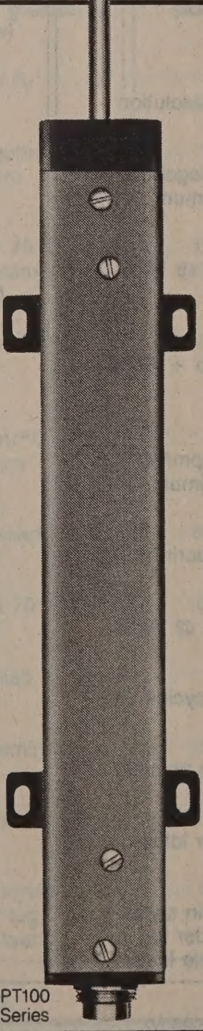
400 Series

RECTILINEAR PT 100 SERIES

POSITION SENSING IN AN EXTREMELY ACCURATE FEEDBACK CONTROL

The Duncan PT-100 Series provides a realistic method of analog signal transfer with a special attention to improvements in mechanical and electrical performance. As a result, applications such as industrial controls, robotics, process controls, production presses, drive systems, or replacement of a linear voltage differential transformer (LVDT) are ideal uses for this versatile, reliable model.

Model No.	Resistance (Ω) ±20%	Linearity (±% Standard)	Electrical Travel in inches (mm)
106	5.0K	0.25	6″ (150)
109	2.4K	0.18	9″ (225)
112	3.2K	0.15	12″ (300)
118	4.8K	0.12	18″ (450)
124	6.4K	0.11	24″ (600)
130	8.0K	0.10	30″ (750)
136	9.6K	0.09	36″ (900)

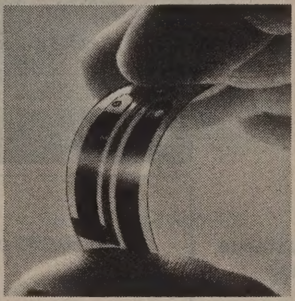


PT100 Series

RESISTIVE ELEMENTS

A STANDARD PRODUCT APPROACH TO LOW-COST POSITION SENSING

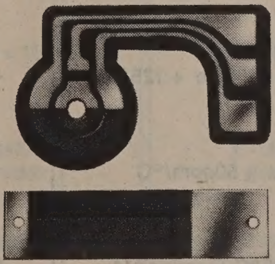
Series 98E Elements are currently operating in hundreds of different systems. You'll find them in everything from airborne applications and instrumentation, to consumer appliances and automotive electronics.



If you want to design your own element, we'll help you. Before your first production quantity is required, you will have the satisfaction of testing and approving a design in ample time to meet your planned requirements.

TYPICAL SPECIFICATION RANGES

Electrical Travel	up to 36″ (900mm)
Resistance Range (Ω per square)	50 to 20K ±20%/±10%
Linearity	to ±0.05%
Power Rating	3 watts/square



Although the 98E Element is priced right for use in commercial products or industrial controls, it meets high standards of reliability, anti-shock and low noise.

DUNCAN
ELECTRONICS
DIVISION

SYSTRON DONNER

A THORN EMI company
2865 Fairview Road, Costa Mesa, CA 92626
(714) 545-8261 TWX 910-595-1128

For More Information. Circle No. 402

BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® RECTANGULAR MULTITURN TRIMMERS

TRIMPOT® TRIMMING POTENTIOMETERS

3005P

3/4" long, 0.16" wide,
0.31" high
Industrial grade

3057

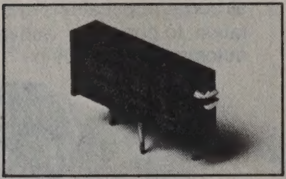
1-1/4" long, 0.19" wide,
0.315" high
Industrial & Military grade
(RT12, RTR12)

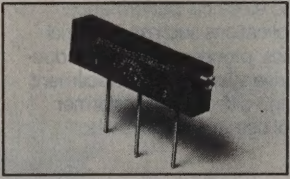
20

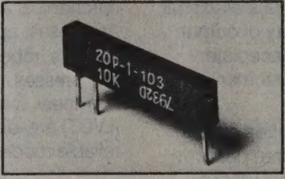
0.787" long, 0.080" wide,
0.185" high
Industrial grade
SIP type

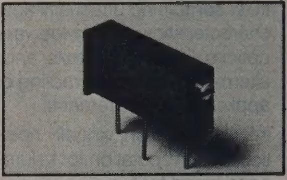
3006

3/4" long, 0.19" wide,
0.25" high
Industrial grade









	3005P	3057	20	3006
	Wirewound		Cermet	
Resistance Range	10 to 50,000 ohms	10 to 100,000 ohms	10 ohms to 5 megohms	10 ohms to 2 megohms
Resistance Tolerance*	±10% standard	±5% standard	±10% standard	±10% standard
Contact Resistance Variation	N/A	N/A	1.0% or 1 ohm (whichever is greater)	1.0% or 1 ohm (whichever is greater)
Adjustability	Within resolution	Within resolution	0.01% V.R.	0.01% V.R.
Insulation Resistance 500 VDC	100 megohms minimum	1000 megohms minimum	100 megohms minimum	100 megohms minimum
Power Rating	1.0 watt @ 40°C	1.0 watt @ 70°C	0.25 watt @ 70°C (250 volt maximum)	0.75 watt @ 70°C (400 volt maximum)
Temperature Range	−65°C to +125°C	−55°C to +150°C	−55°C to +125°C	−55°C to +125°C
Temperature Coefficient	±50ppm/°C maximum	±50ppm/°C maximum	±100ppm/°C maximum (50 ohms and up)	±100ppm/°C maximum
Seal	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**
Load Life (1000 hrs.)	1.0 watt @ 40°C	1.0 watt @ 70°C	0.25 watt @ 70°C	0.75 watt @ 70°C
Mechanical Life	200 cycles	200 cycles	200 cycles	200 cycles
Mechanical Adjustment	20 turns nominal	22 turns nominal	15 turns nominal	15 turns nominal
Mechanical Stops	Wiper idles	Wiper idles	Wiper idles	Wiper idles
Terminals	1 PC pin (shown)	2 PC pin styles 1 solder lug 1 flexible leads	1 PC pin (shown)	3 PC pin styles

*Closer tolerances available.
**Fluorinert is a registered trademark of 3M Company.

Specifications subject to change without notice.

For More Information. Circle No. 404

BOURNS INC
1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® RECTANGULAR MULTITURN TRIMMERS

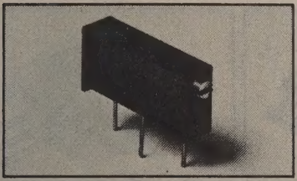
TRIMPOT® TRIMMING POTENTIOMETERS

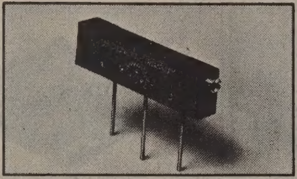
3009
3/4" long, 0.19" wide, 0.35" high
Industrial grade

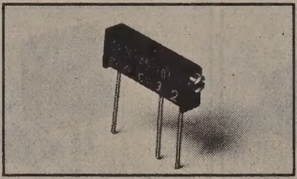
3059
1-1/4" long, 0.19" wide, 0.315" high
Industrial & Military grade
(RJ12, RJR12)

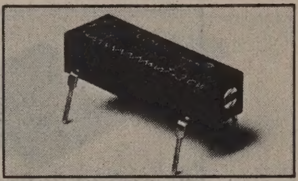
3082
1/2" long, 0.10" wide, 0.15" high
Industrial & Military grade
(RJR28)

3099
3/4" long, 0.25" wide, 0.19" high
Industrial & Military grade
(RJR32)
DIP style









Cermet

3009	3059	3082	3099
10 ohms to 2 megohms	10 ohms to 2 megohms	10 ohms to 2 megohms	10 ohms to 5 megohms
± 10% standard	± 10% standard	± 10% standard	± 10% standard
1.0% or 1 ohm (whichever is greater)	1.0% or 1 ohm (whichever is greater)	3.0% or 3 ohms (whichever is greater)	1.0% or 1 ohm (whichever is greater)
0.01% V.R.	0.01% V.R.	0.03% V.R.	0.01% V.R.
100 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
0.75 watt @ 70°C (400 volt maximum)	1.0 watt @ 70°C (400 volt maximum)	0.6 watt @ 25°C (400 volt maximum)	1.0 watt @ 70°C (400 volt maximum)
−55°C to +125°C	−55°C to +150°C	−65°C to +150°C	−55°C to +150°C
± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum
85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**
0.75 watt @ 70°C	1.0 watt @ 70°C	0.6 watt @ 25°C	1.0 watt @ 70°C
200 cycles	200 cycles	200 cycles	200 cycles
15 turns nominal	22 turns nominal	10 turns nominal	20 turns nominal
Wiper idles	Wiper idles	Wiper idles	Wiper idles
2 PC pin styles	2 PC pin styles 1 solder lug 1 flexible leads	1 PC pin (shown)	1 PC pin (shown)

*Closer tolerances available.
**Fluorinert is a registered trademark of 3M Company.

Specifications subject to change without notice.

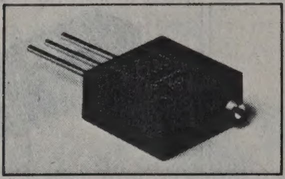
BOURNS INC
1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® SQUARE MULTITURN TRIMMERS

TRIMPOT® TRIMMING POTENTIOMETERS

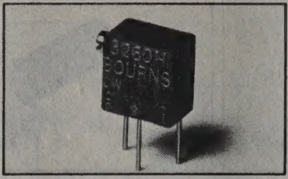
3250

1/2" square
0.23" thick maximum
Industrial & Military grade
(RT22, RTR22)



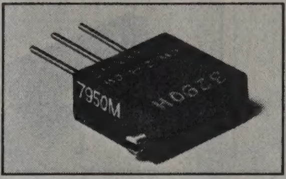
3260

1/4" square
0.185" thick maximum
Industrial & Military grade
(RT26)



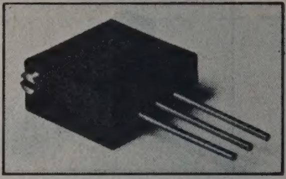
3290

3/8" square
0.16" thick maximum
Industrial & Military grade
(RT24, RTR24)



3252

1/2" square
0.23" thick maximum
Industrial & Military grade
(RJ22)



	Wirewound			Cermet
	3250	3260	3290	3252
Resistance Range	10 to 50,000 ohms	10 to 25,000 ohms	10 to 50,000 ohms	10 ohms to 2 megohms
Resistance Tolerance*	±5% standard	±5% standard	±5% standard	±10% standard
Contact Resistance Variation	N/A	N/A	N/A	2.0% or 2 ohms (whichever is greater)
Adjustability	Within resolution	Within resolution	Within resolution	0.01% V.R.
Insulation Resistance 500 VDC	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
Power Rating	1.0 watt @ 70°C	0.25 watt @ 85°C	1.0 watt @ 70°C	1.0 watt @ 70°C (400 volt maximum)
Temperature Range	−65°C to +150°C	−65°C to +150°C	−65°C to +150°C	−65°C to +150°C
Temperature Coefficient	±50ppm/°C maximum	±50ppm/°C maximum	±50ppm/°C maximum	±100ppm/°C maximum
Seal	85°C Fluorinert** (pin styles only)	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert** (pin styles only)
Load Life (1000 hrs.)	1.0 watt @ 70°C	0.25 watt @ 85°C	1.0 watt @ 70°C	1.0 watt @ 70°C
Mechanical Life	200 cycles	200 cycles	200 cycles	200 cycles
Mechanical Adjustment	25 turns nominal	11 turns nominal	25 turns nominal	22 turns nominal
Mechanical Stops	Wiper idles	Wiper idles	Wiper idles	Wiper idles
Terminals	3 PC pin styles 1 flexible leads	2 PC pin styles	3 PC pin styles	3 PC pin styles 1 flexible leads

*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

Specifications subject to change without notice.

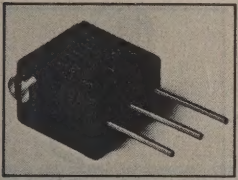
For More Information. Circle No. 404

BOURNS INC
1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

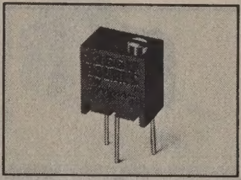
BOURNS® SQUARE MULTITURN TRIMMERS

TRIMPOT® TRIMMING POTENTIOMETERS

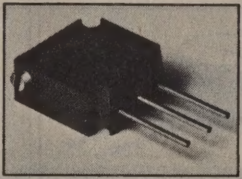
3262
1/4" square
0.185" thick maximum
Industrial & Military grade
(RJ26, RJR26)



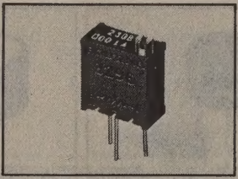
3266
1/4" square
0.185" thick maximum
Industrial grade



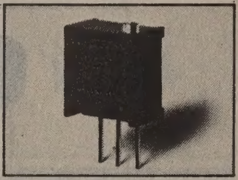
3292
3/8" square
0.16" thick maximum
Industrial & Military grade
(RJ24, RJR24)



3296
3/8" square
0.202" thick maximum
Industrial grade



3299
3/8" square
0.25" thick maximum
Industrial grade



3262	3266	3292	3296	3299
10 ohms to 1 megohm	10 to 500,000 ohms	10 ohms to 1 megohm	10 ohms to 5 megohms	10 ohms to 5 megohms
± 10% standard	± 10% standard (no optional tolerance)	± 10% standard	± 10% standard	± 10% standard
3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)
0.02% V.R.	0.02% V.R.	0.01% V.R.	0.01% V.R.	0.01% V.R.
1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
0.25 watt @ 85°C (300 volt maximum)	0.25 watt @ 85°C (300 volt maximum)	0.5 watt @ 85°C (400 volt maximum)	0.5 watt @ 70°C (300 volt maximum)	0.5 watt @ 70°C (300 volt maximum)
−65°C to +150°C	−55°C to +125°C	−65°C to +150°C	−55°C to +125°C	−55°C to +125°C
± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum
85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**
0.25 watt @ 85°C	0.25 watt @ 85°C	0.5 watt @ 85°C	0.5 watt @ 70°C	0.5 watt @ 70°C
200 cycles	200 cycles	200 cycles	200 cycles	200 cycles
12 turns nominal	12 turns nominal	22 turns nominal	25 turns nominal	25 turns nominal
Wiper idles	Wiper idles	Wiper idles	Wiper idles	Wiper idles
3 PC pin styles	2 PC pin styles	3 PC pin styles 1 flexible leads	5 PC pin styles	5 PC pin styles

*Closer tolerances available.
**Fluorinert is a registered trademark of 3M Company.

Specifications subject to change without notice.

For More Information. Circle No. 404

BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® SINGLE TURN TRIMMERS

TRIMPOT® and ꟼ® TRIMMING POTENTIOMETERS

3305

5/16" diameter
0.195" high maximum
(top adjustment)
Industrial grade

3345

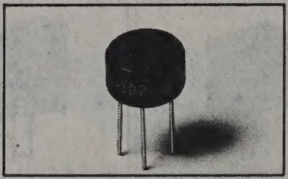
1/2" diameter
0.25" high maximum
(top adjustment)
Industrial grade

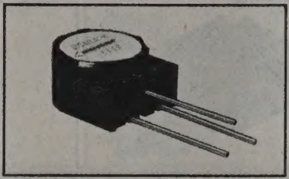
3323

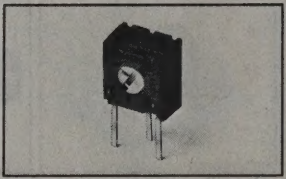
1/4" square
0.22" high maximum
(top adjustment)
Industrial grade

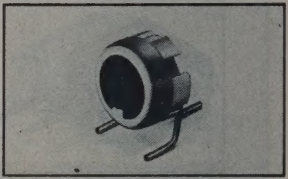
3325

1/4" diameter
0.23" high maximum
(top adjustment)
Surface Mounted Trimmer (SMT)
Industrial grade









	Wirewound		Cermet	
	3305	3345	3323	3325
Resistance Range	10 to 25,000 ohms	10 to 50,000 ohms	20 ohms to 2 megohms	10 ohms to 1 megohm
Resistance Tolerance*	±5% standard	±5% standard	±20% standard	±10% standard
Contact Resistance Variation	N/A	N/A	1.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)
Adjustability	Within resolution	Within resolution	0.05% V.R.	0.05% V.R.
Insulation Resistance 500 VDC	500 megohms minimum	1,000 megohms minimum	1,000 megohms minimum	1,000 megohms minimum
Power Rating	0.5 watt @ 70°C	1.0 watt @ 70°C	0.5 watt @ 70°C (300 volt maximum)	0.5 watt @ 85°C (300 volt maximum)
Temperature Range	−55°C to +125°C	−55°C to +150°C	−55°C to +125°C	−55°C to +150°C (operating) +215°C/3 minutes (processing)
Temperature Coefficient	±70ppm/°C maximum (200 ohms and up)	±50ppm/°C maximum (100 ohms and up)	±100ppm/°C maximum	±100ppm/°C maximum
Seal	Dustproof, splashproof ①	85°C Fluorinert**	85°C Fluorinert**	85°C Fluorinert**
Load Life (1000 hrs.)	0.5 watt @ 70°C	1.0 watt @ 70°C	0.5 watt @ 70°C	0.5 watt @ 85°C
Mechanical Life	200 cycles	200 cycles	200 cycles	200 cycles
Adjustment Angle	280° nominal	300° nominal	240° nominal	240° nominal
Mechanical Angle	300° nominal	310° nominal	275° nominal	260° nominal
Terminals	2 PC pin styles	2 PC pin styles 2 thumbwheel types	5 PC pin styles	1 top adjustment style 2 side adjustment styles

*Closer tolerances available.
**Fluorinert is a registered trademark of 3M Company.
① Performance not guaranteed after exposure to printed circuit board cleaning procedures.

Specifications subject to change without notice.

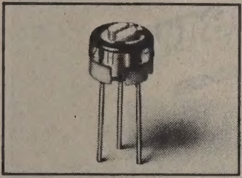
BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

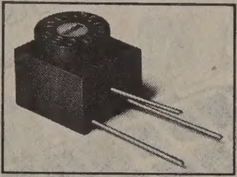
BOURNS® SINGLE TURN TRIMMERS

TRIMPOT® and ℬ® TRIMMING POTENTIOMETERS

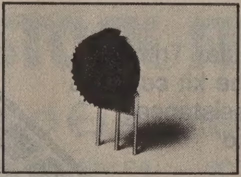
3329
1/4" diameter
0.25" high maximum
(top adjustment)
Industrial & Military grade
(RJ50, RJR50)



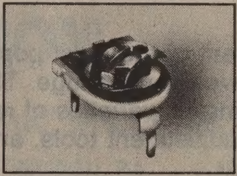
3339
5/16" diameter
0.26" high maximum
(top adjustment)
Industrial grade



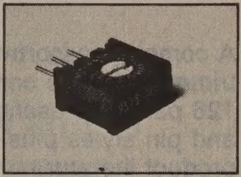
3352
3/8" diameter
0.39" high maximum
(side adjustment)
Industrial grade



3359
3/8" diameter
0.5" high maximum
(side adjustment)
Industrial grade



3386
3/8" square
0.2" thick maximum
Industrial grade



Cermet

10 ohms to 1 megohm	10 ohms to 1 megohm	10 ohms to 5 megohms	10 ohms to 2 megohms	10 ohms to 2 megohms
± 10% standard	± 10% standard	± 20% standard	± 20% standard	± 10% standard
3.0% or 3 ohms (whichever is greater)	3.0% or 3 ohms (whichever is greater)	1.0% or 1 ohm (whichever is greater)	2.0% or 3 ohms (whichever is greater)	1.0% or 1 ohm (whichever is greater)
0.05% V.R.	0.03% V.R.	0.1% V.R.	0.1% V.R.	0.05% V.R.
1,000 megohms minimum	1,000 megohms minimum	10 megohms minimum	N/A	1,000 megohms minimum
0.5 watt @ 85°C (300 volt maximum)	0.5 watt @ 85°C (300 volt maximum)	0.75 watt @ 40°C (250 volt maximum)	0.75 watt @ 40°C (250 volt maximum)	0.5 watt @ 85°C (300 volt maximum)
−55°C to +150°C	−55°C to +150°C	−55°C to +125°C	−65°C to +125°C	−55°C to +125°C
± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum	± 100ppm/°C maximum
85°C Fluorinert**	85°C Fluorinert**	No①	No①	85°C Fluorinert**
0.5 watt @ 85°C	0.5 watt @ 85°C	0.5 watt @ 85°C	0.5 watt @ 70°C	0.5 watt @ 85°C
200 cycles	200 cycles	200 cycles	500 cycles	200 cycles
240° nominal	4 turns nominal	205° nominal	230° nominal	280° nominal
260° nominal	Wiper idles	225° nominal	270° nominal	310° nominal
5 PC pin styles	3 PC pin styles	7 PC pin styles	2 PC pin styles	12 PC pin styles

*Closer tolerances available.

**Fluorinert is a registered trademark of 3M Company.

① Performance not guaranteed after exposure to printed circuit board cleaning procedures.

Specifications subject to change without notice.

For More Information. Circle No. 404

BOURNS INC
1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® TRIM BIN™ KIT

H-800

TRIM BIN
BOURNS

A complete assortment of the most popular Trimpot® trimmers in one convenient package. The kit contains 126 parts representing 50 varieties of resistances and pin styles plus adjustment tools, and product literature.

Single-turn and Multiturn trimmers with wirewound or cermet resistance elements in various configurations (rectangular, square or round) are all included in this kit.

Select the size, shape, type of element and method of adjustment to suit your applications.

PARTS LIST

	Resistance Code	-501	-102	-502	-103	-203	-503	-104
Model	**Description** **Resistance Value (ohms)**	**500**	**1,000**	**5,000**	**10,000**	**20,000**	**50,000**	**100,000**
20P-1	Multiturn, Cermet, SIP		2		4		2	
3005P-1	Multiturn, Wirewound			2	2			
3006P-1	Multiturn, Cermet		2		4		2	2
3266W-1					2			
3099P-1	Multiturn, Cermet, DIP		2		4			
3290W-1	Multiturn, Wirewound, Square		2	2				
3290P-1			2	2				
3296P-1	Multiturn, Cermet, Square				2			
3296W-1					4			
3296X-1					2			
3323P-1	Single-turn, Cermet, Square		2		4			2
3323W-1				2		2		
3323X-1					2		2	
3329H-1	Single-turn, Cermet		2		4		2	
3329W-1			2		4			
3339P-1	Four-turn, Cermet		2		4		2	
3345P-1	Single-turn, Wirewound			2				
3352P-1	Single-turn, Cermet		2		4		2	
3352W-1			2		4		2	
3352T-1		2			4		2	
3386P-1	Single-turn, Cermet		2		4		2	
3386W-1			2		4		2	
H-90	Adjustment Tool (1)							
H-91	Adjustment Tool (1)							
	Product Literature							

BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
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BOURNS® TRIMMERS · PANEL CONTROLS RESISTOR NETWORKS PRECISION POTENTIOMETERS IN STOCK FROM

Almo Electronics Corporation

PHILADELPHIA, PA
(215) 698-4000

PITTSBURGH, PA
(412) 931-5990

HAMDEN, CT
(203) 288-6556

NY, NJ, DE
(800) 523-3155

ROCKVILLE, MD
(301) 792-9197

CANTON, MA
(617) 821-1450

BOURNS® TRIMMERS · PANEL CONTROLS RESISTOR NETWORKS PRECISION POTENTIOMETERS IN STOCK FROM

IDEAL INDUSTRIAL ELECTRONIC SUPPLY, INC.

EL PASO, TX
(915) 779-6647

BOURNS® TRIMMERS · PANEL CONTROLS RESISTOR NETWORKS PRECISION POTENTIOMETERS IN STOCK FROM

RS ELECTRONICS

A Subsidiary of Chelsea Industries

LIVONIA, MI
(313) 525-1155

KALAMAZOO, MI
(616) 381-5470

ROSEVILLE, MI
(313) 779-2450

MAUMEE, OH
(419) 893-0721

GRAND RAPIDS, MI
(616) 241-3483

WYANDOTTE, MI
(313) AV2-5880

FLINT, MI
(313) 762-5800

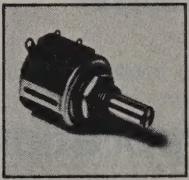
For More Information. Circle No. 404

BOURNS INC
1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

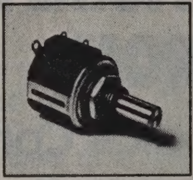
PRECISION CONTROLS DIVISION, 2533 North 1500 West, Ogden, UT 84404
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 • TEL (714) 781-5050

BOURNS® MULTITURN PRECISION POTENTIOMETERS

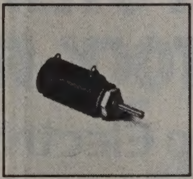
3543
3-Turn
Wirewound



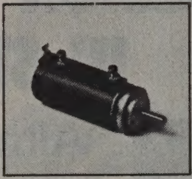
3545
5-Turn
Wirewound



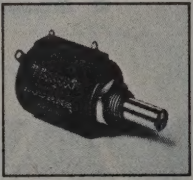
3700/3701
10-Turn
Wirewound/Hybrid



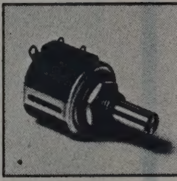
3750/3751
10-Turn
Wirewound/Hybrid



3500/3501
10-Turn
Wirewound/Hybrid

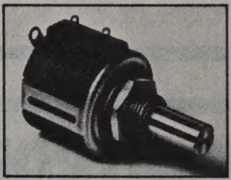


3540
10-Turn
Wirewound

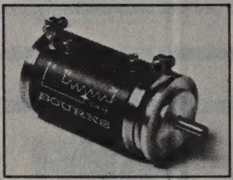


	3543	3545	3700/3701	3750/3751	3500/3501	3540
Resistance	20 to 50k ohms	50 to 50k ohms	**3700** 100 to 100k ohms **3701** 1k to 100k ohms	**3750** 100 to 100k ohms **3751** 1k to 100k ohms	**3500** 50 to 200k ohms **3501** 1k to 100k ohms	100 to 100k ohms
Power Rating @ 70°C	1.0 watt	1.5 watts	1.0 watt	1.0 watt	2.0 watts	2.0 watts
Independent Linearity	±0.25%	±0.25%	±0.25%	±0.25%	±0.2%	±0.25%
Rotational Life	0.3×10^6 revolutions	0.5×10^6 revolutions	**3700** 1×10^6 revolutions **3701** 4×10^6 revolutions	**3750** 1×10^6 revolutions **3751** 4×10^6 revolutions	**3500** 2×10^6 revolutions **3501** 4×10^6 revolutions	1×10^6 revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 3/4"	1/2" diameter x 1"	1/2" diameter x 1"	7/8" diameter x 1"	7/8" diameter x 3/4"

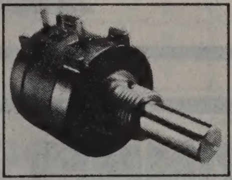
3541
10-Turn
Hybrid



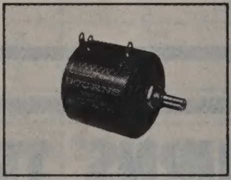
3550/3551
10-Turn
Wirewound/Hybrid



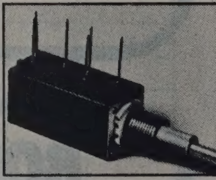
3590
10-Turn
Wirewound



3400
10-Turn
Wirewound



83/84
10-Turn
Wirewound/Hybrid



	3541	3550/3551	3590	3400	83/84
Resistance	1k to 100k ohms	**3550** 100 to 200k ohms **3551** 1k to 100k ohms	200 to 100k ohms	100 to 500k ohms	**Wirewound** 200 to 100k ohms **Hybrid** 1k to 100k ohms
Power Rating @ 70°C	2.0 watts	2.5 watts	2.0 watts @ 40°C 0 watts @ 125°C	5.0 watts @ 40°C	1.0 watt
Independent Linearity	±0.25%	±0.2%	±0.25%	±0.15%	±0.25%
Rotational Life	4×10^6 revolutions	**3550** 2×10^6 revolutions **3551** 4×10^6 revolutions	1×10^6 revolutions	2×10^6 revolutions	**Wirewound** 1×10^6 revolutions **Hybrid** 4×10^6 revolutions
Size	7/8" diameter x 3/4"	7/8" diameter x 1-9/16"	7/8" diameter x 3/4"	1-13/16" diameter x 1-3/4"	5/8" square x 3/4"

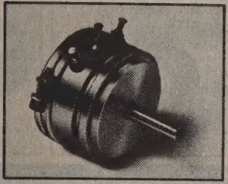
Specifications subject to change without notice.

For More Information. Circle No. 404

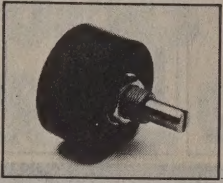
1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® SINGLE-TURN PRECISION POTENTIOMETERS

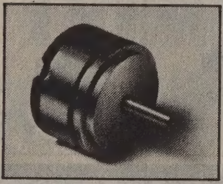
6534/6634
Conductive Plastic
Servo Mount/
Bushing Mount



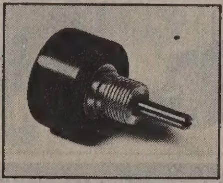
6637/6638
Conductive Plastic
Bushing Mount



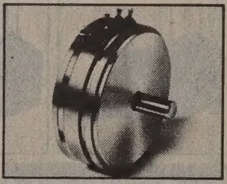
6538
Conductive Plastic
Servo Mount



6657
Conductive Plastic
Bushing Mount



6574/6674
Conductive Plastic
Servo Mount/
Bushing Mount

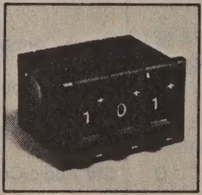


	6534/6634	6637/6638	6538	6657	6574/6674
Resistance	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms
Power Rating @ 70°C	1.0 watt	1.0 watt	1.0 watt	1.5 watts	2.0 watts
Independent Linearity	±0.5%	±1.0%	±1.0%	±1.0%	±.25%
Rotational Life	25x10^{6} revolutions	10x10^{6} revolutions	20x10^{6} revolutions	10x10^{6} revolutions	25x10^{6} revolutions
Size	7/8" diameter x 15/32"	7/8" diameter x 7/16"	7/8" diameter x 15/32"	1-5/16" diameter x 5/8"	2" diameter x 3/5"

BOURNS® DIALS, KNOBPOTS®, AND PUSH-BUTTON POTENTIOMETERS

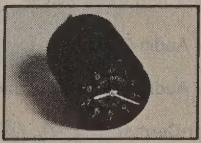
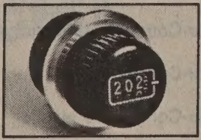
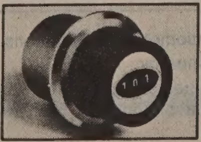
PUSH-BUTTON POTENTIOMETERS

3680 Series
Cermet



Decades	Model	Resistance	Resolution
1	3681	10 to 100k ohms	10%
2	3682	100 to 100k ohms	1.0%
3	3683	1k to 1 megohm	0.1%
4	3684	10k to 1 megohm	0.01%
5	3685	100k to 1 megohm	0.001%

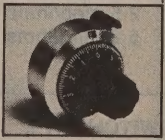
KNOBPOTS®

	Resistance	Power Rating	Diameter
3600 Wirewound 	100 to 100k ohms	1.5 watts @ 25°C	3/4"
3610 Wirewound 	100 to 100k ohms	1.5 watts @ 25°C	7/8"
3640 Wirewound	100 to 250k ohms	2.5 watts @ 25°C	1-1/4"
3650 Wirewound 	100 to 250k ohms	2.5 watts @ 25°C	1-1/4"

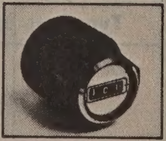
DIALS

H-507-6
7/8" diameter

H-490
1" diameter



CT23
1-1/16" diameter

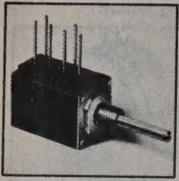
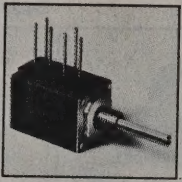
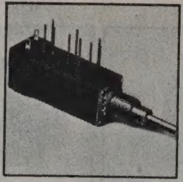
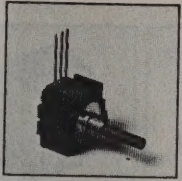
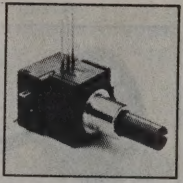
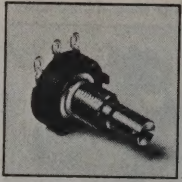
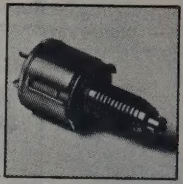


CT26
1-1/4" diameter

For More Information. Circle No. 404

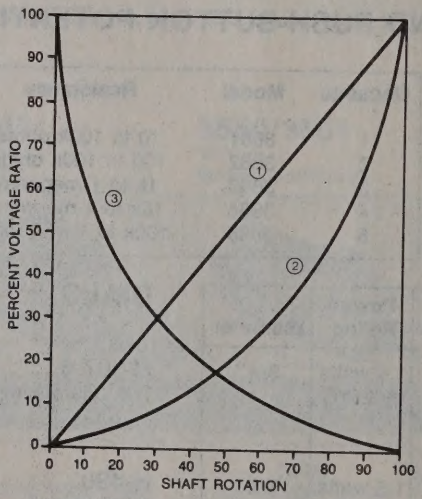
BOURNS INC
1200 Columbia Avenue, Riverside, CA 92507
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® PANEL CONTROL POTENTIOMETERS

81/82	87/88	85/86*	91/92/93/ 94/95	97/98/99	3851/3852	3862
•5/8" square •Modular construction •Single or multiple sections •Linear or audio tapers •Concentric or single shafts •Cermet •Conductive plastic	•5/8" square •Modular construction •Single or multiple sections •Semi-precision linear tapers •Concentric or single shafts •Cermet •Conductive plastic	•5/8" square •Modular construction •Multiple sections •DPST and DPDT rotary switches* •Concentric or single shafts •Cermet •Conductive plastic	•5/8" square •Modular construction •Single or dual sections •Linear or audio tapers •Single plastic shaft •Cermet •Conductive plastic	•5/8" square •Modular construction •DPST and DPDT rotary switches •Single shaft •Cermet •Conductive plastic	•3/4" diameter •1/4" depth •Single section •Linear or audio tapers •Single shaft •Cermet •Conductive plastic	•1/2" diameter •Rear terminals •Single section •Linear taper •1/8" diameter single shaft •Cermet

Resistance Range
50
100
250
500
1k
2.5k
5k
10k
25k
50k
100k
250k
500k
1 megohm
2.5 megohms
5.0 megohms



Audio tapers available from 1k to 2.5 megohms only.

Taper Code	Description	Linearity	Tol.	Fig. Ref.
A	Linear-Cermet	±5% Ind.	±10%	1
B	Linear-Conductive plastic	±5% Ind.	±20%	1
C	CW Audio-Cermet	N/A	±10%	2
D	CW Audio-Conductive plastic	N/A	±20%	2
E	Linear-Conductive plastic	±5% Ind.	±10%	1
F	CCW Audio-Cermet	N/A	±10%	3
G	CCW Audio-Conductive plastic	N/A	±20%	3
H	Linear-Cermet	±5% Ind.	±5%	1
L	Linear-Conductive plastic	±2% Z.B.Ⓐ	±5%	1
M	Linear-Cermet	±2.5% Z.B.Ⓐ	±3%	1
N	Linear-Conductive plastic	±1% Z.B.Ⓐ	±5%	1
P	Linear-Cermet	±1.5% Z.B.Ⓐ	±3%	1
S	CW Audio-Conductive plastic	N/A	±10%	2
T	CCW Audio-Conductive plastic	N/A	±10%	3

SWITCH TYPE

Type	Detent	Contacts
DPST	CW	Open/Closed Open/Open Closed/ Closed
	CCW	Open/Closed Open/Open Closed/Closed
DPDT	CW	Open/Closed
	CCW	Open/Closed

*Switch/potentiometer combinations only.

Ⓐ Zero base linearity.

Resistance values and tapers vary from model to model. See individual model specifications in the PCD catalog.

For More Information. Circle No. 404

BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
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For More Information. Circle No. 404

BOURNS INC

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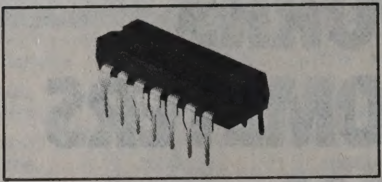
TWX 910-332-1252, CBL BOURNSINC, TLX 676-423 TEL. 714-781-5050

BOURNS® ATTENUATORS

Bourns offers an extensive line of fixed, variable and switchable attenuators. All Bourns attenuators are available in both standard and custom configurations. Our Engineering Departments can custom design special attenuators for your special applications.

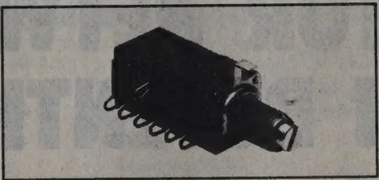
Fixed Attenuators

Models
4114R-033-001
O-Pad Configurations



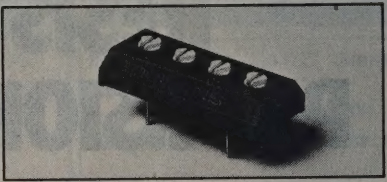
Variable Attenuator

Models 81/82, 91/92
Straight T-Pad



Switchable Attenuators

Model
3100
T and O-Pad Configurations



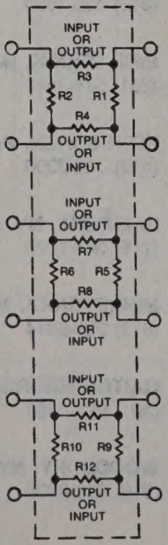
NETWORKS DIVISION

Pre-assembled 14 pin DIPs contain balanced or unbalanced attenuator pads. Available in 1/2 dB steps to 36 dB

Features include temperature coefficient of ±100ppm/°C operating temperature −55°C to +125°C

Attenuation tolerance (dB) of ±1%

Flat response through 1MHz


INPUT OR OUTPUT
R3
R2
R1
R4
OUTPUT OR INPUT
INPUT OR OUTPUT
R7
R6
R5
R8
OUTPUT OR INPUT
INPUT OR OUTPUT
R11
R10
R9
R12
OUTPUT OR INPUT

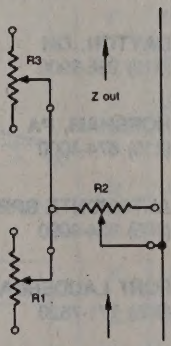
O-Pad

PRECISION CONTROLS DIVISION

Thick film cermet elements achieve infinite resolutions and setting stability

Straight T is available with 10% to 20% impedance tolerances

Minimum attenuation loss 0.2 dB all models with flat response through complete audio range


R3
Z out
R2
R1
Z in

Straight T-Pad

TRIMPOT DIVISION

Bourns Model 3100 switchable attenuators incorporate both switching and attenuator network functions in a single integrated package resulting in reduced component count, assembly costs and PC board space

Sealed to avoid switch contamination and PCB cleaning procedures

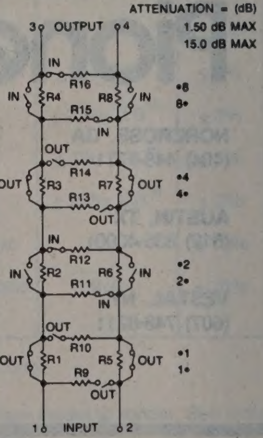
Precious metal switch contacts assure low insertion loss and long term operating stability

Impedance: 600 ohms ±2% (balanced or unbalanced)
75 ohms ±5% (unbalanced)

Standard attenuation ranges:
0-1.5, 0-15, and 0-24 dB

Binary Weighted Switching, 0.1 dB minimum step

Consult factory for details or additional values.


ATTENUATION = (dB)
1.50 dB MAX
15.0 dB MAX
3
OUTPUT
4
IN
R16
IN
R4
R8
IN
R15
IN
•8
8•
OUT
R14
OUT
R3
R7
OUT
R13
OUT
•4
4•
IN
R12
IN
R2
R6
IN
R11
IN
•2
2•
OUT
R10
OUT
R1
R5
OUT
R9
OUT
•1
1•
1
INPUT
2

O-Pad

Specifications subject to change without notice.

BOURNS INC

1200 Columbia Avenue, Riverside, CA 92507
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RESISTOR NETWORKS
PRECISION POTENTIOMETERS
IN STOCK FROM

SPIRIT of the WEST

ACACIA SALES
A California Corporation

LAKEWOOD, CO
(303) 232-2882

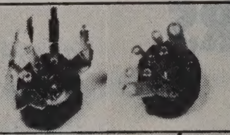
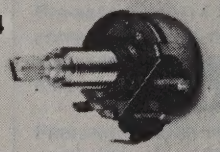
For More Information. Circle No. 404

MURA®

CORPORATION

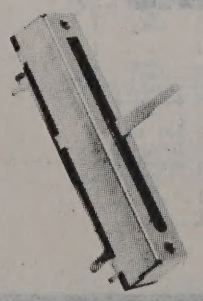
177 CANTIAGUE ROCK ROAD, WESTBURY, N.Y. 11590 / (516) 935-3640 Telex: 967 879

ROTARY
SLIDE
TRIMMING
CARBON COMPOSITION

SERIES	DIAMETER IN/MM	RESISTANCE RANGE (KΩ)(+/−20%)	POWER RATING (WATTS)	SHAFT TYPE	SWITCH TYPE	SWITCH RATING	TERMINAL TYPE P-PCB, S-SOLDER	ANGLE OF ROTATION (+/−10%)
12 	½/12	.5-500	0.1	N/A	ROTARY SPST	12VDC/1A	P/S	230°
16	⅝/16	.5-1000	0.1	N/A	ROTARY SPST	12VDC/1A	P/S	260°
17	43⁄64/17	.5-1000	0.1	S,R,F,H,E	ROTARY SPST	12VDC/1A	P/S	260°
18	21⁄32/16.8	.5-1000 AVAILABLE WITH DUAL ELEMENT	0.2	S,F,R,M,H	ROTARY SPST SPST	12VDC/1A 125 VAC/1A	P/S	300°
24 	15⁄16/24	.1-3000 AVAILABLE WITH DUAL ELEMENT AND DUAL ELEMENT WITH SWITCH.	0.5	S,F,R,M,H	ROTARY SPST SPST SPDT DPST DPDT PUSH-PULL	125VAC/1A 125VAC/3A 125VAC/1A 125VAC/3A 125VAC/1A 250VAC/3A	P/S	300°

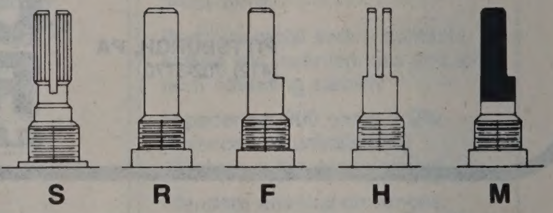
ROTARY POTS:
DETENTS–SERIES 18 AND 24
CENTER,11, 41

SLIDE POTS:
CENTER DETENT-10, 15, 30, 45
11 DETENTS-60

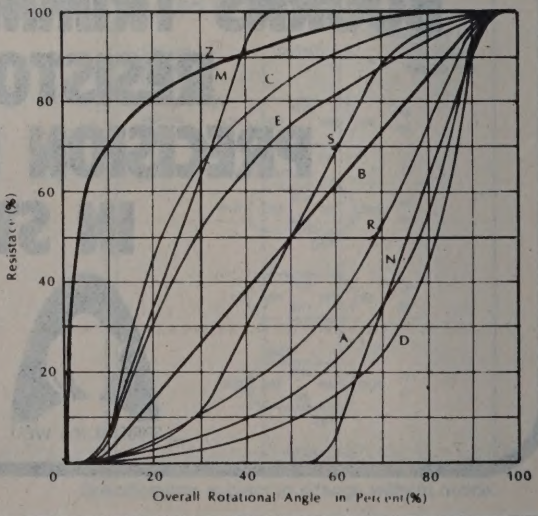
SLIDE POTS	TRAVEL (MM)	TERMINAL TYPE P-PCB, S-SOLDER	DUAL AVAIL.
SV10	10	P	YES
SV15	15	S	YES
SV20	20	S	YES
SV30 	30	P S	YES YES
SV45	45	P S	YES YES
SV60	60	P S	NO

RESISTANCE RANGE: 500Ω-2MΩ

SHAFT TYPES



RESISTENCE TAPERS

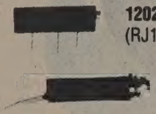
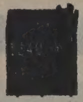
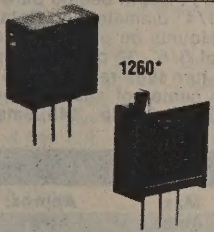


For More Information Circle No. 405

VISHAY RESISTIVE SYSTEMS GROUP

TRIMMERS

Precision Trimming Potentiometers

	Model Number	Resistance (Ohms)	Tolerance	Power	No. of Adj. Turns	Nominal Dimensions (Excluding Leads) H x L x W Inch (mm) and Termination Styles	Load-Life Stability (Max.△R)[2]	TCR (End-to-End)[3]
	**1202*** (RJ12 Style)	2, 5, 10 20, 50, 100, 200, 500, 1K 2K, 5K, 10K, 20K	±10%, ±20%, ±5%, ±10%	0.5W @ 85°C	25 ±2	0.35 x 1.250 x 0.195 (8.255) x (31.750) x (4.953) Type P: In-line pins Type Y: Staggered pins Type L: Flexible leads Type LB: Panel-mount with flexible leads	1% 2,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
 	**1240*** (RJR26 Sty'	5, 10 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K,	±10% ±5%	0.25W @ 85°C	21 ±2	0.250 x 0.250 x 0.175 (6.350) x (6.350) x (4.445) Type X: Edge-mount, side-adjust Type W: Edge-mount, top-adjust	1% 10,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
	1242 (RJ26)	50, 100, 200, 500, 1K, 2K 5K	±10%	25W @ 85°C	21 ±2	0.175 x 0.250 x 0.250 (4.445) x (6.350) x (6.350) Type P: Flat-mount, side adjust	2% 1,000 hrs. @ 85°C	
	**1260***	5, 10 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K	±10 ±5	.25W @ 85°C	21 ±2	0.420 x 0.375 x 0.170 (10.67) x (9.52) x (4.32) Type W: Edge-mount, top-adjust Type X: Edge-mount, side adjust	1.0% 10,000 hrs. @ 85°C	-55°C to +25°C +10ppm/°C +25°C to +150°C -10ppm/°C
	1280*	10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10%	0.75W @ 25°C	26 ±2	0.270 x 0.750 x 0.190 (6.86) x (19.05) x (4.83) (Panel mount available)	0.5% 2,000 hrs. @ 25°C	-55°C to +25°C +15ppm/°C +25°C to +125°C -15ppm/°C
	1285*	10 20, 50 100, 200, 500 1K, 2K, 5K, 10K, 20K	±10% ±5%	0.75W @ 25°C	26 ±2	0.270 x 0.750 x 0.190 (8.86) x (19.06) x (4.83) (Panel mount available)		–55°C to +25°C +5ppm/°C +25°C to +125°C –5ppm/°C

* Screening for low noise (CRV) is available.

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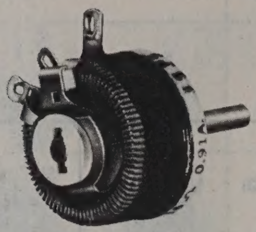
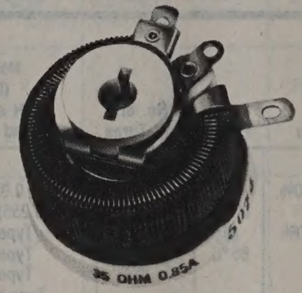
VISHAY-ANGSTROHM

Vitreous Enameled Power Rheostats

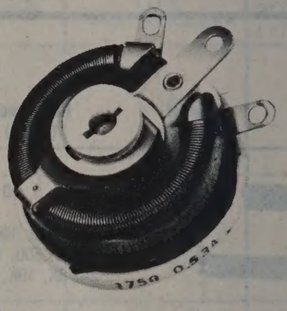
TYPE MP06 12.5 WATT



TYPE MP10 25 WATT

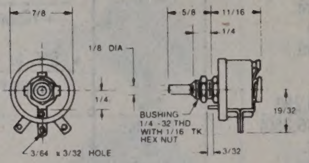


TYPE MP15 50 WATT



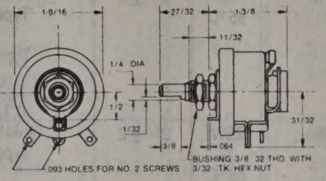
DIMENSIONS

TYPE MP06 12.5 WATT


7/8
5/8
11/16
1/4
1/8 DIA
1/4
BUSHING 1/4 -32 THD WITH 1/16 TK HEX NUT
19/32
3/64 x 3/32 HOLE
3/32

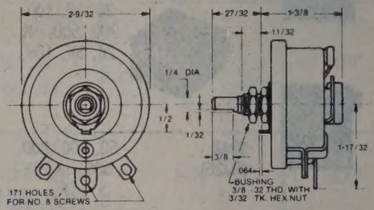
Diameter 7/8" . . . Depth behind panel 11/16" . . . Shaft 1/8" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/8" by means of 1/4"-32 bushing and hex nut . . . Non-turn lugs require 1/8" hole 1/4" below center of shaft (Type "A" shaft). WEIGHT: .037 lb., 17 Gms.

TYPE MP10 25 WATT


1-9/16
27/32
1-3/8
11/32
1/4 DIA
1/2
1/32
31/32
3/8
.064
.093 HOLES FOR NO. 2 SCREWS
BUSHING 3/8 32 THD WITH 3/32 TK. HEX NUT

Diameter 1 9/16" . . . Depth behind panel 1 3/8" . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require 3/16" hole 1/2" below center of shaft. (Type "A" shaft). WEIGHT: .180 lb., 82 Gms.

TYPE MP15 50 WATT


2-9/32
27/32
1-3/8
11/32
1/4 DIA
1/2
1/32
1-17/32
3/8
.064
171 HOLES FOR NO. 8 SCREWS
BUSHING 3/8 32 THD WITH 3/32 TK. HEX NUT

Diameter 2 9/32". . . Depth behind panel 1 3/8 . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require 3/16" hole 1/2" below center of shaft. (Type "A" shaft). WEIGHT: .321 lb., 145 Gms.

RESISTANCE VALUES

TYPE MP06 12.5 WATT

Total Ohms	Max. Amps.	Approx. Steps
1.0	3.53	29
2.0	2.50	42
2.5	2.24	38
3.0	2.04	44
5.0	1.58	40
6.0	1.44	48
8.0	1.25	51
10	1.12	51
15	0.91	51
25	0.71	73
35	0.60	75
50	0.50	86
75	0.41	103
100	0.35	108
125	0.32	128
150	0.29	128
175	0.27	148
200	0.25	130
250	0.22	166
350	0.19	185
500	0.16	215
750	0.13	255
1000	0.11	260
1500	0.091	310
2500	0.071	321
3500	0.060	378
5000	0.050	430

TYPE MP10 25 WATT

Total Ohms	Max. Amps	Approx. Steps
1.0	5.00	28
2.0	3.54	31
3.0	2.89	48
6.0	2.04	51
8.0	1.77	54
10	1.58	54
15	1.29	64
25	1.00	86
35	0.85	105
50	0.71	115
75	0.58	135
100	0.50	152
125	0.45	143
175	0.38	160
250	0.32	185
350	0.27	205
500	0.22	230
750	0.18	270
1000	0.16	292
1500	0.13	353
2500	0.10	358
3500	0.08	392
5000	0.07	440

TYPE MP15 50 WATT

Total Ohms	Max. Amps	Approx. Steps
0.5	10.00	24
1.0	7.07	46
2.0	5.00	50
4.0	3.54	44
6.0	2.89	74
8.0	2.50	85
12	2.04	108
16	1.76	108
22	1.50	123
35	1.19	148
50	1.00	113
80	0.79	147
125	0.63	178
150	0.58	173
225	0.47	203
300	0.41	214
500	0.32	290
800	0.25	365
1000	0.22	358
1600	0.18	367
2500	0.14	460
3500	0.12	505
5000	0.10	565
8000	0.08	695
10000	0.07	693

All other intermediate resistance values are available and can be manufactured on normal delivery cycle.

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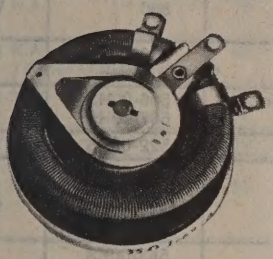
For More Information. Circle No. 407

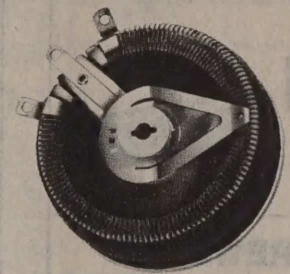
VISHAY-ANGSTROHM

Angstrohm's broad line of vitreous enameled power rheostats is designed to provide exceptional reliability through the application of the most modern manufacturing techniques and sophisticated materials. These same techniques have resulted in a line of power rheostats that feature a very compact size for their dissipation rating. Furthermore, many standard value rheostats are available for off-the-shelf delivery while special devices are available with short delivery cycles. Rheostats are also available in tapered windings, in tandem assemblies, with off positions and with special shaft assemblies.

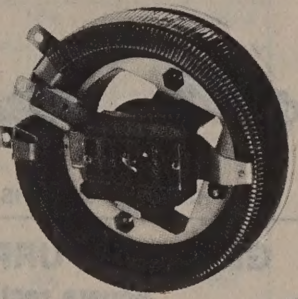
TYPE MP25 100 WATT



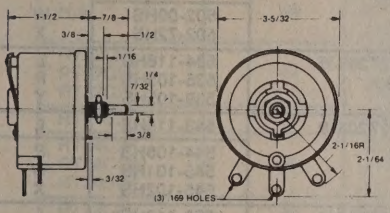
TYPE MP30 150 WATT



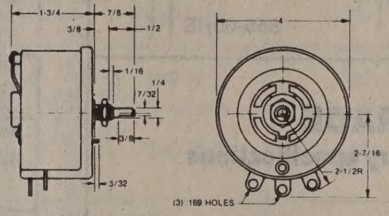
TYPE MP40 300 WATT



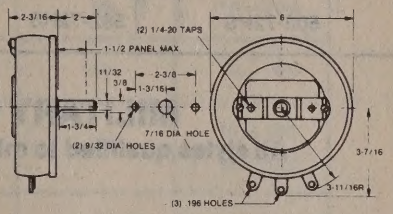
DIMENSIONS



Diameter 3 5/32". . . Depth behind panel 1 1/2" . . .Shaft 1/4" diameter . . . Rotation 300°, ±5°. . . Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require a 3/16" hole 1/2" below center of shaft. (Type "A" shaft) WEIGHT: .594 lbs., 268 Gms.



Diameter 4" . . . Depth behind panel 1 3/4" . . . Shaft 1/4" diameter . . . Rotation 300°, ±5°. . . Mounts on panels up to 1/4" by means of 3/8"-32 bushing and hex nut . . . Non-turn lugs require a 3/16" hole 1/2" below center of shaft. (Type "A" shaft) WEIGHT: 1.014 lbs., 460 Gms.



Diameter 6". . . Depth behind panel 2 3/16". . . Shaft 3/8" diameter . . . Rotation 315°, ±5°. . . Mounts on panels up to 1 1/4" by means of mounting bracket with two 1/4"-20 flat head screws. (Type "A" shaft) WEIGHT: 2.625 lbs., 1.191 Kg.

RESISTANCE VALUES

Total Ohms	Max. Amps.	Approx. Steps
.5	14.140	30
1	10.000	30
2	7.071	56
3	5.774	66
5	4.472	56
7.5	3.652	66
10	3.162	104
15	2.582	113
25	2.000	144
50	1.414	180
75	1.155	180
100	1.000	216
200	.707	252
300	.577	252
400	.500	252
500	.447	324
750	.365	396
1000	.316	410
2000	.224	410
2500	.200	410
5000	.141	685
7500	.115	820
10000	.100	820
—	—	—
—	—	—

Total Ohms	Max. Amps	Approx. Steps
.5	17.350	35
1	12.247	39
2	8.660	39
3	7.071	70
5	5.477	73
7.5	4.472	70
10	3.873	70
15	3.162	120
25	2.449	152
50	1.732	190
75	1.414	228
100	1.225	228
200	.866	265
300	.707	303
400	.612	342
500	.548	342
750	.447	418
1000	.387	432
2000	.274	575
2500	.244	456
5000	.173	865
7500	.141	1000
10000	.122	1000
—	—	—
—	—	—

Total Ohms	Max. Amps	Approx. Steps
1	17.320	40
1.5	14.142	58
2	12.247	78
2.5	10.954	78
3	10.000	73
4	8.660	78
5	7.745	78
7.5	6.324	148
10	5.477	154
15	4.472	147
25	3.464	155
35	2.927	231
50	2.449	267
75	2.000	308
100	1.732	326
150	1.414	270
200	1.224	308
300	1.000	340
400	.866	370
500	.774	455
750	.632	514
1000	.547	578
1500	.447	675
2500	.346	720

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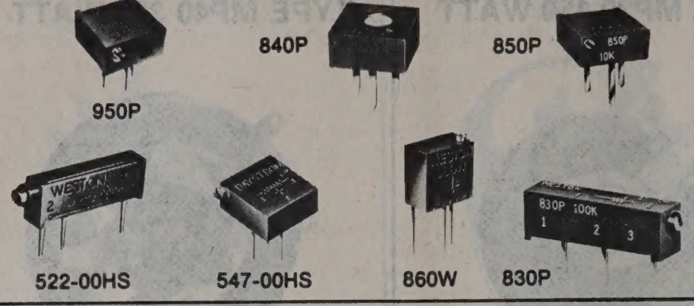
WESTON

GENERAL PURPOSE CERMET

Square, rectangular, and round



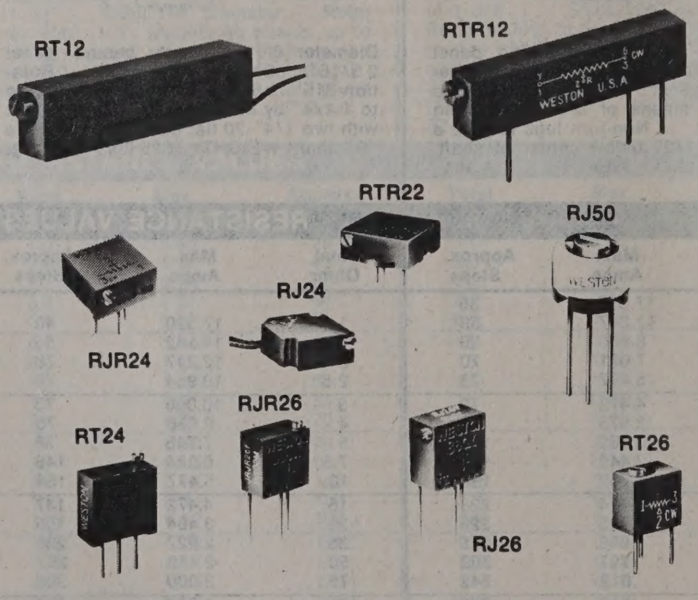
GENERAL PURPOSE WIREWOUND

Square, rectangular, and round

502-72HS
562-72HS
545-00HS
555-00HS

MILITARY GRADE

All styles qualified to military specifications



NOTES: All units are humidity resistant per MIL-STD-202, Method 106.

- Model 840 & 567-105HS contain solid stops. All other units are manufacture with slip clutch (wiper idles) for mechanical protection.

DESCRIPTION	MODEL	TERM.
¾" Rect. Comm.	830P †	P
⅜" Sq. Comm.	840P †	P
⅜" Sq. Comm.	850P †	P
¼" Sq. Comm.	860	W X
⅜" Sq. Comm.	950P †	P
¼" Round Comm.	566-00HS 567-00HS	P P
½" Rect.	522-00HS	P
⅜" Sq.	546-00HS 547-00HS 548-00HS 548-72HS	L P W X
⅜" Sq.	543-00HS 544-00HS 545-00HS 545-72HS	L P W X
¼" Sq.	561-00HS 562-00HS 562-72HS	P W X
5/16" Sq.	501-00HS	P
	502-00HS 502-72HS	W X
MIL-R-27208/8 1¼" Rect.	534-118HS 535-105HS 539-105HS	L P Y
MIL-R-27208/9 ⅜" Sq.	543-118HS	L
	544-105HS 545-101HS 545-102HS	P W X
MIL-R-27208/4 ½" Sq.	553-118HS	L
	555-101HS 555-102HS	W X
	701-105HS	P
MIL-R-27208/10 ¼" Sq.	561-105HS 562-101HS 562-102HS	P W X
MIL-R-22097/4 Char. "F" ⅜" Sq.	546-118HS 547-105HS 548-101HS 548-102HS	L P W X
MIL-R-22097/5 Char. "F" ¼" Sq.	860-101HS 860-102HS	W X
MIL-R-22097/6 ¼" Round Char. "C"	567-105HS	P
MIL-R-39015/1 1¼" Rect.	534-160HS 535-160HS 539-160HS	L P Y
MIL-R-39015/2 ½" Sq.	701-160HS 553-160HS	P L
	555-160HS 555-161HS	W X
MIL-R-39015/3 ⅜" Sq.	543-160HS	L
MIL-R-39035/3 Char. "F" ¼" Sq.	860-160HS 860-161HS	W X
MIL-R-39035/2 ⅜" Sq.	870-160HS 870-161HS 870-162HS	P W X

Specifications subject to change without notice.

FAIRCHILD WESTON
Schlumberger

Weston Controls, Inc.
Archbald, Pennsylvania 18403
Tel. (717) 876-1500
Telex: 83-1873
TWX: 510-656-2902

WESTON

MILITARY DESIG.	TURNS	SIZES L W T	POWER RATING (W)	TEMPERATURE COEFFICIENT + PPM/°C	RESISTANCE TOLERANCE %	RESISTANCE RANGE (OHMS)
N.A. † Other Models available	12	.75 × .25 × .19 Consult Factory	.75 @ 70°C	100	10%	10 — 2 Meg
N.A. † Other Models available	1	.375 × .375 × .188 Consult Factory	.5 @ 70°C	100	10%	10 — 2 Meg
N.A. † Other Models available	22	.375 × .375 × .187 Consult Factory	1 @ 70°C	100	10%	10 — 2 Meg
N.A.	16	.250 × .250 × .185	.5 @ 85°C	100	10%	100 — 1 Meg
N.A. † Other Models available	22	.375 × .375 × .187	1 @ 50°C	100	10%	100 — 2 Meg
N.A.	1	.270 Dia. × .215	.50 @ 70°C	100	10%	10 — 1 Meg
	10	.50 × .17 × .10	.3 @ 85°C	100	10%	10 — 1 Meg
N.A.	25	.375 × .375 × .150 .375 × .375 × .170 .417 × .375 × .170 .417 × .375 × .170	.5 @ 85°C	100	10%	10 — 1 Meg
N.A.	25	.375 × .375 × .150 .375 × .375 × .170 .417 × .375 × .170 .417 × .375 × .170	1 @ 70°C	50	5%	10 — 50K
N.A.	13	.250 × .250 × .170	.25 @ 70°C	50	5%	10 — 25K
N.A.	15	.312 × .312 × .175 .312 × .312 × .200 .312 × .312 × .190	.6 @ 70°C	70	5%	10 — 20K
RT12C2L RT12C2P RT12C2Y	24	1.25 × .315 × .190 1.25 × .315 × .190 1.25 × .325 × .195	.75 @ 85°C	50	5%	10 — 20K
RT24C2L RT24C2P RT24C2W RT24C2X	25	.375 × .375 × .150 .375 × .375 × .170 .417 × .375 × .170 .417 × .375 × .170	.75 @ 85°C	50	5%	10 — 10K 10 — 10K
RT22C2L RT22C2W RT22C2X RT22C2P	35 35 35 37	.500 × .500 × .187 .535 × .500 × .220 .535 × .500 × .220 .500 × .500 × .230	.75 @ 85°C	50	5%	50 — 20K 50 — 20K 10 — 20K
RT26C2P RT26C2W RT26C2X	13	.250 × .250 × .170 .250 × .250 × .170 .250 × .250 × .170	.25 @ 85°C	50	5%	10 — 5K
RJ24FL RJ24FP RJ24FW RJ24FX	25	.375 × .375 × .150 .375 × .375 × .170 .417 × .375 × .170 .417 × .375 × .170	.50 @ 85°C	100	10%	50 — 1 Meg
"C" Characteristic also available						
RJ26FW RJ26FX	16 16	.250 × .250 × .185 .250 × .250 × .185	.25 @ 85°C	100	10%	100 — 1 Meg
"C" Characteristic Also Available						
RJ50CP	1	.260 Dia. × .210	.25 @ 85°C	250	10%	10 — 1 Meg
RTR12DL RTR12DP RTR12DY	24	1.25 × .315 × .190 1.25 × .315 × .190 1.25 × .325 × .195	.75 @ 85°C	50	5%	100 — 20K
RTR12DL-M & P Level Failure Rate RTR12DP & RTR12DY-M Level Failure Rate						
RTR22DP RTR22DL	37 35	.500 × .500 × .230 .500 × .500 × .187	.75 @ 85°C	50	5%	10 — 20K 100 — 20K
M P Level Failure Rate						
RTR22DW RTR22DX	35 35	.535 × .500 × .220 .535 × .500 × .220	.75 @ 85°C	50	5%	100 — 20K 100 — 20K
M Level Failure Rate						
RTR24DL	25	.375 × .375 × .150	.75 @ 85°C	50	5%	200 — 10K
RTR24DL-M Level Failure Rate						
RJR26FW RJR26FX	16 16	.250 × .250 × .185 .250 × .250 × .185	.25 @ 85°C	100	10%	100 — 1 Meg
M P Level Failure Rate						
RJR24FP RJR24FW RJR24FX	22	.375 x .375 x .187	.50 @ 85°C	100	10%	100Ω - 100K
Also available: Characteristic "C" (250 PPM/°C) "M" Failure Rate Level						

** Non-QPL Resistance values

FAIRCHILD WESTON

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Tel. (717) 876-1500
Telex: 83-1873
TWX: 510-656-2902

For More Information. Circle No. 408

SAW Bandpass Filters:

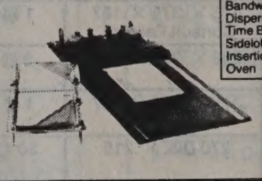
Optimum amplitude and phase characteristics for radar, ECM, ESM and communications filtering.

Range of Performance	
Center Frequency (f.)	20 MHz to 1 GHz
1 dB bandwidth (Δf)	100KHz to 40% f。
Rejection bandwidth	Δf + 600 KHz min
Transition bandwidth	350 KHz min
Shape factor (1 dB to 40 dB)	1.1 min
Insertion Loss	10 dB to 30 dB, 20 dB typical
Rejection level	30 dB to 55 dB, 40 dB typical
Amplitude ripple	±.2 dB to ±.5 dB, ±.3 dB typical
phase deviation from linear	±2° to ±5°, ±3° typical

SAW and IMCON Dispersive Delay Lines:

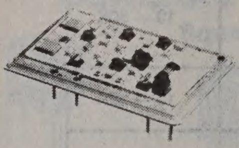
The powerful signal processing tool for radar, ELINT, EŞM receivers

	SAW ID	SAW RAC	IMCON
Center Frequency	1000 MHz	1000 MHz	30 MHz
Bandwidth	<50% f。	<50% f。	<50% f。
Dispersion	<50 μs	< 100 μs	< 600 μs
Time Bandwidth Product	< 2000	< 4000	< 4000
Sidelobes	30 db	35 db	40 db
Insertion Loss	30-50 db	30-50 db	20-40 db
Oven	No	Yes	Yes



SAW Hybrid Oscillators:

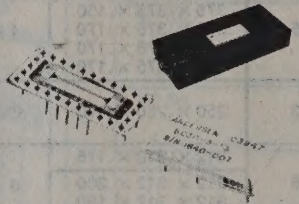
Compact, rugged, alignment-free frequency sources available in standard industry packages for PC mounting. Two types available:



SAW Delay Line Voltage Control Oscillators SAW Resonator Stabilized Oscillators	
Fundamental Frequency Output	.1 to 1.1 GHz
Non Harmonic Spurious Harmonic Spurious	− 60 dBc − 30 dBc
Output Power	+ 10 dBm min into 2:1 load

Programmable and Fixed Coded Correlators:

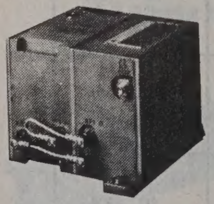
The key to spread spectrum communications and next generation radar.



SAW Convolvers and Programmable Correlators
Bandwidths to 100 MHz Time bandwidth product to 1000 Programmable pulse to pulse
Fixed Coded devices
Bandwidth to 20 MHz Codes Barker or to 127 Chips biphase or quad phase

Frequency Synthesizers:

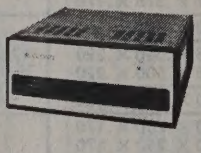
Unique design provides optimized programmable frequency source for today's most demanding applications including radar, radios, telecommunications, TACAN, telemetry,navigational equipment and satellite communications.



Frequency Output	.25 to 5 GHz
Stepping Bandwidth	600 MHz
Non Harmonic Spurious Harmonic Spurious	− 60 dBc − 35 dBc
Output Power	+ 23 dBm
Phase noise	− 60 dBc at 10 Hz
Compact/Cavity Free	

Compressive (Microscan) IF Receivers:

100% probability of intercept and real time spectrum analysis for ESM and ELINT Receivers.

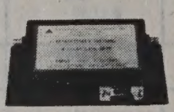


Representative Performance			
Bandwidth	**Resolution**	**Process Time**	**Sidelobes**
500 MHz	3 MHz	.5 μs	25 db
250 MHz	1.5 MHz	1 μs	30 db
20 MHz	45 KHz	34 μs	35 db
11 MHz	25 KHz	100 μs	45 db
1.25 MHz	3 KHz	550 μs	40 db
2.5 MHz	200 Hz	8 ms	30 db

Bulk Acoustic Wave (BAW) Delay Lines and Subsystems:

Practical and economical memory for radar, communications and TV signal processing.

Glass
Frequency < 5mHz to > 70 mHz
Bandwidth > 50% of f_0
Delay < 1 μs to > 250 μs
Excellent Delay Stability



Quartz
Frequency < 5 mHz to > 150 mHz
Bandwidth > 50% of f_0
Delay < 0.300 μs to > 5000 μs
Multiple Channel Assemblies

Radar MTI

Acousto-Optic Products:

Controlling laser energy in computer printing and semiconductor processing.

Modulators
UV, visible, near infrared
Modulation bandwidth to 20 MHz
Contrast ratio in excess of 1000 to 1
Deflection efficiency greater than 85%
Drivers available

Beam Deflectors
UV, visible, near infrared
Resolution to 300 spots
Access time 300 ns to 10 μs
Drivers available

Q-Switches
Available for all commercial YAG lasers
For up to 50 watt CW laser power output

ANDERSEN LABORATORIES

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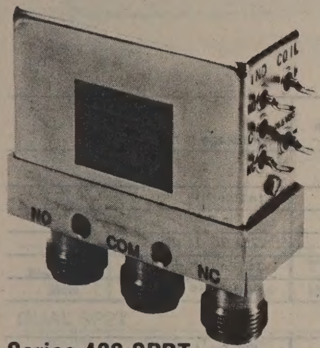
Telephone (203) 242-0761/TWX 710-425-2390

DOW-KEY IS MICROWAVE SWITCHES.



Series 402 SPDT

The model 402 is available as a failsafe or pulse latching relay. A set of Form C indicator contacts is available on both versions. Standard coils are 12 Vdc (45 ohms) and 26.5 Vdc (175 ohms). Operate time at 20°C is 20 ms max.

RF Characteristics

Frequency GHz	VSWR (Max.)	Isolation dB (Min.)	Ins. Loss dB (Max.)	RF Power W
0-1	1.15	85	0.15	1000-350
1-2	1.2	80	0.2	350-250
2-4	1.25	70	0.25	250-150
4-8	1.35	65	0.35	150-120
8-12.4	1.5	60	0.5	120-100

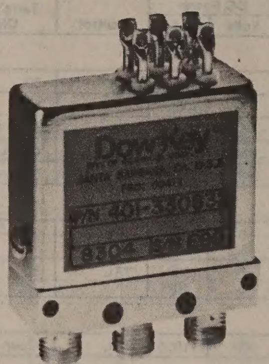
Connectors and Part Numbers

		Failsafe	
Coil Voltage	Connector Type	Standard SPDT	With 1C Ind. Contacts
12 Vdc	N	402-2201	402-220132
26.5 Vdc	N	402-2301	402-230132
		Pulse Latching*	
12 Vdc	N	402-3201	402-320132
26.5 Vdc	N	402-3301	402-330132

*Pulse width 20 ms min.

Dimensions*
2.20" (55.9 mm) H x 2.64" (67.1 mm) L x 1.09" (27.7 mm) W.
*Excludes connectors.

Weight
Approximately 9 oz.



Series 401 SPDT

Failsafe and latching versions are available, each with an optional set of form C indicator contacts. Standard coils on failsafe relays are 12 Vdc (42 ohms) and 28 Vdc (260 ohms). Coils on latching relays are 12 Vdc (35 ohms) and 28 Vdc (220 ohms). Operate time at 20°C is 15 ms max.

RF Characteristics

RF characteristics for the 401 are the same as the Series 411 Transfer. Please refer to characteristics chart for the 411 to the right.

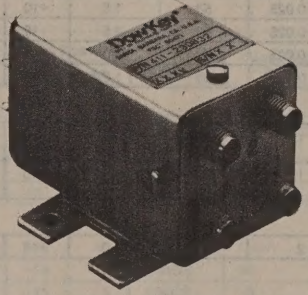
Connectors and Part Numbers

		Failsafe	
Coil Voltage	Connector Type	Standard SPDT	With 1C Ind. Contacts
12 Vdc	SMA	401-2208	401-220832
28 Vdc	SMA	401-2308	401-230832
		Pulse Latching*	
12 Vdc	SMA	401-3208	401-320832
28 Vdc	SMA	401-3308	401-330832

*Pulse width 15 ms. min.

Dimensions*
1.40" (35.6mm)H x 1.34" (34.0mm)L x .50" (12.7mm)W.
*Excludes connectors.

Weight
Approximately 2 oz.



Series 411 Transfer

The Model 411 is a failsafe transfer relay with an optional set of Form C indicator contacts.
Standard coils are 12 Vdc (30 ohms) and 26.5 Vdc (125 ohms). Operate time at 20°C is 20 ms max.

RF Characteristics

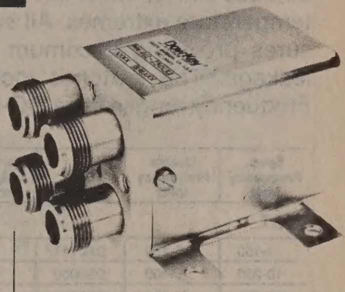
Frequency GHz	VSWR (Max.)	Isolation dB (Min.)	Ins. Loss dB (Max.)	RF Power W
0-1	1.1	85	0.1	200-65
1-4	1.2	80	0.2	65-35
4-8	1.3	70	0.3	35-25
8-12	1.4	65	0.4	25-20
12-18	1.5	60	0.5	20-15

Connectors and Part Numbers

		Failsafe	
Coil Voltage	Connector Type	Standard Transfer	With 1C Ind. Contacts
12 Vdc	SMA	411-2208	411-220832
26.5 Vdc	SMA	411-2308	411-230832

Dimensions*
2.10" (53.3 mm) L x 1.26" (32.0 mm) Sq.
*Excludes mounting bracket and connectors.

Weight
Approximately 6 oz.



Series 412 Transfer

Both failsafe and latching relays are available, each with an optional set of Form C indicator contacts.
Standard coils on failsafe relays are 12 Vdc (40 ohms) and 26.5 Vdc (160 ohms). Standard coils on latching relays are 12 Vdc (36/68 ohms) and 26.5 Vdc (145/270 ohms). Operate time at 20°C is 20 ms max.

RF Characteristics

Frequency GHz	VSWR (Max.)	Isolation dB (Min.)	Ins. Loss dB (Max.)	RF Power W
0-1	1.15	85	.15	1000-350
1-2	1.2	80	.2	350-250
2-4	1.25	70	.25	250-150
4-8	1.35	65	.35	150-120
8-12.4	1.5	60	.5	120-100

Connectors and Part Numbers

		Failsafe	
Coil Voltage	Connector Type	Standard Transfer	With 1C Ind. Contacts
12 Vdc	N	412-2201	412-220132
26.5 Vdc	N	412-2301	412-230132
		Pulse Latching*	
12 Vdc	N	412-3201	412-320132
26.5 Vdc	N	412-3301	412-330132

*Pulse width 20 ms min.

Dimensions*
3.00" (76.2 mm) L x 1.75" (44.5 mm) Sq.
*Excludes mounting bracket and connectors.

Weight
Approximately 16 oz.

Reliability

Dow-Key relays have been preferred for rugged military applications and commercial communications equipment for nearly thirty years. All connectors and sub-assemblies are manufactured by Dow-Key to ensure optimum conductivity and low insertion loss throughout the life of our relays.

Delivery

Dow-Key maintains a large inventory for fast delivery. Production lead time for larger quantities is typically less than eight weeks.

Custom Capabilities

We invite inquiries concerning your special needs. If we don't have a relay specifically suited to your needs we can adapt one in a surprisingly short time.

DowKey®
Division of Kilovac Corporation

P.O. Box 4422G
Santa Barbara, CA 93103 USA
(805) 684-4560
TWX 910-336-1141

For More Information. Circle No. 410

DAICO

MIC SWITCHES

The M.I.C. (Microwave Integrated Circuits) Switches are built utilizing Daico's inhouse Hi-Rel Thin Film Technology, which provides excellent stability over temperature extremes. All switches are encased in shielded hermetic enclosures providing maximum protection to the circuitry with minimum RF leakage. The switches include drivers compatible with TTL or CMOS. Frequency ranges from DC-6000 MHz with isolation over 75 dB are available.

Spec. Frequency MHz	Usable Frequency MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Termination Ohms	Package
								Volts	mA			
SPST												
3-150	3-150	DS0111	0.025	40	1.0	+6	1.25	+5	90	TTL	50	14 Pin DIP
10-200	5-400	DS0050	0.025	50	1.5	+10	1.25	+5	100	TTL	50	14 Pin DIP
10-200	10-300	DS0235	0.025	60	2.5	+16	1.25	+5	230	TTL	50 or 93	.750 Sq. 14 Pin
100-500	70-700	DS0141	0.025	50	3.0	+17	1.4	+5	200	TTL	Open	14 Pin DIP
400-450	100-1000	DS0411	0.5	60	1.2	+13	1.25	+5	110	TTL	50	14 Pin DIP
DUAL SPST												
45-75	10-1000	DS0343	1.	50	1.5	+10	1.4	+5 -5.2	55 40	TTL	50	.800 Sq. 14 Pin
460-500	70-700	DS0321	1.	60	1.5	+10	1.4	+5 -5	55 40	TTL	50	.800″ Sq. 14 Pin
3-SPST												
10-500	10-700	DS00031	2.	50	1.0	+13	1.25	+5	110	TTL	Open	.380 x .655 22 Lead Planar
SP2T												
1-100	1-150	DS0042-10	0.04	60	1.0	+6	1.25	+5	100	TTL	Open	14 Pin DIP
3-300	1-500	DS0252	0.015	45	1.5	+10	1.25	+5	170	TTL	50	14 Pin D DIP
5-500	5-500	DS0386	20.	60	1.0	+10	1.25	+15	15	CMOS	50	14 Pin DIP
5-1500	5-1500	DS0074	5.	35	1.5	+5	1.25	+12	4.5	CMOS	Open	14 Pin DIP
8-180	8-500	DS0175	100.	45	1.4	+0	1.25	+15	5	CMOS	50	14 Pin DIP
10-150	10-500	DS0082	0.3	50	1.0	+0	1.3	+5	70	TTL	50	14 Pin DIP
10-200	10-300	DS0042-100	0.04	60	1.5	+6	1.4	+5	100	TTL	Open	14 Pin DIP
10-350	10-500	DS0108	0.03	25	1.5	+15	1.25	+5	180	TTL	50 or Ground	14 Pin DIP
20-80	10-500	DS0397	5.	55	0.8	+20	1.25	+15	14	TTL	50	14 Pin DIP
20-500	10-500	DS0047	1.	40	1.0	+10	1.18	+5 -5	40 30	TTL	50	14 Pin DIP
20-80	10-500	DS0112	5.	55	0.8	+20	1.25	+15	30	TTL	50	14 Pin D DIP
20-180	10-500	DS0152	100.	40	0.7	+15	1.25	+15	8	CMOS	Open	TO-8
20-300	20-500	DS0158	0.03	25	1.25	+15	1.25	+5	130	TTL	50 or Ground	14 Pin DIP
20-1000	10-1000	DS0052	1.	30	2.0	+10	1.25	+5 -5	25 15	TTL	50	14 Pin DIP
20-2000	20-2000	DS0352	1.	30	2.5	+10	1.5	+5 -5	25 15	TTL	50	14 Pin DIP
30-85	30-85	DS0024	15.	75	1.5	+10	1.2	+12	4	CMOS	Open	14 Pin DIP
40-200	30-300	DS0022	0.2	45	1.0	+10	1.2	+5	40	TTL	Open	14 Pin DIP
50-90	10-100	DS0083	5.	60	1.2	+15	1.25	+15	5	CMOS	75	14 Pin DIP
50-140	10-500	DS0164	15.	45	0.7	+16	1.2	+15 -15	15 15	TTL	50	.375 x .655 22 Lead Planar
50-300	50-500	DS0075	5.	50	1.2	+20	1.25	+15	5	CMOS	50	14 Pin DIP
60-1500	40-1500	DS0068	20.	40	1.3	+10	1.25	+12	8	CMOS	Open	14 Pin DIP
70-1000	10-1000	DS0320	0.2	40	3.	+10	1.5	+5	225	TTL	Ground	18 Pin D DIP
100-500	70-700	DS0142	0.025	45	2.5	+17	1.5	+5	200	TTL	Open	16 Pin D DIP
160-500	160-500	DS0271	2.	50	1.2	+10	1.25	+5 -5	11 6	TTL	50	14 Pin DIP .400 Pin Row
225-400	225-400	DS0332	0.1	40	1.5	+10	1.3	+5	100	TTL	50	14 Pin DIP .400 Pin Row
225-400	225-800	DS0342	6.	60	0.5	+10	1.25	+5 -3	35 15	TTL	Ground	14 Pin DIP
250-450	10-500	DS0229	2.	60	1.0	+10	1.25	+5 -5	40 25	TTL	Open	14 Pin DIP .400 Pin Row
345-425	300-700	DS0189	10.	40	1.0	+15	1.2	+15	8	CMOS	Open	TO-8
490-590	70-700	DS0322	1.	60	1.5	+15	1.4	+5 -5	35 20	TTL	50	.800″ Sq. 14 Pin
500-2000	400-2000	DS0257	0.4	35	1.5	+10	1.4	+5 -5	25 25	TTL	50	14 Pin DIP .400 Pin Rows
1197-1605	600-3000	DS0292	2.	60	2.	+10	1.4	+5 -5	10 10	TTL	50	18 Pin D DIP
1900-4100	1000-5000	DS0379	0.5	50	1.2	+10	1.6	+5 -5	25 18	TTL	Ground	.625 x .750 Planar

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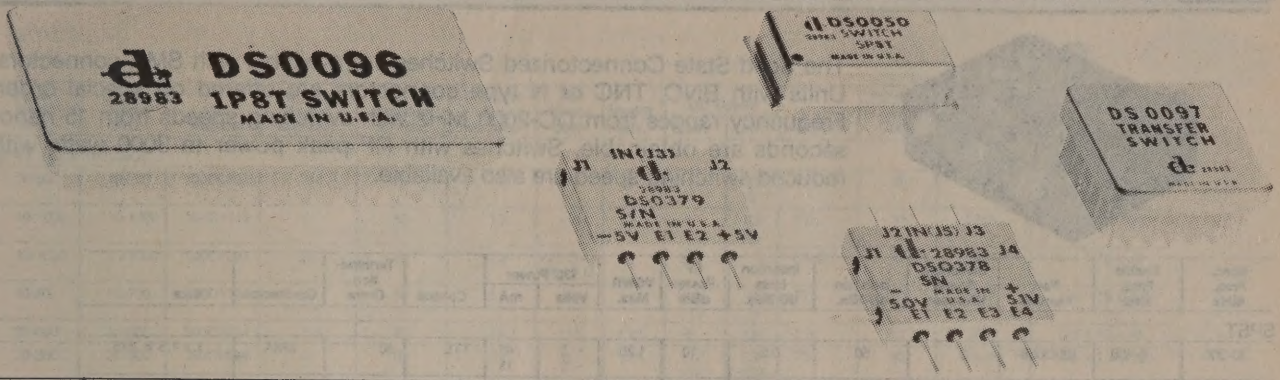
MIC SWITCHES

DAICO



Spec. Frequency MHz	Usable Frequency MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Termination Ohms	Package
DUAL SP2T												
10-100	10-200	DS0241	0.05	40	0.8	+10	1.15	+5	200	TTL	50 or Ground	16 Pin D DIP
20-60	10-500	DS0020	100.	50	1.0	+10	1.25	+15	4	CMOS	Open	16 Pin DIP
20-300	10-500	DS0043	50.	30	1.0	+10	1.25	+15	8	CMOS	Open	16 Pin DIP
20-750	20-750	DS0017	1.	30	1.3	+10	1.5	+5	120	TTL	Open	16 Pin DIP
SP3T												
20-80	20-250	DS0113	5.	55	0.8	+20	1.25	+15	40	TTL	Open	14 Pin DIP .400 Pin Row
50-500	30-700	DS0073	2.	40	1.0	+10	1.25	+15	5	CMOS	50	.8 Sq. 24 Pin Plug In
250-460	100-600	DS0233	1.	35	1.2	+20	1.25	+15	5	CMOS	50	.8 Sq. 24 Lead Plug In
250-500	250-500	DS0270	2.5	45	0.8	+10	1.25	+15	5	CMOS	50	.8 Sq. 24 Lead Plug In
2700-5000	2000-6000	DS0433	0.5	60	1.5	+10	1.6	+5 -5	40 30	TTL	Ground	.625 x .750 Planar
SP4T												
DC-12	DC-20	DS0294	10.	50	1.2	+20	1.4	+10 -5	7 5	TTL	Open	18 Pin D DIP
10-500	10-500	DS0085	35.	25	0.8	+10	1.2	+15	6	CMOS	50	14 Pin DIP .400 Pin Row
10-100	10-150	DS0033	0.2	50	0.6	+10	1.25	+5	160	TTL	50	.8 Sq. 24 Lead Plug In
10-100	10-500	DS0221	20.	35	1.0	+27	1.2	+5 -15	60 50	TTL	Ground	16 Pin D DIP
10-100	10-500	DS0222	20.	35	1.0	+27	1.2	+5 -15	60 50	TTL	Ground	16 Pin D DIP
50-70	20-500	DS0078	1.	60	1.0	+23	1.2	+5 -12	10 10	TTL	50	.8 Sq. 24 Lead Plug In
159-209	30-400	DS0014	0.5	45	1.0	+10	1.25	+5 -5	35 30	TTL	50	1" Sq. 13 Lead Planar
225-400	225-400	DS0304	0.1	40	1.5	+10	1.3	+5	135	TTL	50	24 Pin D DIP
200-1500	200-1500	DS0069	20.	20	1.1	+10	1.25	+12	5	CMOS	Open	.8 Sq. 24 Lead Plug In
300-550	300-700	DS0354	2.	60	1.5	+30	1.25	+15 -15	50 75	TTL	50	1.036 x 1.925 34 Lead Planar
130-570	50-500	DS0362	1.	50	1.5	+15	1.4	+5 -5.2	75 45	TTL	50	24 Pin D DIP
500-2000	500-2000	DS0259	0.4	35	1.5	+10	1.4	+5 -5	45 25	TTL	50	24 Pin D DIP
1900-4100	1000-5000	DS0378	0.5	50	1.2	+10	1.6	+5 -5	40 30	TTL	Ground	.625 x .750 Planar
SP5T												
645-795	10-800	DS0347	1.	40	1.5	+10	1.3	+5 -5.2	65 40	TTL	50	38 Pin DIP .800 Pin Row
20-300	10-700	DS0028	1.	40	1.0	+10	1.3	+5 -5	20 80	TTL	50	24 Pin D DIP
130-180	30-300	DS0018	100.	40	1.0	+10	1.25	+5	10	CMOS	50	24 Pin D DIP
SP6T												
400-450	200-500	DS0208	0.1	36	2.5	+15	1.5	+5	400	TTL	Ground	38 Pin DIP .800 Pin Row
SP7T												
100-400	30-500	DS0137	100.	40	1.5	+10	1.5	—	—	—	Open	16 Pin D DIP
SP8T												
20-1200	20-1200	DS0328	20.	40	1.5	+10	1.35	+5 -15	40 15	CMOS	Ground	38 Pin DIP .800 Pin Row
25-520	10-700	DS0338	10.	40	1.5	+10	1.35	+12	6	CMOS	50	38 Pin DIP .800 Pin Row
DUAL BY PASS												
450-550	30-700	DS0079	5.	25	1.7	+10	1.25	+15	6	CMOS	N/A	14 Pin DIP
TRANSFER												
15-45	10-500	DS0097	10.	50	1.0	+10	1.25	+5	20	CMOS	N/A	.8 Sq. 24 Lead Plug In
50-100	10-500	DS0110	10.	50	1.0	+5	1.15	+12	30	CMOS	N/A	.8 Sq. 24 Lead Plug In
70-1000	50-1000	DS0319	10.	40	1.5	+10	1.3	+15	15	CMOS	N/A	18 Pin D DIP

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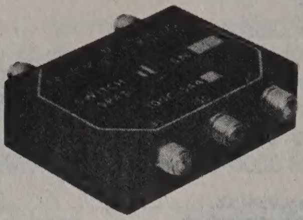
DAICO CONNECTORIZED SOLID STATE RF SWITCHES



The Solid State Connectorized Switches are available with SMA connectors. Units with BNC, TNC or N type connectors are offered on special order. Frequency ranges from DC-2000 MHz with switching speeds from 15 nanoseconds are obtainable. Switches with RF peak power to 3000 watts with reduced switching speed are also available.

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Termination Ohms	Connector	Size
								Volts	mA				
SPST													
30-300	5-400	100D0581	2.	50	0.5	+10	1.25	+ 5 - 5	45 15	TTL	50	SMA	1 x 1.5 x .675
10-200	5-300	100C1041	0.025	50	1.5	+10	1.25	+ 5	100	TTL	50	SMA	2 x 1.5 x .5
10-500	10-500	100D0801	0.8	60	1.2	+10	1.5	+ 5 - 5	75 45	TTL	50 or open	SMA	1.5 x 1.5 x .69
15-1000	15-1000	100C1291	20.	60	1.5	+22	1.5	+10	3	CMOS	50	SMA	1 x 1.5 x .9
20-300	20-800	100D0591	4.	50	0.7	+27	1.25	+15 -15	60 50	TTL	50	SMA	1 x 1.5 x .675
20-300	10-200	100C1051	0.035	55	2.0	+10	1.4	+ 5	200	TTL	50	SMA	2 x 2 x .48
20-600	10-600	100C1281	0.5	70	1.3	+13	1.25	+ 5	75	TTL	50	SMA	1 x 1.5 x .72
300-350	100-500	100C1570	0.05	90	3.	+10	1.4	+ 5	270	TTL	50	SMA	1.5 x 2 x .54
SP2T													
DC-50	DC-50	100C1562	2.	65	2.5	+25	1.35	+15 -15	10 20	TTL	50	SMA	2 x 3 x 1
1-100	1-100	100C1042	0.015	60	0.8	+ 8	1.2	+ 5	130	TTL	Open	SMA	1.5 x 1.5 x .5
2-500	2-600	100C1052	0.04	40	1.5	+10	1.4	+ 5	160	TTL	50	SMA	2 x 2 x .48
30-300	10-300	100D0582	2.	50	1.0	+10	1.25	+ 5 - 5	45 15	TTL	50	SMA	1 x 1.5 x .675
10-500	5-600	100D0802	0.8	70	1.0	+10	1.2	+ 5 - 5	40 25	TTL	50	SMA	2 x 1.5 x .68
10-700	10-1000	100C1172	5.	50	1.2	+20 Over 100 MHz	1.25	+15	20	CMOS	50	SMA	2 x 2 x .48
20-2000	20-2000	100C1558	1.	20	2.5	+10	1.5	+ 5 - 5	25 15	TTL	50	SMA	1.5 x 2 x .44
10-1000	10-1000	100C1182	10.	35	1.0	+15	1.25	+15	5	CMOS	50	SMA	2 x 2 x .48
15-1000	15-1000	100C1292	20.	60	1.5	+22 Over 80 MHz	1.5	+15	3	CMOS	50	SMA	1.5 x 1.5 x .6
20-300	20-800	100D0592	4.	55	0.7	+27	1.25	+15 -15	60 50	TTL	50	SMA	1.5 x 1.5 x .78
20-600	10-700	100C1282	0.5	70	1.2	+10	1.25	+ 5	50	TTL	50	SMA	1.5 x 1.5 x-.6
40-1000	30-1000	100D1102-HF	5.	35	1.2	+10	1.25	+12	10	CMOS	50	SMA	2 x 2 x .48
10-500	10-700	100D1102-LF	10.	50	1.0	+10	1.25	+12	10	CMOS	50	SMA	2 x 2 x .48
150-1500	100-2000	100C1244	1.	45	0.5	+30	1.3	+ 5 +15 -15	60 25 25	TTL	Ground	SMA	2.75 x 1.75 x 1
500-2000	300-2000	100C1515	0.4	35	1.5	+10	1.4	+ 5 - 5	25 25	TTL	50	SMA	1.5 x 1.5 x .625
SP3T													
1-30	1-30	100C0624	5.	65	0.5	+10	1.25	+ 5 -15	60 30	TTL	50	SMA	1.5 x 1.5 x .675
30-300	5-800	100D0583	2.	50	0.5	+10	1.25	+ 5 - 5	65 40	TTL	50	SMA	1.5 x 1.5 x .675
10-500	10-700	100D0803	0.8	70	1.2	+10	1.5	+ 5 - 5	100 100	TTL	50	SMA	2.5 x 1.3 x .67
15-1000	10-1000	100C1293	20.	60	1.5	+22 Over 80 MHz	1.5	+15	3	CMOS	50	SMA	2 x 1.5 x .72
20-300	20-800	100D0593	4.	55	0.7	+27	1.25	+15 -15	75 50	TTL	50	SMA	2 x 1.5 x .68
20-600	10-700	100C1283	0.5	70	1.3	+10	1.25	+ 5	170	TTL	50	SMA	2 x 1.5 x .72
250-1150	200-1500	100C1204	10.	65	1.0	+10	1.25	+ 5 - 5	40 45	TTL	50	SMA	3 x 3 x 1
SP4T													
DC-12	DC-20	100C1526	10.	50	1.2	+20	1.4	+10 - 5	7 5	TTL	Ground	SMA	2 x 3 x .54
.1-32	.1-32	100C1684	50.	75	2.5	+27	1.2	+15 -15 + 5	20 20 350	TTL	50	SMA	3.75 x 2 x 1.34
1-100	1-200	100C1021	10.	80	0.6	+ 5	1.2	+ 5 - 5	200 50	TTL	50	SMA	3 x 3 x 1.03
30-300	5-500	100D0584	2.	50	0.5	+10	1.3	+ 5 - 5	75 75	TTL	50	SMA	2 x 1.5 x .68

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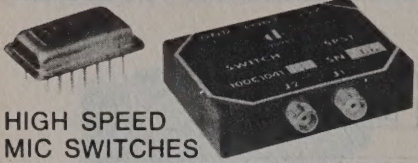
CONNECTORIZED SOLID STATE RF SWITCHES DAICO

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss- dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Termination Ohms	Connector	Size
								Volts	mA				
SP4T (Continued)													
10-500	10-700	100D0804	0.8	70	1.6	+10	1.2	+5 -5	80 150	TTL	50	SMA	3 x 1.75 x .67
10-1000	10-1000	100C1449	10.	50	1.5	+15	1.3	+5 -5	100 100	TTL	50	SMA	3 x 3 x 1.125
15-1000	10-1000	100C1294	20.	55	1.5	+22 Over 80 MHz	1.5	+10	3	CMOS	50	SMA	3 x 1.75 x .6
20-80	10-700	100D1304	4.	90	1.5	+20	1.3	+5 +15	25 30	TTL	50	SMA	3 x 1.79 x .95
20-600	10-600	100C1284	0.5	70	1.4	+10	1.25	+5	130	TTL	50	SMA	3 x 1.75 x .6
20-300	20-300	100D0594	4.	60	0.7	+27	1.25	+12 -12	130 100	TTL	50	SMA	2.5 x 1.5 x .69
500-2000	300-2000	100C1514	0.4	35	1.5	+10	1.4	+5 -5	45 25	TTL	50	SMA	2 x 1.5 x .625
DP4T													
20-200	10-200	100C1024	0.05	55	0.5	+10	1.25	+5	150	TTL	Open	SMA	3 x 1.5 x .67
SP5T													
2-32	1-200	100C1215	110.	45	0.7	+17	1.5	+12 +5	220 20	TTL	50	BNC	5 x 3 x 1.375
30-300	5-400	100D0585	2.	50	0.5	+10	1.3	+5 -5	125 75	TTL	50	SMA	2.5 x 1.5 x .675
15-1000	10-1500	100C1295	20.	50	1.5	+22 Over 80 MHz	1.5	+15	3	CMOS	50	SMA	3.5 x 1.75 x .6
20-500	15-500	100D0805	1.	80	1.3	+10	1.3	+5 -5	40 50	TTL	50	SMA	3.5 x 1.75 x .67
20-500	20-500	100D0970	2.	40	1.0	+20	1.5	+5 -5	150 20	TTL	50	SMA	2.5 x 1.5 x .675
20-600	10-700	100C1285	0.5	60	1.8	+10	1.35	+5	175	TTL	50	SMA	3.5 x 1.75 x .6
SP6T													
30-300	5-500	100D0586	2.	50	.8	+10	1.4	+5 -5	150 90	TTL	50	SMA	3 x 1.5 x .675
10-500	10-500	100D0826	4.	70	2.0	+30	1.5	+15 -15	85 260	TTL	50	SMA	4.5 x 2.5 x .95
10-1000	10-1000	100C1448	10.	45	2.5	+15	1.3	+5 -5	200 150	TTL	50	SMA	5 x 4 x 1.3
15-1000	10-1000	100C1296	20.	50	1.8	+22 Over 100 MHz	1.4	+15	20	CMOS	50	SMA	4 x 1.75 x .6
20-600	20-600	100C1286	0.5	70	2.	+10	1.25	+5	250	TTL	50	SMA	4 x 1.75 x .6
SP8T													
4-6	1-40	100C1348	0.9	60	1.5	+ 3	1.25	+5	400	TTL	50	SMA	5 x 2.5 x 1
10-350	10-500	100C1188	5.	70	1.3	0	1.5	+5 -5	200 300	TTL	50	SMA	6 x 3 x .63
50-750	10-1000	100C1560	20.	65	2.	+15	1.4	+15	22	CMOS	50	SMA	3.13 x 5.8 x .84
SP12T													
15-500	10-700	100D1450	10.	55	2.0	+15	1.3	+5 -5	300 150	TTL	50	SMA	5 x 3 x 3.75
SP14T													
2-32	1-40	100D1247	20.	40	1.2	+10	1.35	+5	1.5A	TTL	50	BNC	12 x 6 x 1.12
SP16T													
10-1000	10-1000	100D1447	10.	45	3.0	+15	1.3	+8 -8	300 150	TTL	50	SMA	5 x 3 x 3.75
TRANSFER													
30-300	1-600	100C0587	2.	50	0.8	+10	1.3	+5 -5	90 90	TTL	N/A	SMA	2 x 1.5 x .94
15-1000	10-1000	100C1297	20.	70	1.2	+15 Over 70 MHz	1.25	+15	20	CMOS	N/A	SMA	2 x 1.5 x .69
20-600	20-1000	100C1287	1.	50	0.8	+10	1.25	+5	80	TTL	N/A	SMA	2 x 1.5 x .69

DAICO HIGH SPEED RF SWITCHES


HIGH SPEED MIC SWITCHES

Daico's High Speed Switches are available in both M.I.C. (Microwave Integrated Circuit) as well as connectorized form. Switching speeds as low as 15 nanoseconds are available. The M.I.C. units are packaged in hermetic DIP configurations, while the connectorized units have SMA connectors for convenient cable attachment.

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Nanosec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Termination Ohms	Package
SPST												
3-150	3-150	DS0111	25	40	1.0	+6	1.25	+5	90	TTL	50	14 Pin DIP
10-200	5-400	DS0050	25	50	1.5	+10	1.25	+5	100	TTL	50	14 Pin DIP
10-200	10-300	DS0235	25	60	2.5	+16	1.25	+5	230	TTL	50	.750 Sq. 14 Pin Plug In
100-500	70-700	DS0141	25	50	3.0	+17	1.4	+5	150	TTL	Open	14 Pin DIP
SP2T												
1-100	1-150	DS0042-10	40	60	1.0	+6	1.25	+5	100	TTL	Open	14 Pin DIP
3-300	1-500	DS0252	15	45	1.5	+10	1.25	+5	170	TTL	50	14 Pin D DIP
10-200	10-300	DS0042-100	40	60	1.5	+6	1.4	+5	100	TTL	Open	14 Pin DIP
10-350	10-500	DS0108	30	25	1.5	+15	1.25	+5	180	TTL	50	14 Pin DIP
20-300	20-500	DS0158	30	25	1.25	+15	1.25	+5	130	TTL	50 or Ground	14 Pin DIP
100-500	70-700	DS0142	25	45	2.5	+17	1.5	+5	200	TTL	Open	16 Pin D DIP
DUAL SP2T												
10-100	10-200	DS0241	50	40	.8	+10	1.15	+5	200	TTL	50	16 Pin D DIP

CONNECTORIZED HIGH SPEED SWITCHES

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Nanosec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Termination Ohms	Connectors	Size
SPST													
10-200	5-300	100C1041	25	50	1.5	+10	1.25	+5	100	TTL	50	SMA	2x1.5x.5
20-300	10-300	100C1051	35	55	2.0	+10	1.4	+5	200	TTL	50	SMA	2x2x.48
300-350	100-500	10DC1570	50	90	3.0	+10	1.4	+5	270	TTL	50	SMA	1.5x2x.54
SP2T													
1-100	1-100	100C1042	15	60	.8	+8	1.2	+5	130	TTL	Open	SMA	1.5x1.5x.5
2-500	2-600	100C1052	40	40	1.5	+10	1.4	+5	160	TTL	50	SMA	2x2x.48
DP4T													
20-200	10-200	100C1024	50	55	.5	+10	1.25	+5	150	TTL	Open	SMA	3x1.5x.67

DAICO HIGH POWER RF SWITCHES

The Daico High Power RF Switches handle peak power to 3000 watts with CW power to 1000 watts. Frequency ranges from 1-2000 MHz are available. These High Power Diode Switches have been used successfully in numerous CW and pulse systems.

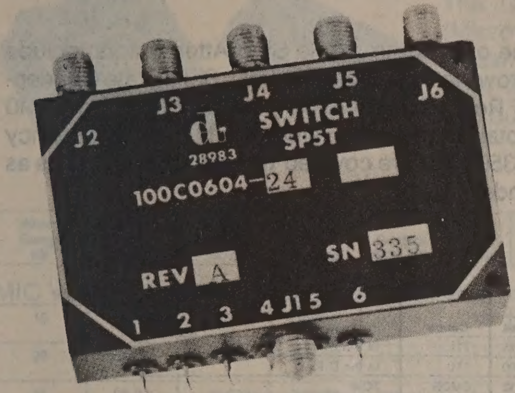
CONNECTORIZED HIGH POWER SWITCHES

Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Isolation dB Min.	Insertion Loss dB Max.	RF Power Watts CW	RF Power Watts Peak	VSWR Max.	DC Power Volts	DC Power mA	Control	Termination Ohms	Connectors	Size
SP2T														
20-80	15-150	100C1142	20	60	.25	1000	3000	1.15	+5 −300	250 15	TTL	Ground	N	4x5x2.75
20-100	10-200	100D1078	20	70	.5	250	500	1.15	+5 −15	350 15	TTL	Open	N	6x3x2.5
20-500	20-500	100C1592	10	55	.75	20	100	1.25	+5 −15	220 20	TTL	Ground	SMA	2.75x3x1.4
100-500	50-500	100C1492	30	45	.4	100	500	1.25	+5 −50	300 10	TTL	Ground	N	4x4.75x1.3
100-1400	70-1500	100C1032	10	40	.5	20	250	1.3	+5 −5	160 160	TTL	Open	SMA, NC, TNC	2.75x1.75x1
950-1225	925-1250	100C0932	10	23	.5	20	2000	1.25	+5 −15	65 25	TTL	Ground	N	3x4x1.38
1060-1100	1060-1100	100C1246	10	35	1.0	10	2000	1.4	+5 −70	300 5	TTL	50	SMA	3x3x1.12
SP4T														
1700-2000	1700-2000	100D1004	30	30	1.0	220	2000	1.4	+5 −150	700 4	TTL	Open	TNC	6x3.5x2.13
TRANSMIT/BY PASS														
225-400	225-400	100C1545	50	30	.15	600	2000	1.25	+5 −200	800 25	TTL	Open	TNC	7x5.25x2.5
TRANSMIT/RECEIVE														
Xmtr. 100-400 Rcvr.	100-400	100D1569	15	30 80	.2 .8	1000 .02	1500 10	1.25	125 VAC 400 Hz	100	Line Rcvr.	Ground	SC TNC	5x6x3.16

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

DAICO

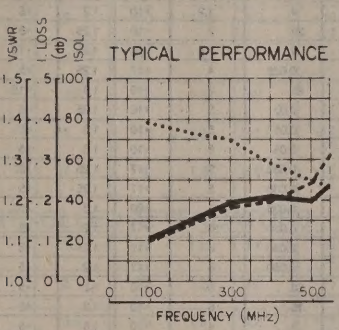
RF RELAYS



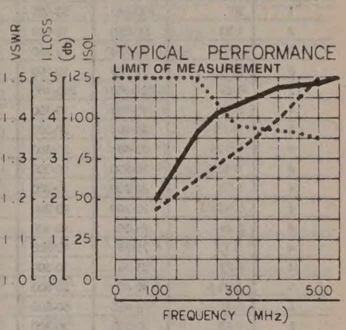
Daico Industries RF relays employ hermetically sealed switching elements which provide extreme resistance to the severe environments encountered in military aircraft and communications systems, including 20 g's vibration to 3 kHz, 80 g's shock and altitude in excess of 100,000 ft. A continual test and evaluation program assures switch performance in excess of 20 million operations. These units are operable at extremely low current levels and may be ordered with 6-, 12-, 18- or 24-volt coils.

LEGEND
.... Isolation
— — — — Insertion Loss
———— VSWR

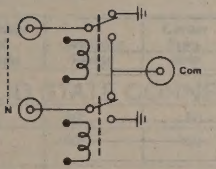
STANDARD



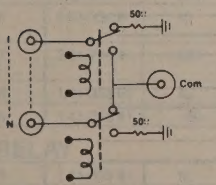
HIGH ISOLATION



RF RELAYS DC-500 MHz 50 watts cw SMA Connections SIZE MATRIX	 SPST	 SP2T	 SP3T	 SP4T	 SP5T	 SP6T	 TRANS.
STANDARD		100C0073 1x1½x.56	100C0254 1½x1½x.63	100C0259 2x1½x.63	100C0604 2½x1½x.69	100C0605 3x1½x.69	100C0347 2x1½x.87
HIGH ISOLATION		100C0109 1½x1½x.63	100C0630 1½x1¾x1.5	100C0104 1½x1¾x1.5			100C0608 1¼x1¼x1.3
STANDARD 50 OHM TERMINATION	100C0610 1x1½x.55	100C0611 1½x1½x.63	100C0612 2x1½x.63	100C0613 2½x1½x.63	100C0614 3x1½x.63	100C0615 3½x1¾x.63	
HIGH ISOLATON & 50 OHM TERMINATION	100C0609 1x1½x.50	100C0350 1½x1½x.75	100C0285 2x1½x.75	100C0485 2½x1½x.75			



Switching Speed: 5 millisec. max
RF Power: 50W CW, 50W Peak
Drive Current: 24 mills nom. at 24 VDC. Other coils available include 6, 12, 18 VDC.



Units can be provided with Fail Safe (no power) to a through path.

Can be operated directly from TTL with integrated circuit 75450 Dual Driver, 54 45 Decoder or equivalent.

ALSO AVAILABLE

Type	Part Number	Frequency	Isolation	Connector
SP2T	100C0878	DC-1250 MHz	45 dB	SMA
SP2T	100C0076	DC-400 MHz	45 dB	BNC or TNC
SP2T	100C0942	DC-100 MHz	70 dB	75 Ohm SMC
SP2T	100C1003	DC-1250 MHz	45 dB	SMA or BNC or TNC
SP3T	100C1015	DC-450 MHz	50 dB	BNC or TNC
SP4T	100C0954	DC-100 MHz	55 dB	75 Ohm TNC
SP4T	100C1423	DC-500 MHz	45 dB	BNC or TNC
SP6T	100C1026	DC-450 MHz	45 dB	BNC or TNC or SMA
SP7T	100C1094	DC-200 MHz	50 dB	SMA
SP8T	100C1159	DC-200 MHz	50 dB	SMA
2P4T	100C0368	DC-250 MHz	100 dB	SMA
14P2T	100D0872	DC-200 MHz	60 dB	SMA
14P4T	100D0873	DC-500 MHz	40 dB	SMA

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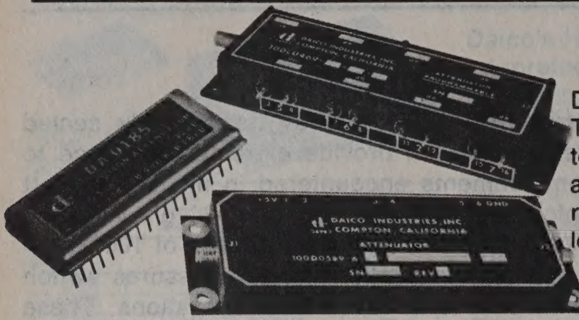
DAICO

STEP ATTENUATORS



Daico's complete line of Programmable Step Attentuators include Thin Film M.I.C. (Microwave Integrated Circuits), Solid State Connectorized, as well as RF Relay Control. Binary steps from 1 through 10 are available with total attenuation values to 111 dB. Frequency ranges from DC to 2350 MHz are covered with switching speeds as low as 25 nanoseconds.

MIC STEP ATTENUATORS

Number of Steps	Available Range dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Package
1	24	25-35	7-200	DA0130	0.04	2.	+10	1.2	+5	75	TTL	14 Pin DIP
1	24	25-35	10-100	DA0188	0.05	3.	+17	1.2	+5	100	TTL	14 Pin DIP
1	4 or 8 or 16	50-500	50-500	DA0240	10.	1.2	+10	1.2	+15	12	CMOS	TO-8
1	20	140-160	10-700	DA0491	5.	1.2	+10	1.5	+15	5	CMOS	14 Pin DIP
1	20	200-240	50-500	DA0236	4.	1.2	+10	1.2	+5	8	CMOS	TO-8
2	1-33	20-250	10-500	DA0351	20.	2.	+10	1.25	+5	12	CMOS	14 Pin DIP
2	.25/40	20-250	20-250	DA0051	1.	1.8	+10	1.25	+15	6.5	CMOS	14 Pin DIP
2	8-16	20-200	10-300	DA0147	0.035	4.	+17	1.25	+5	100	TTL	14 Pin D DIP
2	8-24	250-460	250-460	DA0230	25.	2.	+10	1.3	+15	10	CMOS	16 Pin DIP
4	2-30	10-100	10-100	DA0104	0.05	5.	+10	1.35	+5	240	TTL	38 Pin Plug In 1.998 x .988
4	.1-1.5	20-40	20-300	DA0264	0.05	5.	+10	1.3	+5	175	TTL	24 Pin D DIP
4	1.6-24	20-40	20-300	DA0265	0.05	5.	+10	1.3	+5	165	TTL	24 Pin D DIP
4	.5-32.6	20-200	10-300	DA0146	0.035	5.	+17	1.25	+5	200	TTL	24 Pin D-DIP
4	1-15	20-200	10-300	DA0145	0.035	5.	+17	1.25	+5	200	TTL	24 Pin D DIP
4	1.5-22.5	20-200	10-300	DA0129	0.035	4.	+20	1.3	+5	200	TTL	24 Pin D DIP
4	2-24	25-35	10-300	DA0181	0.050	6.	+17	1.2	+5	200	TTL	24 Pin D DIP
4	.5-7.5	25-35	10-300	DA0186	0.050	6.	+17	1.2	+5	200	TTL	24 Pin D DIP
4	8-32	25-35	10-300	DA0187	0.050	6.	+17	1.2	+5	200	TTL	24 Pin D DIP
5	.5-15.5	40-80	20-500	DA0245	20.	5.	+10	1.5	+5	10	CMOS	24 Pin D DIP
5	1-31	345-425	50-500	DA0178	15.	6.	+10	1.3	+5	6	CMOS	24 Pin D DIP
6	1-63	30-300	30-300	DA0204	1.	4.	+10	1.5	+5	250	TTL	38 Pin Plug In .998 x 1.988
6	1-63	40-150	10-700	DA0296	0.050	8.	+10	1.35	+5	500	TTL	38 Pin Plug In .998 x 1.988
6	1-63	45-75	10-300	DA0376	1.	5.	+10	1.35	+5	600	TTL	38 Pin Plug In .998 x 1.988
7	.5-63.5	30-500	30-500	DA0285	20.	6.	+10	1.35	+5 to +15	30	CMOS	38 Pin Plug In .998 x 1.988
7	.5-63.5	30-500	30-500	DA0295	20.	6.	+10	1.35	+5	50	TTL	38 Pin Plug In .998 x 1.988
7	.1-12.7	45-75	10-300	DA0375	0.035	3.5	+10	1.35	+5	540	TTL	38 Pin Plug In .998 x 1.988
7	.5-63.5	45-75	10-300	DA0377	0.035	5.8	+10	1.35	+5	640	TTL	38 Pin Plug In .998 x 1.988

RF RELAY STEP ATTENUATORS

Number of Steps	Standard Range* dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Millisec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.		Connector	Size
1	24	30-300	10-1000	100C1629	5.	0.6	+33	1.2	RF Relay Attenuators Available With 6, 12, 18, or 24 Volt Coils	SMA	1 x 1.5 x .65
2	16-48	DC-500	DC-500	100C1428	5.	1.	+20	1.2		SMA	1.5 x 1.5 x .63
3	10-30	DC-1000	DC-1000	100C0994	5.	0.5	+33	1.4		SMA	2.75 x 2 x .88
4	2-30	DC-500	DC-500	100D0809-4	5.	3.5	+20	1.2		SMA, BNC, TNC	1.5 x 3.5 x .88
5	1-32	DC-500	DC-500	100D0809-5	5.	3.5	+20	1.2		SMA, BNC, TNC	1.5 x 3.5 x .88
5	1-31	DC-500	DC-500	100C1427	5.	2.	+20	1.2		SMA	3 x 1.5 x .63
6	1-63	DC-200	DC-400	100C0469 6 Bit	5.	2.5	+20	1.3		SMA	1.75 x 5.75 x .88
7	.5-63.5	DC-200	DC-400	100C0469 7 Bit	5.	2.5	+20	1.3		SMA	1.75 x 5.75 x .88
7	1-63	DC-400	DC-400	100D0712	5.	3.5	+20	1.25		SMA	1.75 x 5.75 x .88
8	1-127	DC-200	DC-400	100D0469 8 Bit	5.	2.5	+20	1.3		SMA	1.75 x 5.75 x .88
9	1-106	DC-15	DC-15	100C1403 TTL Control	5.	0.8	+33	1.2		BNC	5.75 x 1.75 x 1.25
10	1-111	DC-500	DC-500	100C1426	5.	3.5	+20	1.3		SMA	4.25 x 1.5 x 2.25

SOLID STATE CONNECTORIZED STEP ATTENUATORS

Number of Steps	Standard Range* dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power Volts	DC Power mA	Control	Connector	Size
2	3-9	20-300	20-500	100D0589-2	1.	1.	+13	1.35	+5	70	TTL	SMA	1.75 x 2.5 x .5
3	6-42	30-300	10-1000	100C1628	1.	2.	+10	1.5	+5	170	TTL	SMA	1.75 x 3.75 x .5
4	2-24	25-35	10-300	100C1418	0.05	6.	+17	1.2	+5	250	TTL	SMA	2 x 1.5 x .53
4	1-15	20-300	20-500	100D0589-4	1.	2.	+13	1.35	+5	140	TTL	SMA	1.75 x 3.75 x .5
6	1-63	20-300	20-500	100D0589-6	1.	3.	+13	1.35	+5	210	TTL	SMA	1.75 x 5.25 x .5
6	1-63	200-400	200-400	100D1513	1.	10.	+20	1.35	+5	60	TTL	SMA	10 x 3.25 x 1.06
6	1-63	1128-2350	1128-2350	100D1071	0.5	10.	+10	1.5	+5 -5	1 Amp 1 Amp	TTL	SMA	7 x 6.5 x 2.19
7	.5-63.5	30	10-300	100D1350	0.025	12.	+16	1.2	+5	500	TTL	SMA	1.75 x 3.5 x .4
7	.5-63.5	30-500	20-1000	100C1585	20.	6.	+13	1.35	+5 to +15	25	CMOS	SMA	1.75 x 3 x .54
7	.5-63.5	30-500	20-1000	100C1595	20.	6.	+13	1.35	+5	50	TTL	SMA	1.75 x 3 x .54
8	.5-63.5	20-300	20-300	100D1438	1.	3.5	+13	1.3	+5	300	TTL	SMA, BNC, TNC, N	6 x 3 x 1.18

* In addition to the standard ranges listed, most attenuators available with the following pad values: .1, .2, .4, .5, .8, 1, 1.6, 2, 3.2, 4, 6.4, 8, 12.8, 16, 32.

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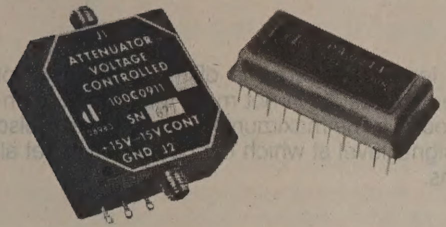
For More Information. Circle No. 411

VOLTAGE CONTROLLED ATTENUATORS DAICO



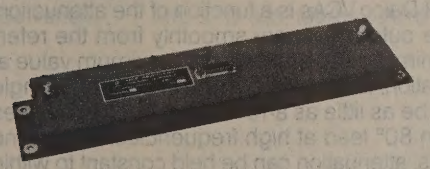
The Daico Voltage Controlled Attenuators are available both as M.I.C. (Microwave Integrated Circuits) as well as in Solid State Connectorized form. Linearity of ±.75 dB from best straight line is achieved with frequency ranging from 10 to 1300 MHz. Constant impedance of 50 ohms is maintained at input and output ports over full attenuation range. VSWR over band is 1.25 typical.

Atten. Range dB	Spec. Freq. MHz	Usable Freq. MHz	Part Number	Control Volts DC	Atten. Slope dB/Volt	Slew Rate dB/ Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	Line-arity dB	DC Power		Con-nector	Size
											Volts	mA		
MIC VOLTAGE CONTROLLED ATTENUATORS														
18	20-300	20-700	DA0035	0 to +5	6.5	6.	1.5	+10	1.25	±0.8	+15 -15	25 25	—	14 Pin DIP
28	558-568	30-1300	DA0260	0 to +5	7.	3.	5.	+10	1.7	±2.	+15 -15	60 80	—	1 x 1 Planar 13 Leads
35	25-37	20-300	DA0308	0 to +5	15.	4.5	3.	+10	1.25	±0.5	+15 -15	40 50	—	14 Pin DIP .400 Pin Rows
40	20-300	20-500	DA0098	0 to +5	15.	6.	2.	+10	1.35	±2.	+15 -15	40 50	—	14 Pin DIP .400 Pin Rows
40	100-300	100-300	DA0408	0 to +5	15.	6.	3.5	+15	1.25	±2.	+15 -15	30 40	—	18 Pin D DIP
40	50-1300	50-1300	DA0243	0 to +5	13.	3.	3.5	+10	1.5	±2.	+15 -15	60 80	—	1 x 1 Planar 13 Leads
Dual Section 20/Section	80-120	80-120	DA0138	0 to +5	6.5	6.	1.	+10	1.25	±1.	+15 -15	40 60	—	28 Pin Plug In .58 x 1.18
Dual Section 20/Section	80-120	80-120	DA0244	0 to +5	6.8	6.	1.	+10	1.25	±0.75	+15 -15	60 80	—	28 Pin Plug In .58 x 1.18
SOLID STATE CONNECTORIZED VOLTAGE CONTROLLED ATTENUATORS														
18	20-700	20-300	100C0911	0 to +5	6.5	6.	1.5	+10	1.25	±1.	+15 -15	25 25	SMA	1.5 x 1.5 x .69
40	20-300	20-700	100C0912	0 to +5	15.	6.	2.	+10	1.35	±2.	+15 -15	40 50	SMA	2 x 1.5 x .75
40	50-1300	50-1300	100C1521	0 to +5	13.	3.	3.5	+10	1.5	±2.	+15 -15	60 80	SMA	1.5 x 2 x .43
Dual Section 20/Section	30-200	30-200	100C1522	0 to +5	6.5	6.	1.	+10	1.25	±0.75	+15 -15	60 80	SMA	1.5 x 2 x .54
60	60	10-200	100C1463	0 to +5	19.5	6.	3.	+20	1.5	±4.	+15 -15	75 85	SMA	3 x 2.38 x .75

PHASE COMPENSATED VOLTAGE CONTROLLED ATTENUATORS

Atten. Range dB	Spec. Freq. MHz	Usable Freq. MHz	Phase Stability Degrees	Part Number	Control Volts DC	Atten. Slope dB/Volt	Slew Rate dB/ Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	Line-arity dB	DC Power		Con-nector	Size
												Volts	mA		
40	150-250	150-250	10	100C1575	0 to +5	15	6	4	+15	1.25	±2	+15 -15	40 40	SMA	1.5 x 2 x .6

DAICO PHASE SHIFTERS



Daicos Phase Shifters utilize either solid state or RF relay switching. Steps from 1 through 9 are available, allowing from 1.41° to 718.61° phase shift. Switching speed as low as 50 nanoseconds are obtainable.

Number of Steps	Available Range	Center Freq. MHz	Usable Freq. MHz	Part Number	Switching Speed Microsec.	Insertion Loss dB Max.	RF Power dBm	VSWR Max.	DC Power		Control	Connector	Size
									Volts	mA			
SOLID STATE CONNECTORIZED													
1	180°	60	40-80	100C1146	5.	1.3	+7	1.2	+5	40	TTL	SMA	2 x 1.5 x .94
1	180°	350	100-500	100C1157	10.	0.8	+37	1.3	+5 -15	200 5	TTL	SMA	2.5 x 2.5 x 1
6	5.63-354.8	660	640-680	100C0792	5.	4.	+12	1.2	+5	250	TTL	SMA	3 x 3 x .72
6	5.63-354.8	fo	20-300	100D0896	4.	4.	+10	1.5	+5	375	TTL	SMA, TNC, BNC	11.5 x 3 x 1.13
7	2.81-714.4	1080	960-1215	100C1140	0.5	4.	+10	1.7	+5 -5	90 90	TTL	SMA	9 x 6 x 1.5
8	1.41-358.61	fo	20-300	100D0898	4.	5.	+10	1.5	+5	375	TTL	SMA	3 x 14.5 x 1.13
8	1.41-358.61	60	55-65	100D1187	0.05	14.4	+10	1.5	+5	1.45A	TTL	SMA	3 x 14.5 x 1.13
RF RELAY													
8	1.41-358.61	fo	30-300	100D0888	5.	2.5	+20	1.3	RF Relay Phase Shifters Available With 6, 12, 18, or 24 Volt Coils			SMA	14.5 x 3 x 1.13
9	1.41-718.61	70	65-75	100D1433	5.	3.	+20	1.2				SMA	14.5 x 3 x 1.13

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

DAICO PERFORMANCE NOTES

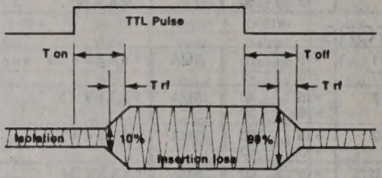
SPECIFICATION FREQUENCY vs. USABLE FREQUENCY

Although a device is designed for optimum characteristics over a specified frequency, the part is functional with slight performance reduction over a broader frequency range. This broader band is the Usable Frequency.

SWITCHING SPEED

A review of the adjacent figure will reveal that the switching time T_{on} is measured from the 50% point of the leading edge of the square wave control (TTL, CMOS or ECL) to the 90% point of the leading edge of the resultant RF envelope. Similarly, T_{off} is measured from the 50% point of the trailing edge of the square wave control pulse to the 10% point of the trailing edge of the resultant RF envelope. Switching speed is defined as the greater of these two values.

Of specific interest is the RF switching envelope which is defined as T_{rf} from 10-90% of the RF envelope. Systems requiring excessively high speed operation occasionally program the switch operation with a delay or anticipatory circuit to be able to accommodate only the T_{rf}. Values of five nanoseconds are readily available.



TRANSIENTS

During the switching of one part to another, video transients are incurred with characteristics that are occasionally disturbing to RF components following the switch. Daico Industries has over the years developed balanced designs which will provide less than 10-15 millivolts of in-band transients at switching speeds (T_{rf}) of 5-10 nanoseconds. Where lower transients are required during the switching period, it is recommended that slow switching speeds be tolerated or discussed with the manufacturer.

ISOLATION

The minimum isolation in dB is the worst case condition over the specification frequency between any two ports, with all other ports terminated in 50 ohms.

INSERTION LOSS

Insertion loss is defined as the worst case path loss between the input port and any output port in the "ON" state with all other ports "OFF" and terminated in 50 ohms. Insertion loss for attenuators is measured with zero or minimum attenuation level from the input to output and is as the reference level for all attenuation values.

NOISE FIGURE

Experience has shown that the Noise Figure (N.F.) of a switch may be assumed to be equal to the Insertion Loss. This assumption can be made without introducing substantial error.

RF POWER

The RF power level (measured in dBm) is the level of CW input power that results in not more than 0.1 dB compression at the output. The maximum RF power level is also the maximum signal level at which the device will meet all RF specifications.

VSWR

The maximum VSWR in a 50 ohm system applies only to the thru condition, unless otherwise specified. Devices with open or short to ground terminations exhibit total refection.

DC POWER

The typical current for the maximum regulated DC supply voltage is listed. Exceeding the DC voltage may damage the device. Nominal ±0.25V.

CONTROL

The driver control circuitry is listed as either TTL or CMOS. TTL devices may be driven directly from system TTL outputs. 5 volt CMOS devices may be driven directly from system TTL outputs with a pull up resistor to +5 volts. Hi-voltage CMOS devices (8 to 15 volts) may be driven with TTL using a pull up resistor to VCC with an open collector transistor, or the 5400 series of Hi-voltage TTL compatible buffers. CMOS control lines should be pulled up to VCC to prevent possible damage to internal drivers.

RF relays may be made TTL compatible using the SN55450 series of relay drivers. See RF DESIGN AIDS.

TERMINATION

Internally terminated switches are so defined.

PACKAGE OR SIZE

The outline configuration is given in inches or standard DIP configurations. The DIP package has .100" pin spacings with .300" pin rows. A DDIP has .600" pin rows.

PHASE SHIFT OF VOLTAGE CONTROLLED ATTENUATORS

The phase shift of Daico VCAs is a function of the attenuation. The phase at the output will vary smoothly from the reference value at minimum attenuation to its maximum value at maximum attenuation. The maximum phase shift for a single section VCA can be as little as a 10° lead at low frequencies to as much as an 80° lead at high frequencies. With some effort the phase vs. attenuation can be held constant to within +2° to +5° (again depending on frequency) at an increase in price of about 20% and some NRE depending upon quantity. We will be pleased to quote on any specific applications.

STEP ATTENUATORS

Actual attenuation value and associated accuracy applies with actual insertion loss subtracted from total attenuation value.

TEMPERATURE

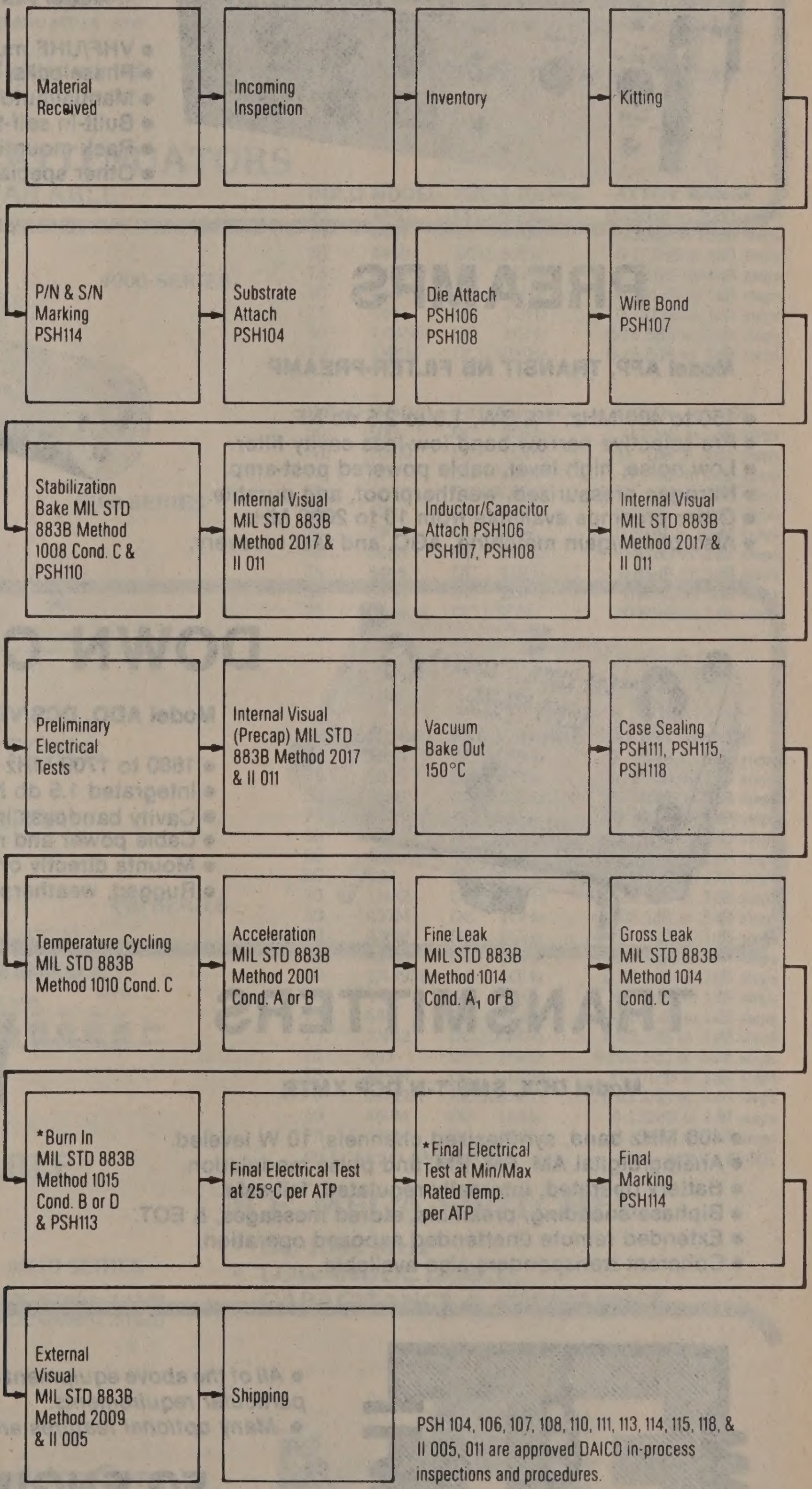
Specifications are applicable from −55°C to +85°C. Some derating of performance may occur when operated over the MIL temperature of −55°C to +125°C.

DAICO INDUSTRIES, INC. / 2351 E. DEL AMO BLVD. / COMPTON, CA 90220 / (213) 631-1143 / TWX 910-346-6741

DAICO

QUALITY ASSURANCE

TYPICAL MIC ASSEMBLY CYCLE


Material Received
Incoming Inspection
Inventory
Kitting
P/N & S/N Marking PSH114
Substrate Attach PSH104
Die Attach PSH106 PSH108
Wire Bond PSH107
Stabilization Bake MIL STD 883B Method 1008 Cond. C & PSH110
Internal Visual MIL STD 883B Method 2017 & II 011
Inductor/Capacitor Attach PSH106 PSH107, PSH108
Internal Visual MIL STD 883B Method 2017 & II 011
Preliminary Electrical Tests
Internal Visual (Precap) MIL STD 883B Method 2017 & II 011
Vacuum Bake Out 150°C
Case Sealing PSH111, PSH115, PSH118
Temperature Cycling MIL STD 883B Method 1010 Cond. C
Acceleration MIL STD 883B Method 2001 Cond. A or B
Fine Leak MIL STD 883B Method 1014 Cond. A1 or B
Gross Leak MIL STD 883B Method 1014 Cond. C
*Burn In MIL STD 883B Method 1015 Cond. B or D & PSH113
Final Electrical Test at 25°C per ATP
*Final Electrical Test at Min/Max Rated Temp. per ATP
Final Marking PSH114
External Visual MIL STD 883B Method 2009 & II 005
Shipping

PSH 104, 106, 107, 108, 110, 111, 113, 114, 115, 118, & II 005, 011 are approved DAICO in-process inspections and procedures.

*Optional Testing

ADDITIONAL ENVIRONMENTAL TESTING AVAILABLE

Vibration:	MIL STD 202 Method 204 64g RMS, 1.5 hrs. each axis
Mechanical Shock:	MIL STD 883 Method 2002 Condition C, 3000g Y axis
Moisture Resistance:	MIL STD 883 Method 1004
Salt Atmosphere:	MIL STD 883 Method 1009
Thermal Shock:	MIL STD 883 Method 1011 Condition B, 15 cycles
Lead Integrity:	MIL STD 883, Method 2004 Condition B_2
Solderability:	MIL STD 883 Method 2003 260°C±10°C
Resistance to Solvents:	MIL STD 883, Method 2015

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For More Information. Circle No. 411

FG-7200 DUAL CH PL RCVR

RECEIVERS

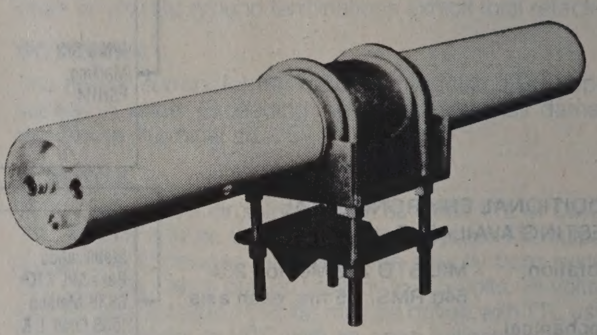
Model PLR, DCS/VISSR/WEFAX PL RCVR

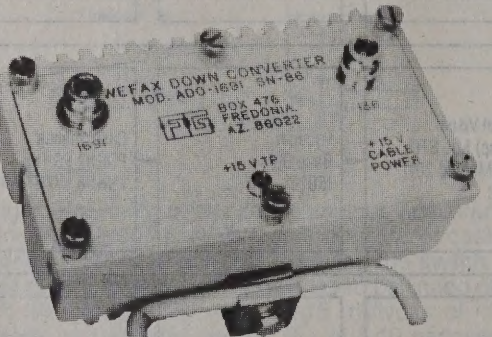
- VHF/UHF multi-channel, function, and purpose.
- Phaselocks, translates, and demodulates PM/FM.
- Manual/auto sweep acq., visual/aural monitors.
- Built-in self-test, computer controllable.
- Rack mounting, modular, sturdy, and reliable.
- Other special purpose receivers also available.

PREAMPS

Model AFP, TRANSIT NB FILTER-PREAMP

- 150 to 400 MHz, 1% BW, 1.5 to 2.5 db NF.
- Pre-selective narrow-band low-loss cavity filter.
- Low noise, high level, cable powered post-amp.
- Nitrogen pressurized, weatherproof, and durable.
- Other preamps available from 10 to 2000 MHz.
- Also phase/gain matching, AGC, and fast recovery.





DOWN CONVERTERS

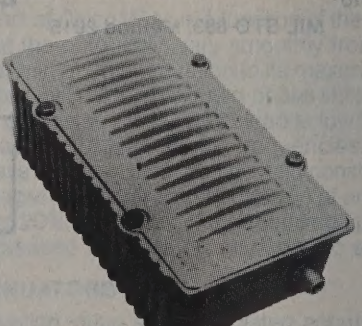
Model ADO, DCS/VISSR/WEFAX/HRPT DN CONV

- 1680 to 1700 MHz in, 70 or 135 MHz out.
- Integrated 1.5 db NF LNA, high level IF.
- Cavity bandpass image and L.O. filters.
- Cable power and remote excitation.
- Mounts directly on antenna feed.
- Rugged, weatherproof, and reliable.

TRANSMITTERS

Model DCX, SMS/T-N DCP XMTR

- 400 MHz band, synthesized channels, 10 W leveled.
- Analog/digital AM, FM, PM, and pulse modulation.
- Battery operated, internally regulated, fail-safe.
- Biphase encoding, preamble, stored messages, & EOT.
- Extended remote unattended exposed operation.
- Coherent transponders also available.



- *All of the above equipment can be custom modified to meet your particular requirements.*
- *Many optional features are available.*

FG ENGINEERING CO.

BOX 476 • FREDONIA, AZ • 86022
(602) 643-7375

For More Information. Circle No. 412

HIGH QUALITY ATTENUATORS!

Kay switch attenuators are constructed with patended switches using teflon housings and gold plated silver contacts. These high quality switches have been field proven for over 10 years. All Kay attenuators are equipped with precision resistors.

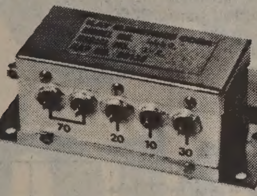
Kay rotary switch attenuators are gold plated printed circuit contact with dual contacts at each connector. This design provides superior electrical contact.

Kay has designed over 200 special attenuators for OEM applications using our extensive design capabilities. We can adapt our current line to fit specific requirements.

Please call or write for our complete attenuator catalog.

OEM PROGRAMMABLE ATTENUATORS

- LOGIC ADAPTORS AVAILABLE



4000 SERIES

IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	4440	DC-1.5GHz	0-130dB in 10dB steps
75	4447	DC- 1GHz	0-130dB in 10dB steps
50	4450	DC-1.5GHz	0-127dB in 1dB steps
75	4457	DC- 1GHz	0-127dB in 1dB steps
50	4460	DC-1.5GHz	0- 31dB in 1dB steps
75	4467	DC- 1GHz	0- 31dB in 1dB steps
50	1/4450	DC- 1GHz	0-16.5dB in .1dB steps
75	1/4457	DC-750MHz	0-16.5dB in .1dB steps

OEM STEP ATTENUATORS

- HIGH RELIABILITY
- DUAL CONTACT

MODEL 5436 ATTENUATOR
KAY

5400 SERIES

500 SERIES

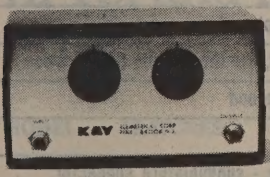
IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	500	DC- 2GHz	0-10dB in 1dB steps
50	1/500	DC- 1GHz	0- 1dB in .1dB steps
75	510	DC-1.5GHz	0-10dB in 1dB steps
75	1/510	DC-500MHz	0- 1dB in .1dB steps
50	520	DC- 2GHz	0-70dB in 10dB steps
75	530	DC-1.5GHz	0-70dB in 10dB steps
50	5435	DC- 1GHz	0-81dB in .1dB steps
75	5445	DC- 1GHz	0-81dB in .1dB steps
50	5436	DC- 2GHz	0-80dB in 1dB steps
75	5446	DC-1.5GHz	0-80dB in 1dB steps

BENCH STEP ATTENUATORS

- HIGH ACCURACY
- POSITIVE REPEATABILITY
- COMPACT DESIGN

400 SERIES

Attenuator
Attenuator

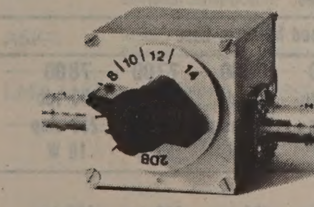


5000, 5100 SERIES

IMP. Ω	MODEL	FREQ. RANGE	ATTEN. RANGE
50	5050	DC- 1GHz	0- 81dB in .1dB steps
75	5075	DC- 1GHz	0- 81dB in .1dB steps
50	5150	DC- 2GHz	0- 80dB in 1dB steps
75	5175	DC-1.5GHz	0- 80dB in 1dB steps
50	430	DC- 1GHz	10- 51dB in 1dB steps
50	431	DC- 1GHz	0- 41dB in 1dB steps
50	432	DC- 1GHz	0-101dB in 1dB steps
50	1/432	DC-500MHz	0-22.1dB in .1dB steps
50	437M	DC- 1GHz	0-102.5dB in .5dB steps
50	438M	DC- 1GHz	0- 41dB in 1dB steps
50	439M	DC- 1GHz	0-101dB in 1dB steps
50	1/439M	DC- 1GHz	0-22.1dB in .1dB steps
75	441	DC- 1GHz	0- 41dB in 1dB steps
75	442	DC- 1GHz	0-101dB in 1dB steps
75	1/442	DC-500MHz	0-22.1dB in .1dB steps
75	447	DC- 1GHz	0-102.5dB in .5dB steps
75	449M	DC- 1GHz	0-101dB in 1dB steps
75	1/449M	DC-500MHz	0-22.1dB in .1dB steps
50	460M	DC- 1GHz	0-132dB in 1dB steps
75	470M	DC- 1GHz	0-132dB in 1dB steps

90 Ω ALSO AVAILABLE ***M - MINIATURE**

CONTINUOUSLY VARIABLE ATTENUATORS

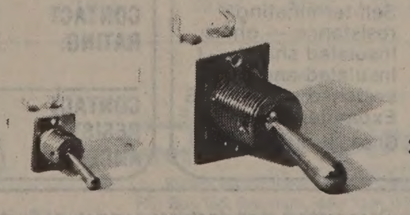


0/400, 0/410 SERIES

0/400 DC-500MHz 1-13dB
0/410 DC-400MHz 2-14dB

R.F. MEGA SWITCHES

- DC-1000 MHz
- LOW INDUCTANCE, CAPACITANCE & RESISTANCE



254 SERIES

0.15pf Between switch arms
0.1pf Between open contacts and switch arm

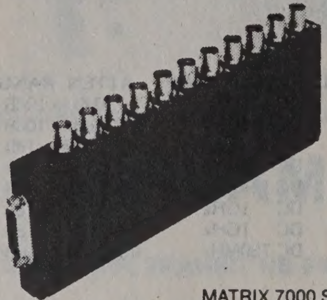
KAY

Kay Elemetrics Corp
13 Maple Avenue
Pine Brook, N.J. 07058
(201) 227-2000

MATRIX

SYSTEMS CORPORATION
5177 NORTH DOUGLAS FIR ROAD
CALABASAS, CALIFORNIA 91302
(213) 992 6776 • TWX 910-494-4975

COAXIAL RELAY MODULE



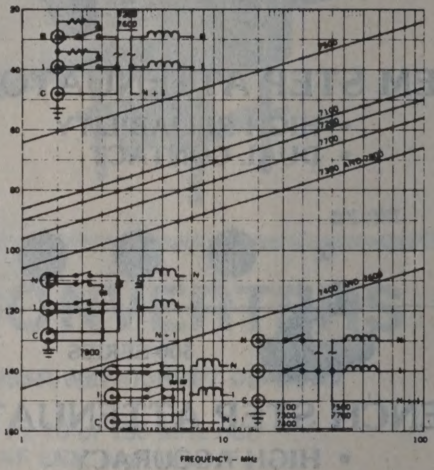
FEATURES

- Two to twenty four throws
- Continuous shield continuity
- Rugged machined aluminum housing
- Crosstalk always less than isolation
- Switchpoints individually field replaceable
- Extremely low EMI
- Low VSWR
- Maitrix configuration easily assembled using 9000 series cross straps
- Signal circuits isolated from control circuitry

MATRIX 7000 Series Switch Modules are designed to maintain coaxial switching continuity over a wide range of critical and high environmental applications. The switch housings are constructed on precision machined aluminum alloy for structural integrity and hard anodized for durability. All signal shield paths are silver plated with covers gasketed for maximum EMI protection. The basic reed switch elements are hermetically sealed in nitrogen filled gas envelopes and employ rhodium plated contacts to insure non-stick operation. Applications for MATRIX 7000 Series include:

— R.F. and I.F. switching where a low VSWR is required .
— CCTV, base band video and pulse switching where low phase distortion and high pulse fidelity are required.
— Applications requiring a high degree of shielding integrity and low contact and induced noise such as pre amp input switching or the switching of high impedance operational amplifier inputs.

Matrix and hybrid switching systems are easily constructed by using Series 9000 (no output), 9100 (one output) or 9200 (two output) push-on cross straps which mate with the BNC connectors on the switch modules. The cross strap output connectors are BNC female type UG 1094/U. The model number of the cross strap is assigned by replacing the two zeros of the series number with the number of inputs desired. For example, a Model 9108 has eight inputs and one output.



SERIES 7000

7100— Standard
7200— Self-terminating
7300— High isolation
7400— Highest isolation
7500— High power
7600— Highest isolation self-terminating
7700— Mercury wetted contacts
7800— Twinax

MODEL NUMBER ASSIGNMENT

7 X XX -X

Series
Number of throws
Coil suppression diodes — DR
TNC connectors — T
Self-terminating resistance — ohms
Insulated shield — I
Insulated and switched shield — IS
Expander output — E
Chassis mount — C

SPECIFICATIONS

FREQUENCY RANGE:	0 - 300MHz
CHARACTERISTIC IMPEDANCE:	50 ohms - 75 ohm optional
SWITCHING CONFIGURATION:	Single or double pole, two thru twenty four throws
SWITCHING SPEED:	Less than one millisecond
ISOLATION:	See graph
CONTROL - CONNECTOR:	28 VDC,30 MA D type - subminiature connector
SIGNAL CONNECTOR:	BNC - UG1094/U, TNC and SMA optional
OPERATING TEMPERATURE AND HUMIDITY RANGE: −30°F to + 150°F, 0 to 98 percent R.H.	
OPERATING SHOCK AND VIBRATION:	50 G's -1MS,2G's p-p 20-2000 Hz
DIMENSIONS:	.625" W × 3.25" H × 1.44" + .625" × Number of throws
MOUNTING:	Three 6-32 tapped holes in base

	7100	7200	7300	7400	7500	7600	7700	7800
CONTACT RATING:	100 vdc .250 amp 10 W	28 vdc .250 amp 3 W	100 vdc .250 amp 10 W	28 vdc .250 amp 3 W	400 vdc 1 amp 15 W	28 vdc .250 amp 3 W	100 vdc 2.0 amp 50 W	100 vdc .250 amp 10 W
CONTACT RESISTANCE:	.150ohm	.300ohm	.300ohm	.300ohm	.060ohm	.300ohm	.050ohm	.300ohm

Matrix Systems Corporation manufactures a variety of Switching Devices. Whether you are Switching VHF, Video, Pulse or Audio or your control requirements are programmable or manual. Give us a call. We specialize in specials. (213) 992-6776

SRA-1
SBL-1X
SBL-1
LMX-113
TFM-2
ASK-1

pick a mixer.

500 KHz to 1 GHz from $3.95

hi-rel and industrial
miniature, flatpack, and low profile

MODEL	FEATURES	Freq. (MHz) LO-RF	Freq. (MHz) IF	†Conversion Loss (dB) one octave bandedge	†Conversion Loss (dB) total range	L-R Isolation (dB) lower bandedge	L-R Isolation (dB) mid range	L-R Isolation (dB) upper bandedge	Price/Qty.
SRA-1*	the world's standard . . . HTRB tested hi-rel 3 year guarantee	.5-500	DC-500	5.5 typ.	6.5 typ.	50 typ.	45 typ.	35 typ.	11.95 (1-49)
TFM-2*	world's tiniest hi-rel mixer only 4 pins for plug-in/flatpack mouting,	1-1000	DC-1000	6.0 typ.	7.0 typ.	50 typ.	40 typ.	30 typ.	11.95 (6-49)
SBL-1	world's lowest cost industrial mixer, only $4.50, metal case	1-500	DC-500	5.5 typ.	6.5 typ.	50 typ.	45 typ.	35 typ.	3.95 (100) 4.50 (10-49)
SBL-1X	industrial grade, rugged all-metal construction	10-1000	5-1000	6.0 typ.	7.0 typ.	50 typ.	40 typ.	30 typ.	5.95 (1-4)
ASK-1	world's smallest DBM flatpack mounting, plastic case	1-600	DC-600	5.5 typ.	6.0 typ.	50 typ.	35 typ.	30 typ.	5.95 (10-49)
LMX-113*	rugged flatpack, hermeticity tested thermal shocked to MIL-STD-202	5-1000	DC-1000	6.5 typ.	7.0 typ.	50 typ.	40 typ.	35 typ.	14.95 (6-24)

***meets MIL-M-28837/1A performance**
units are not QPL listed

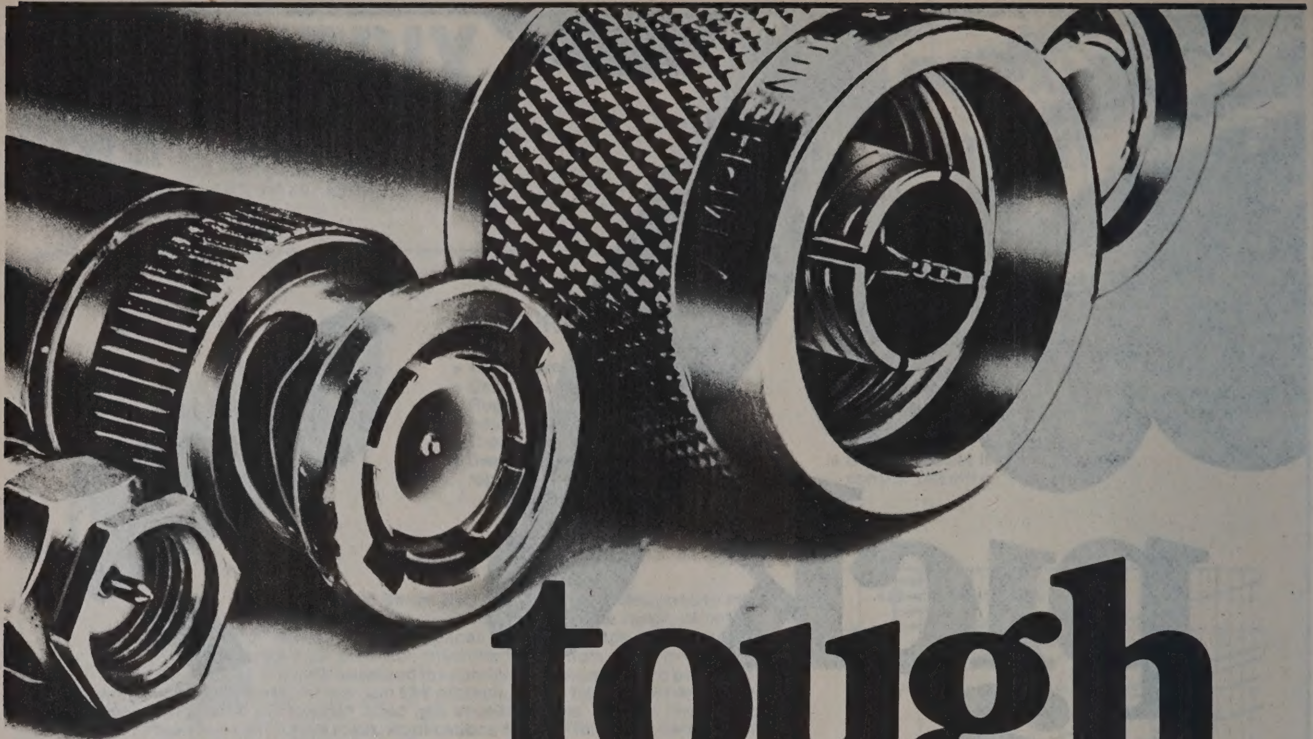
†LO = +7 dBm

CAPD
now available!
computer-automated performance data

finding new ways . . .
setting higher standards

Mini-Circuits
A Division of Scientific Components Corporation
World's largest manufacturer of Double Balanced Mixers
P.O. Box 166, Brooklyn, New York 11235 (718) 934-4500
Domestic and International Telex 125460 International Telex 620156

C74 REV.



tough attenuators

from $11.95 (1-49)

one-piece design defies rough handling

Check these features:

- ✓ Each unit undergoes high-impact shock test
- ✓ Available from 1 to 40 dB
- ✓ DC to 1500 MHz
- ✓ Unexcelled temperature stability, .002 dB/°C
- ✓ 2W max. input power (SMA is 0.5W)
- ✓ BNC, SMA, N and TNC models
- ✓ Immediate delivery, 1-yr. guarantee

NEW!
Precision 50-ohm terminations... only $6.95 (1-24)
DC to 2 GHz, 0.25W power rating, VSWR less than 1.1
BNC (model BTRM-50), TNC (model TTRM-50)
SMA (model STRM-50), N (model NTRM-50)

*Freq. (MHz)	Atten. Tol. (Typ.)	Atten. Change, (Typ.) over Freq. Range		VSWR (Max.)	
		DC-1000	1000-1500	DC-1000 MHz	1000-1500 MHz
DC-1500 MHz	±0.3	0.6	0.8	1.3	1.5

*DC-1000 MHz (all 75 ohm or 30 dB models) DC-500 MHz (all 40 dB models)

MODEL AVAILABILITY

Model no. = a series suffix and dash number of attenuation.
Example: CAT-3 is CAT series, 3 dB attenuation.
■ denotes 75 ohms; add −75 to model no.
● denotes 50 ohms

ATTEN	SAT (SMA)	CAT (BNC)	NAT (N)	TAT (TNC)
1	●	●	●	●
2	●			
3	●	●■	●	●
4	●			
5	●			
6	●	●■	●	●
7	●			
8	●			
9	●			
10	●	●■	●	●
12	●			
15	●			
20	●	●■	●	●
30	●	●	●	●
40	●	●	●	●

PRICING (1-49 qty.): CAT (BNC)..$11.95, SAT (SMA)..$14.95
TAT (TNC)..$12.95, NAT (N)..$15.95

finding new ways...
setting higher standards

Mini-Circuits

A Division of Scientific Components Corporation
World's largest manufacturer of Double Balanced Mixers
P.O. Box 166, Brooklyn, New York 11235 (718) 934-4500
Domestic and International Telex 125460 International Telex 620156

C 92 REV. A

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ordering information *Federal supply code: 15542*

how to order

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information and application engineering data.
Your order may be sent directly to Mini-Circuits or to any of the local sales offices listed.
Prices listed in this catalog are domestic F.O.B. Brooklyn, New York. Mini-Circuits reserves the right to change specifications, models, prices or designs without prior notice and without liability for such changes.

shipping instructions

Shipments can be made by either air or surface carriers. If specific shipping instructions do not accompany the order, Mini-Circuits will specify the carrier to be used.

terms

Net 30 days from date of invoice. If credit is not established with Mini-Circuits, shipments will be made C.O.D. (cash on delivery) or prepaid. When sending prepayments, please include freight.

warranty

Scientific Components Corporation, Mini-Circuits division, warrants each product manufactured by Mini-Circuits to meet all published specifications and to be free from defects in material and workmanship. The Company's liability under this warranty is limited to repair, adjustment and/or replacement of defective parts returned, freight paid by Buyer, to the factory within a period of one year from date of shipment from the factory unless a shorter period is specified.
International customers may ship to the Company's nearest Distributor.
Damage by misuse or abnormal conditions of operation, or evidence of partial or complete disassembly voids this warranty.
SINCE MINI-CIRCUITS HAS NO CONTROL OVER CONDITIONS OF USE, NO WARRANTY IS MADE OR IMPLIED AS TO SUITABILITY FOR CUSTOMER'S INTENDED USE, BEYOND SUCH PERFORMANCE SPECIFICATIONS AS ARE MADE A PART OF THE PURCHASE ORDER. Equipment shipped F.O.B. Mini-Circuits' plant shall become the property of the Buyer upon delivery to carrier. Damage in shipment should be handled by the Buyer directly with the carrier by immediately requesting carrier's inspection upon evidence of damage in shipment.
A fee will be charged to the Buyer to cover the costs of inspection and test of units returned under this warranty and subsequently found to meet specifications or to be faulty for reasons which are not Mini-Circuits' responsibility. This warranty excludes all other warranties expressed or implied. Mini-Circuits shall not be liable for any special, indirect or consequential damages.

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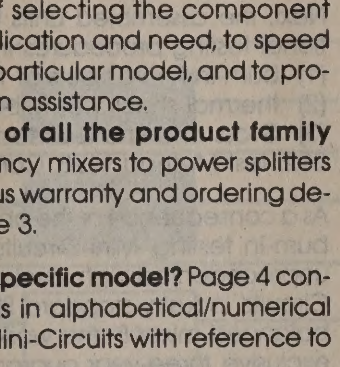
how to use this catalog

Over 1,000 RF/microwave signal-processing components are available to the design engineer from Mini-Circuits. This catalog has been organized to simplify the process of selecting the component best suited to your application and need, to speed location of specs for a particular model, and to provide helpful application assistance.

A complete listing of all the product family groups — from frequency mixers to power splitters to RF transformers — plus warranty and ordering details are found on page 3.

Looking for data on a specific model? Page 4 contains a list of all models in alphabetical/numerical order, available from Mini-Circuits with reference to specific data pages.

For a concise production/test flow diagram illustrating Mini-Circuits quality-control procedures. Turn to pages 6 and 7. Also detailed information on our Hi-Rel, HTRB and TX products for your military, space or rugged industrial applications.



Computer-automated-performance data (CAPD) is a Mini-Circuits' innovation offering the most complete data base for catalog RF signal-processing components. What's involved in CAPD and its benefits towards your new designs are described on pages 8-13.

"Mastering the Mixer Maze"...
Mixer selection, with hundreds of models to choose from, can be confusing. The penalty for improper selection? Overspecify and pay extra; underspecify and face marginal performance. Read pages 14-15 for a clearly-detailed procedure for choosing the optimum mixer for your needs.

Data pages are grouped by product line. Each data page is organized by series within the product line and by models within the series.

Information given includes CAPD data, National Stock Numbers (NSN), equivalent MIL — part numbers, pin connection designations, case styles, and notes to the tables.

Full technical data for each model is given in table form. The tables are arranged by sequence of model number for each series. The various models within a series differentiate from each other by the frequency range they cover. Frequency range is defined in the tables by the lowest frequency fL to the highest frequency fu. For most models, the frequency range is further subdivided into three segments; L = low range, M = mid range, and U = upper range. Each range L, M, U is defined at the bottom of each table in terms of fL and fu.

Mixer selection is primarily determined by selecting a mixer level suitable for the application. Therefore, to aid the designer, frequency mixers are organized in sequence of mixer level — Level 7, 10, 13, 17, 17S, 23, 23S and 27. A Level 7 mixer operates with +7 dBm LO drive, a Level 13 mixer operates with +13 dBm LO drive, etc. For each level mixer, a maximum RF input level for linear operation is specified.

Power splitters are organized in numerical sequence of power split; from 2 way 0°, 2 way 90°, 2 way 180°, 3-, 4-, 5-, 6-, 8-, 12-, 24-, to 48 way 0°.

Case style and dimensions are easy to find... each data page includes a photo of the particular case style for each series and, within the data, there is reference to case style number and outline drawing letter. Turn to pages 58 to 62 for case style dimensions, tolerances and bracket options where applicable.

For example, the SRA-1 mixer detailed on page 16 calls for case A01. The dimensions and outline drawing are given in the table on page 58 and figure A on page 59.

Need Mini-Circuits components in a hurry? Refer to page 63 for a listing of our world-wide network of sales representatives and distributors ready to serve your needs, supply your orders, and answer your questions promptly and courteously.

reliability and hi-rel components

All Mini-Circuits' RF signal-processing components are subjected to rigid quality control procedures starting from raw material procurement through product production and final inspection; the objective—to supply our customers with the finest RF signal-processing components available. Here's a list of some of the procedures taken to insure high-quality performance and product reliability:

A. 100% testing of each diode.

B. 100% testing of each unit.

C. 100% inspection of every solder connection.

D. All transformers bonded to the header for protection against severe shock and vibration.

E. All diodes, resistors and capacitors bonded to the header for protection against severe shock and vibration conditions.

F. Diode and resistor power dissipation derated greater than 50%.

G. All components rated for greater than + 125°C.

H. All transformer leads double wrapped.

I. Heavy coated wire insulation for HiPot/altitude.

J. Completely encapsulated for protection against mechanical shock and vibration as well as temperature shock.

K. Permanent case marking of model number cannot be removed by cleaning agents.

L. Cupro-Nickel case for long-lasting finish especially under salt atmosphere conditions.

Every unit shipped from Mini-Circuits carries a full-year guarantee; in fact, our industry-standard SRA-1 mixer offers an exclusive three-year guarantee.

High-temperature, Reverse-bias (HTRB) testing is an accelerated-life screening test generally reserved for space applications. Here the Schottky and PIN diodes are subjected to a one-volt negative bias at 150°C for 168 hours. The objective of this accelerated aging stress is to force time/temperature-related failures and thus screen out potentially unreliable devices; in conventional "baking" processes, the diode does not experience anywhere near the stress imposed by the HTRB program. The result: highly-reliable Schottky and PIN diodes ready for wiring into assemblies.

Next, the assembled units are subjected to additional testing procedures including
(1) burn-in for 96 hours at 100°C with 8 ma at 1 KHz
(2) thermal shock per MIL-STD 202, Method 107
(3) Gross and fine leak tests according to MIL-STD 202, Test Method 112B, Conditions A and C

As a consequence of the above HTRB, final seal, and burn-in testing, Mini-Circuits components offer an unprecedented high level of reliability. In fact, Mini-Circuits' industry-standard SRA-1 is the only double-balanced mixer in the world to be offered with an exclusive *three-year* guarantee.

TX mixers

For the most critical space, military or industrial applications in hostile environments, Mini-Circuits offers TX mixers. Stringent screening and stressing are applied to the TX mixers which employ TX hermetically-sealed diodes that have passed the following tests per MIL-STD-750:
(1) high-temperature storage for 340 hours at 150°C, Method 1032; (2) thermal shock, Method 1051, Test Condition C (−65°C to +150°C, 10 cycles); (3) constant acceleration, Method 2006, Y1 orientation, 20,000 G's; (4) fine leak, Method 1071, Condition H; (5) gross leak, Method 1071, Condition C; (6) burn-in for 96 hours at 25°C, 75mW/junction at 60 Hz, Method 1038, Condition B.
Those diodes that pass these rigid tests are then electrically tested to ensure that they meet specifications. They are then assembled into TX mixers which are then further exposed to these stress tests: (1)thermal shock, MIL-STD 202, Method 107; (2) burn-in for 96 hours at 100°C, with 8 ma at 1 KHz; (3) gross and fine leak, MIL-STD 202, Method 112B, Conditions A and C
The SRA-1TX is the first off-the-shelf TX mixer in the industry available for immediate delivery. All other Mini-Circuits' mixers are available with TX screening and testing.

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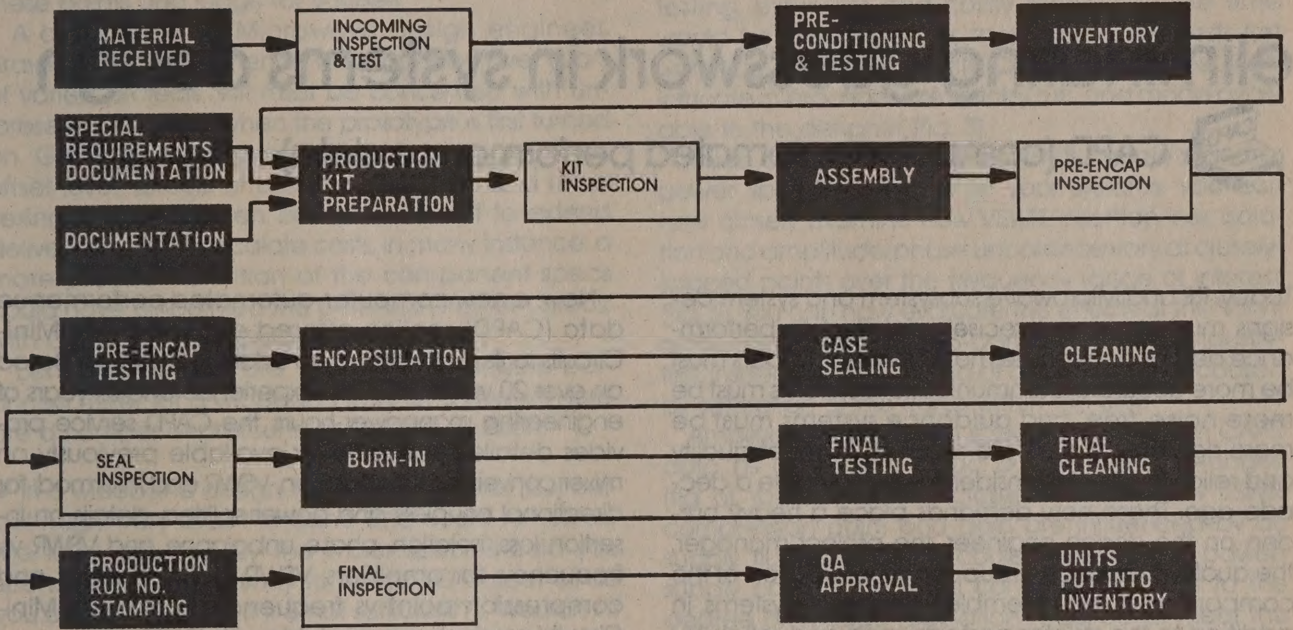
quality control

how Mini-Circuits achieves high reliability


MATERIAL RECEIVED
INCOMING INSPECTION & TEST
PRE-CONDITIONING & TESTING
INVENTORY
SPECIAL REQUIREMENTS DOCUMENTATION
DOCUMENTATION
PRODUCTION KIT PREPARATION
KIT INSPECTION
ASSEMBLY
PRE-ENCAP INSPECTION
PRE-ENCAP TESTING
ENCAPSULATION
CASE SEALING
CLEANING
SEAL INSPECTION
BURN-IN
FINAL TESTING
FINAL CLEANING
PRODUCTION RUN NO. STAMPING
FINAL INSPECTION
QA APPROVAL
UNITS PUT INTO INVENTORY

environmental specifications

All MCL components are manufactured under exacting quality assurance and control standards. They will meet or exceed published specifications over the operating temperature range of −54° to +100°C, and after being subjected to any or all of the following physical or environmental tests of MIL-STD 202E which are applicable.

TEMPERATURE CYCLING:	
−65° to +125°C	102 C
ALTITUDE: 656,000 feet	105 G
(2) HUMIDITY: 90% RH, 65°C	106

THERMAL SHOCK:	
−65°C to +125°C	107 B
(1) (2) SEAL: Less than 10^5 Atm. cc/sec	112 A
DROP: Random, 45 min.	203
VIBRATION:	
2 to 2,000 cps, 20g, 12 hrs.	204 D
SOLDER HEAT: 260°C, 10 sec.	210 B
(1) SOLDERABILITY: 95% coverage	208
TERMINAL TENSILE STRENGTH:	
4½ lbs., 10 sec.	211 A
(1) TERMINAL FATIGUE: 2 lbs., 3 cycles	211 C
MECHANICAL SHOCK: 100g, 6ms	213 I
SOLVENT RESISTANCE:	
Alcohol, Trichloroethan, Freon	215

NOTE:

(1) These specifications do not apply to coaxial connector models.

(2) Exceptions are non-hermetic case styles 6, 38, 46.

absolute maximum ratings

OPERATING AND STORAGE TEMPERATURE −55°C to +100°C

eliminating guesswork in systems design

CAPD (computer-automated performance data)

Today, RF and Microwave subsystem and system designs must be more precisely detailed as performance demands become more stringent. Radars must be more accurate, communications systems must be more noise-free, and guidance systems must be more rigorous, and all are required to meet quality and reliability levels considered unattainable a decade ago. These new demands place a heavy burden on the design engineer, the project manager, the quality assurance group...and the suppliers of the components to be assembled into these systems. In addition to the stricter performance and reliability specs, the designer faces escalating costs if, at the last stages before system delivery, unexpected surprises occur in the form of spurious signals, high VSWR or other pitfalls not anticipated.

Until now, the designer selected his RF/Microwave components, such as mixers, power splitters, and amplifiers, using manufacturers' data sheets to provide detailed specs, performance curves, and environmental ratings. Indeed, the design engineer did receive a workable package of information to see how his design might proceed...but it was not a detailed, close-up look. The reason is simple—it has just been too expensive to take an enormous number of test points, at a considerable number of specific frequencies, tabulate the results and then repeat at other input levels.

As an example, a two-tone intermodulation distortion chart for mixer performance would require at least 100 measurement points plus 10 additional calibration points and would take an experienced technician at least a half-day to complete.

For those customers who required their data at specific frequencies or under conditions other than is offered on the manufacturers' data sheets, extra charges were justifiably added to offset the additional labor costs.

Now, a new computer-automated performance data (CAPD) service offered exclusively by Mini-Circuits to its customers at no additional charge. Based on over 20 years of RF test experience and six years of engineering manpower-hours, the CAPD service provides detailed specs never available previously on mixer conversion loss, isolation, VSWR and intermod; for directional couplers and power splitters, details on insertion loss, isolation, phase unbalance and VSWR vs. frequency; for amplifiers, VSWR, gain changes and compression point vs frequency. In fact, all Mini-Circuits' products are available with CAPD specs.

test setup is self checking

The heavy investment in CAPD, using a Hewlett-Packard Model 85 computer and HP8566A spectrum analyzer as key elements, allows the previously-mentioned, two-tone IM test to be completed in less than ten minutes compared with the manually performed sequence requiring 4-5 hours. Here's how stringent the computer-automated set up dictates each measurement: each point is measured three times, with a maximum allowable deviation of less than 0.05 dB between the three; otherwise the test is repeated. Before each measurement is taken, the computer checks the reference voltage level for any variation due to line voltage, temperature, etc., changes and compensates as required. Similarly, frequency is monitored before each test and any drift is automatically corrected. Such continuous and rapid inspection and correction ensure highly-reliable CAPD data. And, by using a large number of closely-spaced frequency points for component measurement, effects of narrow-band suck-outs or resonances (often missed with manual test procedures) are immediately identified.

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For More Information. Circle No. 415

a close-up view of performance

What's the significance of CAPD to the designer? Is it a sales "gimmick" or is it truly a design tool? Review these points and judge for yourself.

A competent RF/Microwave design engineer, drawing on his experience and expertise over years of varied projects, still must be concerned with unforeseen problems when the prototype is first turned on. Generation of spurious signals, changes in dc offset level, affects of LO drive variations and other vexing problems often become evident to extend delivery time and escalate costs. In many instance, a more precise definition of the component specs could have pinpointed the potential problem areas; with CAPD, it's now possible.

Let's assume you are specifying a double-balanced mixer for a wideband front-end design. Here are a number of profound questions you face:

- In a wideband design, the local oscillator (LO) output might vary over the band and could fall below the level required by the mixer spec. Should you spend additional money to flatten LO output or do you boost LO output if it is not sufficient?... Wouldn't it be valuable to know exactly how performance will be affected since you might find performance acceptable without any additional investment? with CAPD, a close point-by-point printout of key parameters as a function of LO level is available (fig. 1) — now you can make your decision based on a close-up, view of LO drive effects on mixer performance.
- How about VSWR over the full range of receiver specs? Generally, mixer VSWR specs are given at one particular frequency. With manual-test procedures, it's a time-consuming task for the components manufacturer or systems house; with CAPD it's available at no extra charge (fig. 2).
- How does the filter in the design match the mixer IF output and what is the impedance match in-band as well as out-of-band where spurious responses become a threat? CAPD VSWR data tells it all. How will the mixer conversion loss affect receiver sensitivity over the full frequency range? And, how will flatness of conversion loss affect the degree of image rejection in an image-reject mixer? CAPD data (fig. 1) will pinpoint these details.

If the mixer is being used as a phase detector, it may be critical to know how dc offset voltage varies with frequency. Most mixer specs list dc offset at only one frequency; with CAPD, this parameter is given over the full range of frequency (fig 4).

- Harmonic and intermod signals invariably plague your final design. The effects of, for example, a 4th harmonic of the LO mixing with the 5th harmonic of the RF is given on many spec sheets, but at a specific LO and RF level. The effects of LO level changes might be crucial to your design; with manual point-by-point testing, extensive and costly technician test time would be demanded or, more likely, such tests just won't be performed. With CAPD capabilities, such intricate interactions are quickly run, and made available to the designer (fig. 3).

If you are specifying directional couplers and/or power splitter/combiners in your systems, you can now closely examine how VSWR, insertion loss, isolation and amplitude/phase unbalance vary at closely-spaced points over the frequency range of interest, (fig. 5). You can now evaluate the effects of the VSWR of the termination at the S-port and, another industry-first, inspect intermod data of a power splitter caused by saturation of the cores within the unit.

Amplifier performance is clearly shown with CAPD data as a function of dc power supply changes, (fig. 6). You'll be able to closely examine how VSWR, compression point and gain are influenced by dc supply fluctuations; this could reduce your power-supply costs, since it will conveniently point to the degree of voltage regulation required to meet the amplifier performance needed. Also, it's common to furnish amplifier specs over the frequency band of interest, but CAPD testing offers an opportunity to examine the amplifier characteristics, outside the band to foresee the effects of harmonic and spurious signals; for example, an amplifier that is flat to 1200 MHz offers what gain and what VSWR for second-harmonic 2400 MHz signals? Knowing these details can thwart potential systems problems.

Even a relatively common component such as an RF transformer is now available with CAPD data, (fig. 7). The significance...previously insertion loss vs frequency was considered flat over a specified frequency range. With closely spaced CAPD test prints, even slight variations which could affect systems performance become apparent.

CAPD is your microscope

Look at CAPD as a microscope, revealing the "real world" details affecting your design decisions. Most important, CAPD was involved with one uppermost objective—to assist you, the design engineer, in producing a more effective end product. To accomplish this, you may require CAPD data at very specific frequency points not provided by our programmed steps. Not to worry...just furnish us with precise needs for your specific application. Be assured we'll do our best to comply.

eliminating guesswork in systems design

CAPD (computer-automated performance data)

SRA-1 mixer

mixer conversion loss and isolation

RF (MHz)	RF-Level (dBm)	LO (MHz)	C-LOSS (dB) LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm	L-R (dB) LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm	L-I (dB) LO +1dBm	LO +4dBm	LO +7dBm	LO +10dBm
10.00	−14.97	40.00	6.84	6.21	5.48	5.73	48.83	51.66	56.57	56.14	48.48	51.72	56.14	55.84
35.78	−14.92	65.78	7.32	6.68	5.71	5.91	49.28	51.47	54.93	54.83	48.04	50.90	54.75	53.93
61.56	−14.97	91.56	6.96	6.30	5.82	5.76	49.31	50.86	53.42	51.81	48.16	49.62	52.86	51.92
87.34	−14.96	57.34	6.99	6.38	5.77	5.86	49.40	51.62	54.58	55.74	48.70	50.97	54.02	54.69
113.12	−14.96	83.12	6.65	6.73	5.66	6.01	49.23	51.39	54.09	52.15	48.11	50.40	53.81	52.37
138.90	−14.95	108.90	6.10	5.52	5.81	5.05	49.03	50.58	52.04	50.35	48.10	48.84	51.56	50.73
164.68	−14.96	134.68	6.49	5.56	5.77	5.16	48.24	49.50	48.19	48.13	47.47	48.08	48.20	48.64
190.46	−15.02	160.46	6.14	5.41	5.62	5.01	47.61	48.20	46.85	46.44	46.51	47.18	46.27	46.53
216.24	−14.96	186.24	6.03	5.49	5.85	5.11	47.27	45.80	44.88	45.34	44.96	46.25	44.72	45.78
242.02	−14.99	212.02	7.11	6.53	5.91	6.05	46.49	44.25	43.74	43.47	44.64	44.80	43.20	43.56
267.80	−14.92	237.80	6.88	6.33	5.79	5.87	45.17	43.44	42.49	42.93	44.18	44.21	42.27	43.21
293.58	−14.96	263.58	7.08	6.61	6.01	6.17	42.69	42.29	40.93	40.87	42.63	42.74	40.33	40.79
319.36	−15.00	289.36	6.97	6.41	6.03	6.04	41.59	40.77	38.59	39.64	41.75	41.10	39.70	39.51
345.14	−14.97	315.14	7.41	6.71	5.99	6.26	39.60	39.02	37.93	37.84	41.39	40.74	38.97	38.82
370.92	−14.95	340.92	7.58	6.91	6.62	6.17	40.15	38.78	37.22	37.21	41.67	39.80	39.26	37.44
396.70	−15.00	366.70	8.22	7.42	6.93	6.39	39.81	38.10	36.79	35.84	40.85	38.81	37.86	37.46
422.48	−14.97	392.48	8.46	6.99	7.27	5.57	39.50	38.16	36.76	35.79	38.93	36.27	34.74	36.69
448.26	−14.96	418.26	9.44	7.80	7.76	6.22	39.02	37.60	36.14	36.29	38.29	36.00	34.76	33.54
474.04	−15.02	444.04	10.04	8.03	8.13	6.49	39.39	38.03	37.53	36.73	36.78	34.93	35.30	33.84
500.00	−14.92	470.00	10.31	8.43	8.10	6.84	41.24	40.71	40.19	40.14	36.15	34.30	33.89	33.63

FIG. 1

mixer VSWR

Freq. (MHz)	VSWR, RF port LO +4dBm	LO +7dBm	LO +10dBm	VSWR, LO port LO +4dBm	LO +7dBm	LO +10dBm	VSWR, IF port LO +4dBm	LO +7dBm	LO +10dBm
.500	2.57		2.52	3.57		3.82	1.37		1.07
5.000	1.16			2.28			1.16		
26.789	1.06	1.08	1.25	1.41	2.28	3.09	1.43	1.19	1.09
53.079	1.12	1.13	1.24	1.33	2.10	2.99	1.41	1.24	1.14
79.368	1.18	1.18	1.27	1.37	2.08	3.24	1.46	1.29	1.21
105.658	1.30	1.23	1.43	1.37	2.13	2.82	1.73	1.37	1.37
131.947	1.35	1.29	1.46	1.42	2.16	3.01	1.77	1.47	1.45
158.237	1.41	1.35	1.49	1.47	2.12	3.07	1.82	1.54	1.47
184.526	1.48	1.42	1.53	1.46	2.12	2.73	1.96	1.67	1.59
210.816	1.53	1.47	1.57	1.53	2.16	2.83	2.09	1.74	1.67
237.105	1.78	1.53	1.80	1.53	2.19	2.77	2.67	1.82	1.99
263.395	1.81	1.62	1.84	1.57	2.19	2.61	2.60	1.95	2.00
289.684	1.65	1.70	1.66	1.64	2.19	2.72	2.23	2.07	1.83
315.974	1.82	1.76	1.78	1.67	2.22	2.52	2.74	2.16	2.08
342.263	1.88	1.83	1.84	1.79	2.32	2.55	2.94	225	2.21
368.553	1.96	1.87	1.90	1.77	2.40	2.56	3.15	2.29	2.35
394.842	2.00	1.92	1.91	1.70	2.43	2.44	3.11	2.36	2.31
421.132	1.75	2.02	1.71	1.66	2.43	2.54	2.47	2.48	2.00
447.421	1.91	2.04	1.85	1.61	2.40	2.44	3.15	2.41	2.35
473.710	2.06	2.03	1.94	1.57	2.35	2.39	3.56	2.35	2.47
500.000	1.94	2.07	1.85	1.47	2.32	2.37	3.12	2.37	2.30

FIG. 2

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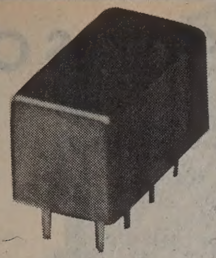

Mini-Circuits

mixer harmonic intermodulation

(Relative to desired IF Output)

LO at +4dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	36	17	24	24	29	33	45	49	49	65	57	59	60	65	58
1	0	18	—	33	18	35	31	45	40	52	50	55	58	49	63	54	65
2	74	42	49	41	63	45	57	57	58	55	67	69	72	72	71	70	70
3	78	66	40	51	35	54	38	57	57	69	63	70	70	72	72	71	71
4	79	68	72	66	69	63	69	63	69	71	72	67	71	70	70	71	72
5	78	72	71	72	65	68	59	60	59	71	70	70	70	71	71	72	72
6	77	70	71	71	72	73	72	73	72	71	71	72	71	70	71	70	72
7	78	71	69	71	71	71	72	71	71	71	71	71	72	71	72	70	70
8	78	72	71	71	70	71	71	70	71	72	71	72	71	71	70	72	70
9	80	72	72	68	70	71	71	72	72	71	71	72	71	71	71	72	70
10	80	71	72	71	70	72	71	71	72	73	71	70	72	72	71	72	72
11	79	71	72	72	72	71	70	70	71	72	72	71	73	72	72	72	71
12	79	71	71	72	71	72	71	71	71	71	71	72	71	71	71	70	72
13	78	71	71	71	70	72	71	71	71	70	71	70	72	71	71	71	72
14	80	72	71	72	71	71	71	71	71	70	71	71	71	72	71	72	72
15	73	66	73	71	71	71	71	72	72	72	72	70	70	71	71	73	71

Harmonic LO Order

LO at +7dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	31	17	27	22	28	30	39	49	46	58	57	58	59	66	53
1	0	17	—	37	11	33	37	47	36	50	53	60	58	59	62	61	67
2	74	48	47	50	52	49	60	56	58	50	69	65	72	73	72	73	71
3	78	66	56	58	46	57	44	68	60	64	58	72	69	72	74	72	74
4	79	71	71	72	70	73	69	70	72	73	73	71	72	71	73	72	73
5	78	73	73	72	73	73	71	72	68	72	73	72	72	71	73	72	73
6	77	73	71	72	71	73	73	73	73	72	73	72	74	73	73	71	72
7	78	73	71	72	71	73	73	73	73	72	73	72	74	73	73	71	72
8	78	74	72	72	71	74	74	73	71	72	73	72	72	73	73	72	72
9	80	74	72	73	72	72	72	73	73	73	72	73	72	74	73	72	73
10	80	73	74	73	71	73	73	73	73	72	73	73	74	72	73	74	72
11	79	71	73	73	72	72	72	71	73	72	74	73	73	73	75	72	73
12	79	73	73	72	74	72	73	72	72	73	74	72	71	72	73	73	71
13	78	73	73	73	73	72	73	73	71	72	72	72	73	72	73	73	71
14	80	73	72	73	73	73	73	73	71	72	72	71	72	73	73	72	73
15	73	66	73	72	73	73	73	73	73	73	72	71	71	73	73	72	73

Harmonic LO Order

LO at +10dBm

Harmonic RF Order	RF CAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	0	—	26	13	25	16	21	21	34	43	38	61	48	54	50	54	47
1	0	19	—	42	10	30	30	39	34	49	50	52	58	57	59	60	64
2	74	63	53	71	59	58	62	58	59	54	71	66	71	73	73	73	74
3	78	69	63	70	69	73	64	72	72	70	63	71	71	73	74	74	73
4	79	72	73	74	72	73	73	74	73	72	72	71	72	73	72	73	73
5	78	72	72	74	74	74	72	73	73	72	72	72	73	73	73	72	73
6	77	71	72	73	72	73	73	72	73	74	73	72	72	72	72	73	72
7	78	72	72	71	73	72	73	73	74	73	73	74	72	71	73	72	72
8	78	72	71	72	72	72	74	73	73	73	73	73	71	72	73	73	73
9	80	74	71	71	71	72	73	73	71	73	73	71	73	73	72	73	73
10	80	73	73	72	72	74	72	73	71	74	74	73	74	71	74	73	71
11	79	73	73	72	73	73	73	71	70	74	73	72	72	74	74	73	72
12	79	73	73	73	73	73	73	72	71	73	74	73	73	72	72	71	73
13	78	73	73	74	72	73	72	73	72	72	71	73	74	72	73	73	73
14	80	72	73	72	74	74	74	73	71	72	73	71	72	72	74	73	72
15	73	66	73	73	73	72	73	73	73	72	73	73	72	72	73	72	73

Harmonic LO Order

test conditions

RF = 400.1 MHz at −10dBm

LO = 370.01 MHz

For other test frequencies, contact factory.

FIG. 3

eliminating guesswork in systems design

CAPD (computer-automated performance data)

SRA-1 mixer

mixer phase detection (+7 dBm)

model SRA-1

max. output/DC offset Vs. freq.

Freq. (MHz)	max. DC output mV	DC offset mV
10.00	−262.53	− .57
30.42	−263.46	− .54
50.83	−260.71	− .54
71.25	−260.38	− .51
91.67	−264.70	− .46
112.08	−265.05	− .42
132.50	−266.23	− .38
152.92	−263.79	− .34
173.33	−263.92	− .34
193.75	−268.92	− .37
214.17	−274.08	− .32
234.58	−276.75	− .33
255.00	−275.81	− .53
275.42	−270.65	− .63
295.83	−266.67	− .35
316.25	−256.71	− .52
336.67	−251.84	− .82
357.08	−236.17	− .63
377.50	−228.06	−1.01
397.92	−217.55	−1.38
418.33	−214.55	−1.88
438.75	−214.43	−1.58
459.17	−210.65	−1.86
479.58	−206.27	−2.74
500.00	−204.64	−2.69

output voltage Vs. phase, 10 MHz

Phase, degrees	output, mV
0 deg.	−262 mVOLT
10 deg.	−258 mVOLT
20 deg.	−246 mVOLT
30 deg.	−227 mVOLT
40 deg.	−200 mVOLT
50 deg.	−168 mVOLT
60 deg.	−131 mVOLT
70 deg.	−89 mVOLT
80 deg.	−45 mVOLT
90 deg.	0.6 mVOLT
100 deg.	46 mVOLT
110 deg.	90 mVOLT
120 deg.	132 mVOLT
130 deg.	169 mVOLT
140 deg.	202 mVOLT
150 deg.	228 mVOLT
160 deg.	247 mVOLT
170 deg.	259 mVOLT
180 deg.	263 mVOLT
190 deg.	259 mVOLT
200 deg.	247 mVOLT
210 deg.	228 mVOLT
220 deg.	292 mVOLT
230 deg.	169 mVOLT
240 deg.	132 mVOLT
250 deg.	90 mVOLT
260 deg.	46 mVOLT
270 deg.	0.6 mVOLT
280 deg.	−45 mVOLT
290 deg.	−89 mVOLT
300 deg.	−131 mVOLT
310 deg.	−168 mVOLT
320 deg.	−200 mVOLT
330 deg.	−227 mVOLT
340 deg.	−246 mVOLT
350 deg.	−258 mVOLT
360 deg.	−262 mVOLT

FIG. 4

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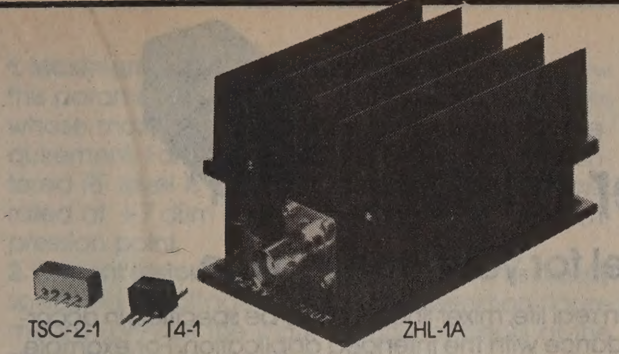


Mini-Circuits

power splitter/combiners

model TSC-2-1

Insertion loss, Amplitude Unbalance, Isolation

MHz	REF. (dBm)	S-1 (dB)	S-2 (dB)	Unbal. (dB)	ISO (dB)
1.00	−4.99	3.25	3.21	−.04	36.02
22.00	−4.95	3.20	3.20	0.00	46.30
43.00	−4.97	3.24	3.21	−.03	40.42
64.00	−4.99	3.25	3.25	0.00	36.77
85.00	−4.92	3.30	3.29	−.01	34.79
106.00	−4.99	3.28	3.28	0.00	33.30
127.00	−5.06	3.29	3.32	.03	32.27
148.00	−5.02	3.31	3.33	.02	31.51
169.00	−5.02	3.31	3.36	.05	30.95
190.00	−5.08	3.30	3.40	.10	30.64
211.00	−4.91	3.30	3.44	.14	30.51
232.00	−4.91	3.30	3.47	.17	30.62
253.00	−4.99	3.33	3.49	.16	31.06
274.00	−4.96	3.34	3.52	.18	31.94
295.00	−5.03	3.32	3.57	.25	33.35
316.00	−4.95	3.39	3.62	.23	35.36
337.00	−5.02	3.39	3.67	.28	39.90
358.00	−4.95	3.40	3.78	.38	45.13
379.00	−5.00	3.44	3.83	.39	40.23
400.00	−4.00	3.49	3.97	.48	32.15

VSWR

MHz	S	1	2
5.00	1.12	1.12	1.12
25.78	1.13	1.11	1.11
46.56	1.13	1.10	1.10
67.34	1.12	1.09	1.09
88.12	1.12	1.09	1.09
108.90	1.12	1.09	1.09
129.68	1.11	1.08	1.10
150.46	1.11	1.08	1.10
171.24	1.10	1.08	1.11
192.02	1.10	1.08	1.12
212.80	1.09	1.08	1.14
233.58	1.10	1.09	1.16
254.36	1.11	1.11	1.16
275.14	1.12	1.13	1.18
295.92	1.15	1.15	1.21
316.70	1.18	1.18	1.24
337.48	1.22	1.21	1.28
358.26	1.27	1.24	1.31
379.04	1.32	1.28	1.35
400.00	1.39	1.33	1.40

FIG. 5

RF transformers

model T4-1

Insertion loss

MHz	REF. (dBm)	I.L. (dB)
.200	−14.95	3.29
.350	−14.92	2.34
2.001	−15.03	1.58
18.612	−14.97	1.21
37.021	−14.99	1.30
55.433	−15.03	1.37
73.843	−14.99	1.39
92.253	−15.02	1.49
100.001	−14.99	1.50
110.661	−14.96	1.67
129.070	−15.06	1.71
147.480	−14.98	1.73
165.890	−15.09	1.85
184.310	−14.93	2.04
202.720	−15.00	2.07
221.131	−15.09	2.12
239.540	−14.94	2.29
257.850	−15.06	2.43
276.359	−14.93	2.49
294.770	−15.03	2.54
299.999	−15.03	2.59
313.180	−15.03	2.71
331.590	−15.09	2.79
350.000	−14.96	2.81

REMARK: 2 units connected back to back

FIG. 7

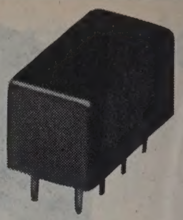
power amplifiers

model ZHL-1A

FREQ. (MHz)	GAIN (dB)				REVERSE GAIN (dB)				VSWR (IN)				VSWR (OUT)			
	12V	15V	20V	24V	12V	15V	20V	24V	12V	15V	20V	24V	12V	15V	20V	24V
2.00	17.90	18.27	18.46	18.52	29.03	29.07	28.96	28.88	1.09	1.13	1.14	1.14	1.10	1.16	1.15	1.15
28.21	17.88	18.27	18.48	18.52	29.53	29.72	29.54	29.24	1.09	1.11	1.13	1.14	1.20	1.19	1.19	1.18
54.42	17.88	18.33	18.54	18.59	29.57	29.62	29.58	29.39	1.12	1.12	1.13	1.14	1.24	1.24	1.24	1.24
80.63	17.94	18.41	18.65	18.70	29.91	29.78	29.64	29.56	1.19	1.17	1.16	1.16	1.30	1.29	1.30	1.30
106.84	17.90	18.41	18.69	18.78	29.85	30.12	29.97	29.75	1.31	1.24	1.21	1.21	1.36	1.36	1.37	1.37
133.05	17.91	18.42	18.75	18.83	30.02	30.06	30.15	29.87	1.42	1.32	1.28	1.27	1.41	1.41	1.42	1.44
159.26	17.68	18.34	18.71	18.81	30.25	30.32	30.03	30.00	1.56	1.42	1.36	1.34	1.46	1.48	1.50	1.52
185.47	17.64	18.34	18.78	18.84	30.50	30.36	30.12	29.99	1.71	1.553	1.45	1.43	1.50	1.53	1.57	1.60
211.68	17.52	18.25	18.74	18.82	30.50	30.64	30.19	30.05	1.83	1.63	1.52	1.50	1.51	1.56	1.63	1.67
237.89	17.46	18.20	18.73	18.81	30.85	30.64	30.35	30.32	1.96	1.72	1.59	1.57	1.52	1.58	1.67	1.73
264.10	17.34	18.09	18.66	18.74	30.99	30.75	30.40	30.43	2.04	1.79	1.64	1.62	1.48	1.56	1.66	1.75
290.31	17.28	18.03	18.58	18.69	31.08	30.89	30.66	30.58	2.14	1.86	1.69	1.66	1.44	1.53	1.66	1.76
316.52	17.33	18.08	18.69	18.79	30.64	30.77	30.51	30.49	2.16	1.88	1.70	1.67	1.40	1.50	1.64	1.75
342.73	17.32	18.06	18.69	18.79	30.50	30.44	30.41	30.44	2.17	1.87	1.69	1.65	1.33	1.43	1.59	1.71
368.94	17.30	18.04	18.71	18.79	30.09	30.23	30.24	30.27	2.09	1.81	1.63	1.59	1.27	1.35	1.49	1.62
395.15	17.23	18.02	18.67	18.82	29.81	29.95	29.91	30.18	2.03	1.75	1.57	1.53	1.24	1.28	1.41	1.55
421.36	17.32	18.13	18.83	18.98	29.19	29.36	29.52	29.85	1.96	1.68	1.49	1.44	1.32	1.29	1.36	1.50
447.57	17.37	18.23	18.96	19.08	28.50	28.79	29.05	29.22	1.90	1.61	1.41	1.36	1.47	1.36	1.34	1.43
473.78	17.17	18.10	18.90	19.08	27.94	28.28	28.64	28.82	1.93	1.64	1.42	1.37	1.68	1.51	1.39	1.42
500.00	17.07	18.14	19.06	19.26	27.68	27.17	28.22	28.50	2.07	1.79	1.57	1.54	1.01	1.79	1.61	1.58

FIG. 6

For More Information. Circle No. 415



mastering the mixer maze...

or selecting the right model for your application.

Mixers are abundant in electronic systems ranging from inexpensive consumer products to sophisticated military hardware. You'll find them in video games, TV sets and video cassette recorders as well as communications gear, test instruments, radar units and countermeasure systems. Mini-circuits offers well over a hundred different off-the-shelf models with thousands of variations. Different connector configurations, tighter specs, Hi-Rel options are available on request. Improper mixer selection bears a penalty—underspecify and face marginal performance; overspecify and pay extra for unnecessary performance characteristics.

making the right choice

Simply stated, there are three basic steps—

(1) deciding on a printed-circuit (PC) or connector version, (2) selecting the mixer level required in the applications, and (3) picking a model that extends over the frequency range involved. Sounds simple enough so let's examine some of the details.

The first step involves the decision on whether the mixer will be mounted to a PC board or be connected by cable to other subsystem components. The next two steps require understanding your specific needs; so it is strongly recommended that you organize the requirements for your application and put it in writing. Decide what frequency range is involved, the LO drive available, the level of harmonic and two-tone, third-order intermodulation (IM) distortion you can tolerate and other dynamic range factors, see Fig. 1.

1 dB compression point key to mixer level

What does the 1 dB compression point signify? As RF input level is increased, IF output should follow in a linear manner. However, after a certain point, IF output increases at a lower rate until mixer output becomes fairly constant. The point at which IF output deviates from linearity with RF input 1 dB is termed the 1 dB compression point. This figure is useful in comparing dynamic range, maximum output and two-tone performance of various mixers. It is a basis on which mixer level is established.

The 1 dB compression point, which defines the linearity of a mixer at high RF input levels, is relatively simple to test and thus this parameter is included on data sheets supplied by all mixer manufacturers. But, in real life, mixer linearity may be specified in accordance with the intended application. For example, in a receiver application, two-tone, third-order intermod may be the critical parameter; for TV applications, percent distortion or intercept point may be specified; and in an attenuator measurement system, compression point may be important for a given RF input level. With this in mind, the engineer needs a convenient means to relate the particular parameter for his application with the published spec, the 1 dB compression point.

Fig. 1 lists the various ways mixer linearity might be specified.

FIG. 1

Dynamic range parameters affecting mixer selection

1. maximum RF input level anticipated
2. percent distortion acceptable
3. intercept point
4. Two-tone, 3rd order IM______________dB at ________dBm, RF input
5. 1 dB RF input compression level
6. LO power available
7. none of the above specified

Let's convert every parameter with the published 1 dB compression point and then show how simple it is to select the proper mixer level, *see Fig. 2 for Mini-Circuits' mixer level/1 dB compression point chart.*

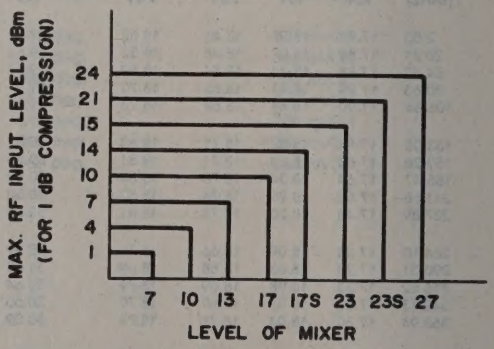


FIG. 2 THE 1 dB COMPRESSION POINT AS A FUNCTION OF THE LEVEL OF MIXER.

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1. Maximum RF input level anticipated. If you know this parameter, simply select the lowest level mixer whose maximum RF input level exceeds your requirement. For example, if the maximum encountered RF level is +5 dBm, select a Level 13 mixer, rated at +7 dBm maximum RF input for 1 dB compression point.

2. Percent distortion. The percent distortion is usually specified in voltage. Thus, a 0.1% distortion figure means 0.999 of the input voltage appears at the mixer output. Next, convert this voltage ratio to a power ratio in dB by squaring and taking ten times the log. The resultant figure is the amount of compression for the specified RF input level. Now this must be extrapolated to 1 dB compression for a corresponding RF input level. As a rule of thumb, extrapolation may be achieved by assuming a linear relationship, in dB, between compression and RF input level. So a ten-times increase in compression corresponds to a ten-times increase in RF input level.

Let's illustrate with an example using a 0.1 percent distortion spec at −10 dBm RF input level. The 0.1 percent corresponds to a 0.999 voltage output; squaring this yields 0.998 power ratio or 0.009 dB. We, therefore, know that 0.1% distortion at −10 dBm input means the maximum allowable compression is 0.009 dB. Extrapolating, using the rule-of-thumb relationship, states that 0.09 dB compression corresponds to an allowable RF of 0 dBm, and further extrapolating results in 0.9 dB compression at a maximum allowable RF input level of 10 dBm. So which mixer level is appropriate? A Level 17S, with +13 dBm RF Input level at the 1 dB compression point, see Fig. 2.

3. Intercept point.
This parameter is a figure of merit corresponding to the amount of intermodulation products generated relative to the desired IF output. An intercept point can be defined for a second order, third order, fifth order, product, etc. As a rule-of-thumb, two-tone third order intercept point is approximately 15 dB above the 1 dB compression point. So, if the intercept point figure is given, merely subtract 15 dB from this figure and pick a mixer which meets the 1 dB compression point spec, see Fig. 2.

4. Two-tone, third-order intermodulation (IM).
When a two-tone, third-order IM spec is given, the intercept point can be calculated. Remember that for each 10 dB increase in signal level, there is a 20 dB degradation in two-tone, third-order product. Once the intercept point is calculated, simply subtract 15 dB from the figure to find the 1 dB compression point and select the appropriate mixer.

5. 1dB Rf input compression level.
This key parameter is listed on mixer spec sheets so merely choose the lowest level mixer that will meet the requirement.

6. LO drive.
The LO dirve is critical since the function of the LO drive is to switch the mixer diodes fully on and off for lowest distortion. So, for optimum performance, select the mixer level to match the LO drive. Mini-Circuits conveniently identifies its mixer levels by the LO drive requirement; thus a Level 7 mixer refers to a LO drive level of +7 dBm. If there are constraints on the LO power available, select the lowest level mixer closest to the available LO power. For example, if +12 dBm LO drive is available, select a Level 10 mixer.

7. No particular spec to meet.
Choose a Level 7 mixer. Why? Because it is the most popular and it offers the widest choice of models at lowest cost.

Freq. range last deciding factor

Once the mixer level has been decided, you may find a wide variety of models to exercise your decision making. You may notice models within a series with overlapping frequency ranges. Why? So you can choose the optimum mixer for your requirement. Each model within a series has a different low-frequency limit. Select a mixer with the highest low frequency limit and whose mid-band range best covers your application.

Specs on the data sheets are given in three ranges. The lower frequency range, L, covers the lowest specified frequency to one decade higher; the upper frequency range, U, covers the highest frequency to one octave lower and mid-range, M, covers the frequency between L and U. Thus, a mixer specified from 0.5 to 500 MHz could offer a low-frequency range of 0.5 to 5 MHz, an upper frequency range of 250 to 500 MHz, and a mid-range of 5 MHz to 250 MHz.

What about "Specials"?

Although most Mini-Circuits mixers are 50 ohm devices, models are available in 75 ohms. Need connector types different than those listed for standard models? No problem. Some applications require matched mixer pairs that must be amplitude (conversion loss) and phase matched. Most Mini-Circuits mixers are tested to within 0.2 dB for the entire production run. Not tight enough? Let us know your exact requirement and we'll screen and test to meet it.

In summary, contact us about "specials" and we'll do our best to satisfy your needs without excessive cost or delivery date extensions. Sometimes, "special" means shipping a quantity of mixers within a very short time span; since Mini-Circuits is the largest manufacturer of mixers in the world, this may hardly be considered "special" and you may be pleasantly surprised. Try us.

order Mini-Circuits Q&A No. 4 Now...

There's lots more to mixer specs, applications and testing. Phone or write for Mini-Circuits' Q&A #4 for a provocative question-and-answer exchange on these topics.

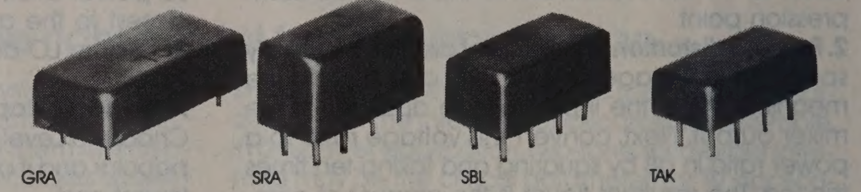
most widely-used

Frequency Mixers

LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

case style selection

outline drawings pages 58-62



Series	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
GRA case D09	GRA-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	12.95	(6-49)
	GRA-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	(6-49)
	GRA-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	22.95	(5-24)
	GRA-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	25.95	(5-24)
SRA case A01	●SRA-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	11.95	(1-49)
	SRA-1TX	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	49.95	(1-49)
	SRA-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	14.95	(5-24)
	SRA-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	13.95	(5-24)
	SRA-2	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	30	20	30	20	14.95	(5-24)
	SRA-2CM	5-1000	DC-1000	6.0	7.0	6.5	8.5	60	50	35	30	30	25	50	45	30	25	25	20	14.95	(1-49)
	SRA-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	14.95	(5-24)
	SRA-4	5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	16.95	(5-24)
	SRA-5	5-1500	10-600	7.0	8.0	7.5	8.5	50	45	35	30	30	20	45	40	30	25	25	15	21.95	(5-24)
	SRA-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	21.95	(5-24)
	SRA-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	26.95	(5-24)
case A06	SRA-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	26.95	(5-24)
	SRA-12	800-1250	50-90	—	—	6.0	7.5	32	25	35	25	35	25	30	20	30	20	30	20	24.95	(5-24)
	SRA-2000 NEW	100-2000	DC-600	6.0	8.0	7.0	9.5	—	—	37	20	—	—	—	—	—	—	30	20	31.95	(1-24)
SBL case A06	SBL-1	1-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	4.50	(10-49)
	SBL-1X	10-1000	5-500	6.0	7.5	7.0	9.0	50	35	40	25	30	20	45	30	35	20	25	20	5.95	(10-49)
TAK case A04	TAK-5	.01-250	DC-250	5.5	7.0	6.5	8.5	60	50	50	35	40	35	55	45	45	30	35	25	18.95	(1-4)
	TAK-5R	.05-200	DC-200	5.5	6.5	6.5	8.0	55	50	45	35	45	35	50	45	40	30	40	30	15.95	(5-24)
	TAK-6	.5-600	DC-600	5.5	7.5	6.5	8.5	60	50	50	30	40	25	55	45	45	30	30	20	18.95	(1-4)
	TAK-6R	5-500	DC-500	6.0	7.0	6.5	8.0	55	50	45	30	35	40	45	40	40	25	30	25	15.95	(5-24)
	TAK-7	2-1000	5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	20.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to $f_U/2$) U = upper range ($f_U/2$ to f_U)

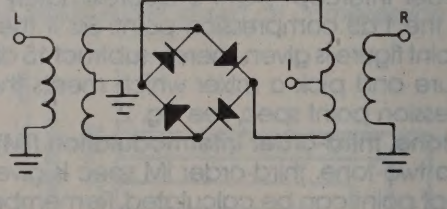
m = mid band (2f_L to $f_U/2$)

NOTES:

- ● HTRB tested, 3 year guarantee

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings;
   RF power 50 mW, peak IF current 40 mA, see pg. 7.
6. Prices and specifications subject to change without notice.
7. PAM-42 protected under patent 4,430,758.

schematic



pin connections

see case style outline drawing

Series	GRA	SRA					SBL		TAK			
models	all models	−1 −1TX −1 −1 −3	−2 −4	−6 −8	−1W −2cm	−5 −11 −12	−1	−1X	−5 −6	−7	−5R	−6R
LO	1	8	8	8	8	8	8	8	8	8	8	1
RF	6	1	3,4	1	1	1	1	3,4	1	3,4	1	8
IF	4	3,4*	1	3,4*	3,4*	3	3,4*	1	3,4*	1	3,4*	5,6*
GND	2,3,5	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,4,7
CASE GND	—	2	2,5,6,7	—	2,5,6,7	2,5,6,7	—	2,5,6,7	2	2,5,6,7	—	3,4,7

*pins must be connected together externally

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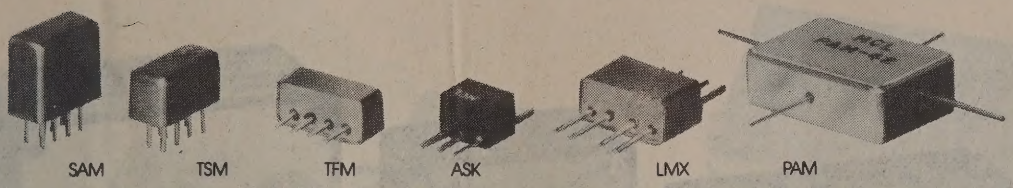
500 Hz to 4.2 GHz

Mini-Circuits



	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
SAM case A03	**SAM-1**	1-600	DC-600	5.5	7.0	6.5	8.5	55	45	45	30	35	20	50	40	40	25	30	20	15.95	(1-24)
	SAM-2	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	25	17.95	(1-24)
	SAM-3	0.1-500	DC-500	5.5	7.0	6.5	8.5	60	50	50	35	35	30	50	40	45	30	30	20	17.95	(1-24)
	SAM-4	5-1250	0.5-1000	6.5	8.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	19.95	(1-24)
	SAM-5	5-1500	0.5-1000	6.5	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	24.95	(1-24)
TSM case A11	**TSM-1**	1-500	DC-500	6.0	7.5	6.5	8.5	60	45	45	35	35	25	55	45	40	30	35	25	17.95	(5-24)
	TSM-3	0.1-400	DC-400	5.3	7.5	6.5	8.5	60	50	50	35	35	25	55	45	45	30	35	25	19.95	(5-24
TFM case B02	**TFM-2**	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	11.95	(1-49)
	TFM-3	0.04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	19.95	(5-49)
	TFM-4	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	21.95	(5-49)
case B13	**TFM-11**	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	35	25	25	10	45	40	27	20	25	20	39.95	(1-24)
	TFM-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	39.95	(1-24)
ASK case W38	**ASK-1** NEW	1-600	DC-600	5.5	7.0	6.0	8.5	50	40	35	25	30	20	45	35	30	20	25	15	5.95	(10-49)
LMX case BB48	**LMX-113** NEW	5-1000	DC-1000	6.5	7.0	7.0	8.0	50	40	40	30	35	25	45	35	35	30	30	20	14.95	(6-24)
	LMX-124 NEW	0.5-500	DC-500	5.5	6/5	6.0	7.0	50	40	45	30	45	25	45	40	40	30	30	20	22.95	(6-24)
	LMX-149 NEW	10-1500	DC-1500	6.0	7.0	6.0	10.0	55	45	45	35	30	20	50	45	40	25	20	12	24.95	(6-24)
PAM case AA46	**PAM-42** NEW	2.0-4.2GHz	DC-1.3GHz	—	—	7.0	8.5	—	—	25 (typ)	17 (min)	—	—	—	—	18 (typ)	10 (min)	—	—	26.95	(1-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

SAM			TSM	TFM	ASK	LMX	PAM
−1 −3	−4 −5	−2	all models	all models	all models	all models	all models
8	8	8	8	4	1	8	3
1	3,4	1	1	1	4	5	1
3,4*	1	3,4*	3,4*	2	5	4	4
2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	3	2,3,6	2,3,6,7	2
2	2,5,6,7	2,5,6,7	2	3	—	2,3,6,7	2

MIL-M-288837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
GRA-1		07 N
GRA-1 HI-REL		07 S
SAM-1	5895-01-117-2926	
SAM-3	5895-01-062-9973	
SAM-5	5895-01-036-9507	
SBL-1	9058-00-256-6818	
SRA-1	6625-00-008-8272	03 N
SRA-1 HI-REL		03 S
SRA-1-1	5962-01-113-5431	
SRA-1W		09 N
SRA-1W HI-REL		09 S
SRA-3	5895-01-021-5914	
SRA-6	5895-01-124-0117	
SRA-8	5985-01-081-0977	12 N
SRA-8 HI-REL		12 S
TAK-5R		01 N
TAK-5R HI-REL		01 S
TAK-6R		02 N
TAK-6R HI-REL		02 S
TFM-2-408	5821-01-076-2497	
TFM-3	5840-01-112-0031	
TSM-1	5895-01-121-7958	

*units are not QPL-listed

In Stock... Immediate Delivery

For More Information. Circle No. 415

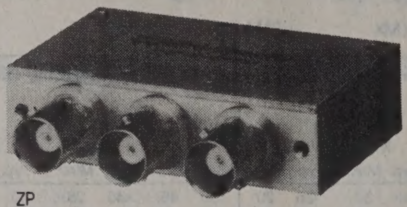
widest-variety of connector types

Frequency Mixers

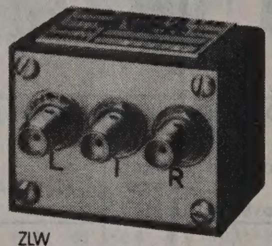
LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

case style selection

outline drawings pages 58-62



ZP



ZLW

ZAD
ZMA

	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
ZP case GG60	ZP10514 NEW	.2-500	DC-500	5.5	7.0	6.5	8.5	55	45	50	35	35	30	50	40	36	30	30	20	51.95	(1-49)
ZLW case M21	ZLW-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	39.95	(4-24)
	ZLW-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	44.95	(4-24)
	ZLW-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	41.95	(4-24)
	ZLW-2	1-1000	DC-1000	6.0	7.5	7.0	9.5	55	45	40	25	35	20	50	40	40	25	30	20	44.95	(4-24)
	ZLW-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	41.95	(4-24)
	ZLW-5	5-1500	5-100	6.5	7.5	6.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	51.95	(4-24)
	ZLW-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	49.95	(4-24)
	ZLW-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	54.95	(4-24)
	ZLW-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	61.95	(4-24)
	ZLW-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	61.95	(4-24)
ZAD case M22	ZAD-1	.5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	29.95	(4-24)
	ZAD-1W	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	34.95	(4-24)
	ZAD-1-1	.1-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	31.95	(4-24)
	ZAD-2	1-1000	.5-500	5.5	7.5	6.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	39.95	(4-24)
	ZAD-3	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	31.95	(4-24)
	ZAD-4	.5-1250	.5-500	5.5	7.5	6.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	41.95	(4-24)
	ZAD-6	.003-100	DC-100	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	39.95	(4-24)
	ZAD-8	.0005-10	DC-10	6.5	7.5	7.0	8.5	60	50	50	40	45	35	60	50	50	40	45	35	44.95	(4-24)
	ZAD-11	5-2000	10-600	7.0	8.5	7.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	51.95	(4-24)
	ZAD-12	800-1250	50-90	6.0	7.5	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	51.95	(4-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to $f_U/2$)   U = upper range ($f_U/2$ to f_U)

m = mid band (2f_L to $f_U/2$)

single-balanced (1 to 3 GHz)

	MODEL NO.	LO/RF f_L-f_U	IF	Mid-Band m*		Total Range		L*		M*		U*		L*		M*		U*			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
ZMA case M23	ZMA-2*	1-2.5GHz	DC-150	7.0	8.5	8.0	9.0	25	20	22	17	20	15	50	35	40	30	35	25	63.95	(1-9)
	ZMA-3*	1.4-3.0GHz	DC-500	6.5	8.0	7.0	9.0	25	20	28	18	23	15	50	35	50	30	50	30	67.95	(1-9)

*m = 500MHz   *L = f_L to (f_L + 500)   *M = (f_L + 500) to (f_U − 500)   *U = f_U to (f_U − 500)

NOTES:

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.-
5. Absolute Maximum Ratings; RF Power 50mW, peak IF current 40mA.
6. For connector types and case mounting options, see case style outline drawing.
7. Prices and specifications subject to change without notice.

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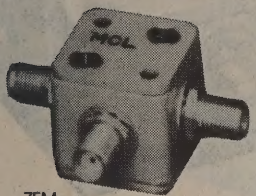
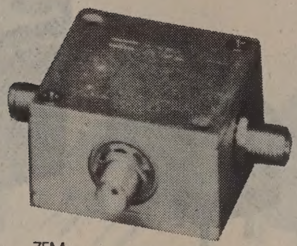
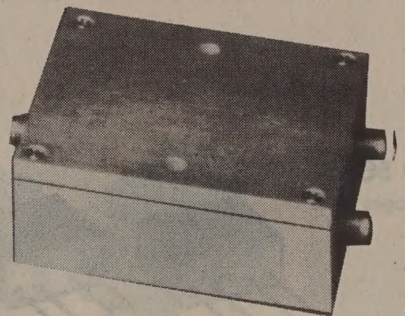
500 Hz to 4.2 GHz

Mini-Circuits


ZEM


ZFM

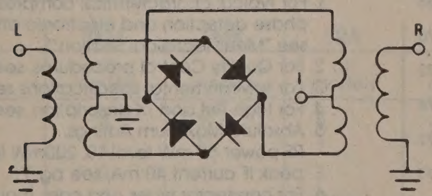

ZAM

	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
		f_L-f_U		Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
ZEM case V37	**ZEM-2**	10-1000	DC-1000	6.0	7.0	6.5	8.5	55	50	30	25	25	20	55	45	30	20	25	20	49.95	(4-24)
ZFM case K18	**ZFM-1W**	10-750	DC-750	6.0	7.0	6.2	8.0	50	45	45	30	35	25	45	40	40	25	27	20	41.95	(4-24)
	ZFM-2	1-1000	DC-1000	6.0	7.5	7.0	8.5	50	45	40	25	30	25	45	40	35	25	25	20	43.95	(1-24)
	ZFM-3	04-400	DC-400	5.3	7.0	6.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	51.95	(1-24)
	ZFM-4	5-1250	DC-1250	6.0	7.5	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	51.95	(1-24)
	ZFM-11	1-2000	5-600	7.0	8.5	7.5	9.0	50	45	35	25	25	20	45	40	27	20	25	20	81.95	(1-24)
	ZFM-12	800-1250	50-90	—	—	6.0	7.5	35	25	35	25	35	25	30	20	30	20	30	20	71.95	(1-24)
	NEW **ZFM-4212**	2000-4200	DC-1300	—	—	7.0	8.5	—	—	25	17	—	—	—	—	18	10	—	—	39.95	(1-9)
ZAM case F14	**ZAM-42** NEW	1500-4200	DC-500	—	—	7.0	8.5	25	20	25	17	25	20	18	10	18	10	18	10	39.95	(1-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

schematic



MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
ZAD-1B	5895-00-280-7750
ZAD-4B	5895-01-127-0376
ZAD-6B	5865-21-200-6364
ZFM-12-1	5825-01-127-3377
ZLW-1W	5840-00-607-7010
ZLW-2B	6920-01-037-1974
ZLW-5-1	4920-01-017-2753
ZMA-3	5865-01-064-0212

coaxial connections

see case style outline drawing

Series	ZP	ZLW	ZAD (ex-2, -4)	ZAD -2, -4	ZMA	ZEM	ZFM	ZAM
models	all models	all models	all models	all models	all models	all models	all models	all models
L	L	1	1	1	1	1	1	2
R	X	3	3	2	2	2	2	1
I	R	2	2	3	3	3	3	3

In Stock... Immediate Delivery

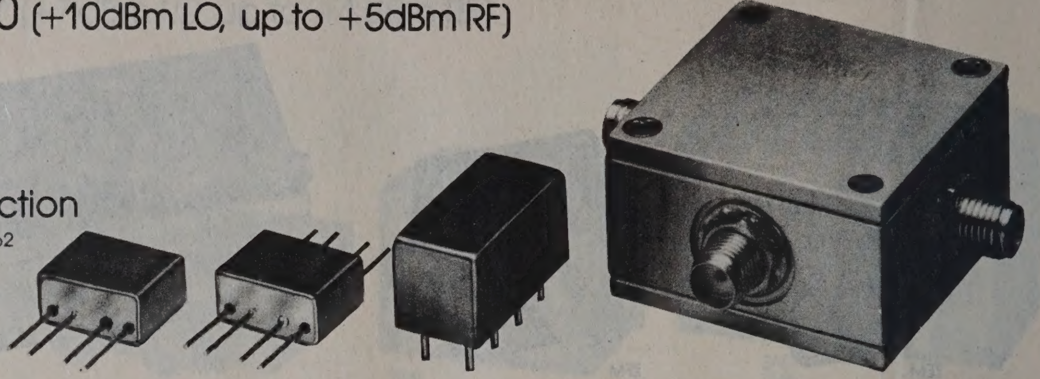
broadband, high dynamic range

Frequency Mixers

LEVEL 10 (+10dBm LO, up to +5dBm RF)

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m Typ.	Max.	Total Range Typ.	Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	PRICE, $ Ea.	Qty.
TFM case B13	**TFM-15**	10-3000	10-800	6.3	8.0	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	49.95	(1-9)
	TFM-150*	10-2000	DC-1000	6.0	8.0	6.5	8.0	32	25	35	25	35	25	33	20	30	20	30	20	39.95	(1-9)
LMX case BB48	**LMX-123**	10-3000	10-3000	7.5	8.0	7.5	8.5	35	25	35	20	30	15	35	25	30	25	30	20	59.95	(6-24)
	LMX-148	10-1500	DC-1500	6.0	7.0	6.0	10	45	40	35	30	25	20	40	35	35	25	20	12	24.95	(6-24)
SRA case A01	**SRA-215**	.05-1500	.05-500	6.0	7.5	7.0	9.0	25	20	35	25	30	20	25	20	35	25	25	15	23.95	(5-24)
	SRA-220	.05-2000	.05-500	6.0	7.5	7.0	9.0	25	20	40	30	30	20	25	20	40	30	25	15	26.95	(5-24)
ZFM case K18	**ZFM-15**	10-3000	10-800	6.3	7.5	6.5	8.5	35	25	35	25	35	25	30	20	30	20	30	20	79.95	(1-9)
	ZFM-150	10-2000	DC-1000	6.0	7.0	6.5	8.0	32	25	35	25	35	20	33	28	30	20	25	20	59.95	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

harmonic attenuation

MODEL TFM-15

Harmonics RF Order	RF CAL	1	2	3	4	5	6	7	8	9	10
1	0	0	31	17	42	32	48	47	52	65	59
2	83	38	45	39	48	46	76	69	70	64	71
3	87	39	49	37	52	42	57	63	65	65	65
4	89	64	60	58	56	59	60	62	69	74	70
5	90	74	69	59	72	55	74	58	71	67	72
6	83	83	76	74	67	69	67	72	70	74	78
7	83	76	83	81	79	69	71	66	70	69	77
8	84	75	76	81	82	77	77	80	78	78	77
9	84	77	76	75	82	80	81	82	80	79	80
10	81	76	76	74	75	80	81	81	81	80	81

Harmonic LO Order

Model: TFM-15 S/N: sample band-width: 0-99999 MHz
999.100 MHZ input P. −.06 dBm
969.010 MHz input P. +9.96 dBm
IF = 30.090 MHz | LO = +10 dBm, 969.01 MHz
IF amplit. −7.14 dBm | RF = 0 dBm, 999.1 MHz

Final Spectrum Analyzer HP-8566A Parameters:
RES BW 1KHz VBW 3kHz
SWP 300 msec ATTEN 10 dB 5 dB/ div SPAN 100 kHz

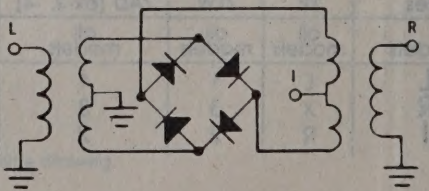
LO drive adjusted with 19.75db Weinschel S/N:G4047 RF,IF attenuator
10.0dB Tektronix S/N:011-0085-00

NOTES:

* Below 10 MHz IF, conversion loss increases up to 6dB higher as frequency decreases to DC.

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings, RF power 50 mW level 10, 200mW level 13, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

schematic



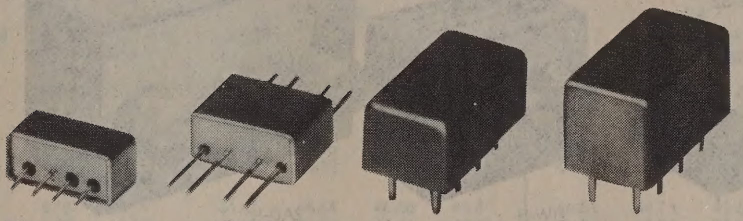
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

50 KHz to 3 GHz

Mini-Circuits

LEVEL 13 (+13dBm LO, up to +9dBm RF)

NEW



	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
TFM-MH case B02	**TFM-1MH**	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	21.95	(5-24)
	TFM-3MH	.1-250	DC-250	5.0	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	21.95	(5-24)
LMX-MH case BB48	**LMX-125MH**	0.5-500	DC-500	6.0	7.0	7.0	9.0	45	40	45	40	40	30	45	40	40	35	35	25	54.95	(6-24)
SBL-MH case A06	**SBL-1MH**	1-500	DC-500	5.5	7.5	6.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	9.50	(10-49)
SRA-MH case A01	**SRA-1MH**	5-500	DC-500	5.5	7.0	6.5	8.5	50	45	45	30	35	25	45	35	40	25	30	20	13.95	(5-24)
	SRA-3MH	.025-200	DC-200	5.5	7.5	6.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	15.95	(5-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

pin and coaxial connections

see case style outline drawing

Series	TFM	LMX	SRA	ZFM	TFM-MH	LMX-MH	SBL-MH	SRA-MH
Models	all models	all models	all models	all models	all models	all models	all models	all models
LO	4	8	8	1	4	8	8	8
RF	1	5	1	2	1	5	1	1
IF	2	4	3	3	2	4	3,4*	3,4*
GND	3	2,3,6,7	2,5,6,7	—	3	2,3,6,7	2,5,6,7	2,5,6,7
CASE GND	3	2,3,6,7	2,5,6,7	—	3	2,3,6,7	—	2

*pins must be connected together externally

CAPD
now available!
computer-automated performance data
(see technical section)

In Stock...Immediate Delivery

For More Information. Circle No. 415

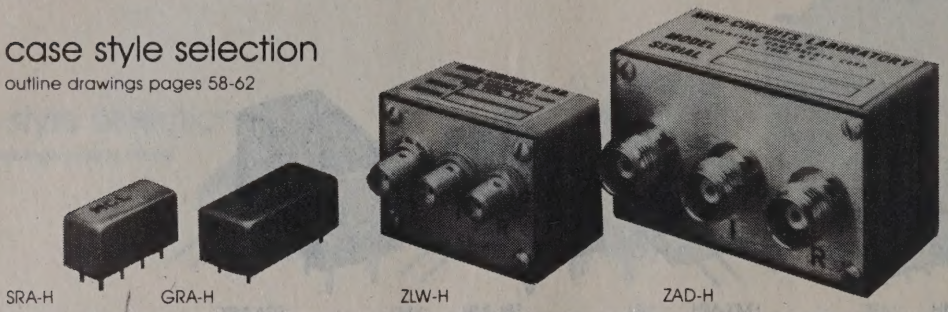
very high dynamic range

Frequency Mixers

LEVEL 17 (+17 dBm LO, up to +10 dBm RF)

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
SRA-H case A01	● SRA-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	17.95	(5-24)
	● SRA-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	40	45	25	35	25	45	35	40	30	30	20	21.95	(5-24)
	● SRA-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	30	30	20	25	20	29.95	(5-24)
	● SRA-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	50	45	40	30	35	25	45	35	40	30	30	20	19.95	(5-24)
	SRA-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	39.95	(1-24)
	SRA-173H NEW	5-1200	DC-1200	6.0	7.0	7.0	9.0	25	20	25	18	25	18	27	20	25	18	25	18	29.95	(1-5)
GRA-H case D08	GRA-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	18.95	(5-24)
	GRA-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	20.95	(5-24)
	GRA-6H	.01-50	DC-50	5.5	6.0	5 5	7.0	50	45	45	30	35	25	50	40	47	35	32	25	26.95	(5-24)
ZLW-H case M21 SMA	● ZLW-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	45.95	(4-24)
	● ZLW-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	49.95	(4-24)
	● ZLW-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	59.95	(4-24)
	● ZLW-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	47.95	(4-24)
	ZLW-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	91.95	(4-24)
ZAD-H case M22 BNC, TNC	● ZAD-1H	.5-500	DC-500	5.5	7.5	6.5	8.5	50	45	45	30	35	25	45	35	40	30	30	20	35.95	(4-24)
	● ZAD-1WH	1-750	DC-750	5.5	7.5	6.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	39.95	(4-24)
	● ZAD-2H	2-1000	DC-1000	6.0	7.5	8.5	10	50	40	35	25	35	25	45	35	30	20	25	20	49.95	(4-24)
	● ZAD-3H	.05-200	DC-200	5.5	7.0	5.5	7.5	55	45	45	30	35	25	45	35	40	30	30	20	37.95	(4-24)
	ZAD-11H	10-3000	10-1000	8.0	10	10	12	27	20	25	18	23	16	27	20	25	18	23	16	81.95	(4-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:

- ● HTRB tested

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings, RF power 200 mW, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
GRA-1H		06N
GRA-1H Hi-Rel		06S
GRA-1H		10N
GRA-1H		10S
GRA-3H		05N
GRA-3H Hi-Rel		05S
SRA-1H	6625-00-594-0223	08N
SRA-1 Hi-Rel		08S
SRA-1WH	5840-00-576-0716	
SRA-2H	5895-01-063-1078	
SRA-3H	5895-01-117-4537	
ZAD-1WH	5895-01-045-4647	
ZLW-1H	5985-01-080-7637	
ZLW-1H-B	5962-045-7500	

*units are not QPL listed

pin and coaxial connections

see case style outline drawing

Series	SRA					GRA-H	ZLW-H	ZAD-H
Models	–1H –3H	–1WH –2H	–11H	–173H Configuration 1	–173H Configuration 2	all models	all models	all models
LO	8	8	8	3,4*	8	1	1	1
RF	1	1	1	1	1	6	3	3
IF	3,4*	3,4*	3	8	3,4*	4	2	2
GND	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,5	—	—
CASE GND	2	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	—	—	—

*pins must be connected together externally

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

10 KHz to 3 GHz

Mini-Circuits

computer-automated performance data

typical production unit / for data of other models consult factory

SRA-1H

RF (MHz)	LO (MHz)	CONVERSION LOSS (dB)			ISOLATION (dB)								VSWR (+17dBm LO)		
					L-R				L-I						
		LO+10 dBm	LO+15 dBm	LO+17 dBm	LO+7 dBm	LO+10 dBm	LO+15 dBm	LO+17 dBm	LO+7 dBm	LO+10 dBm	LO+15 dBm	LO+17 dBm	LO	RF	IF
10.00	40.00	6.99	6.36	6.15	54.08	56.43	54.97	54.54	52.32	51.54	50.87	50.53	—	—	—
35.70	65.70	7.32	6.45	6.24	53.91	51.73	49.79	49.89	50.23	48.49	47.55	46.59	2.40	1.13	1.21
61.56	91.56	6.91	6.19	6.06	52.44	50.08	48.37	47.04	48.30	46.56	44.44	44.06	2.68	1.13	1.20
87.34	57.34	6.87	6.27	6.09	53.43	54.16	51.79	51.34	51.12	50.03	48.89	47.85	2.33	1.13	1.20
113.12	83.12	7.22	6.46	6.28	52.65	50.32	48.99	47.43	48.68	47.19	45.07	44.75	2.63	1.16	1.24
138.90	108.90	5.83	6.18	6.09	51.41	48.68	46.06	45.59	46.51	44.71	42.83	42.51	2.48	1.22	1.36
164.68	134.68	6.06	6.38	6.24	48.62	46.56	43.46	43.17	44.84	42.84	40.96	40.59	2.30	1.31	1.47
190.46	160.46	5.91	6.24	6.12	47.58	44.71	41.57	41.29	43.33	41.13	39.43	38.96	2.46	1.34	1.58
216.24	186.24	5.89	6.27	6.14	46.31	43.35	40.90	40.77	41.89	40.25	38.44	37.95	2.15	1.32	1.57
242.02	212.02	6.97	6.39	6.27	44.86	41.28	39.90	39.73	41.22	39.15	37.32	36.66	2.44	1.30	1.56
267.80	237.80	6.89	6.27	6.14	43.39	40.11	38.57	38.38	40.38	37.88	36.03	35.60	2.13	1.29	1.60
293.58	263.58	7.12	6.57	6.35	42.94	39.51	37.78	37.29	39.34	36.32	34.56	34.34	2.20	1.35	1.86
319.36	289.36	6.82	6.36	6.25	42.95	39.40	38.51	37.90	38.29	35.30	33.21	32.87	2.00	1.40	2.26
345.14	315.14	7.16	6.67	6.48	40.60	37.77	38.42	37.63	37.52	34.26	32.09	31.51	2.10	1.39	2.51
370.90	340.92	7.31	6.73	6.46	38.07	36.51	38.02	36.99	36.70	33.98	31.44	30.59	1.88	1.32	2.38
396.70	366.70	7.80	6.91	6.57	38.32	36.15	37.63	37.27	37.02	34.60	31.29	30.28	2.21	1.25	2.11
422.48	392.48	8.05	6.97	6.57	38.36	36.13	36.72	37.13	35.55	33.82	31.33	30.13	1.82	1.22	2.02
448.26	418.26	7.89	7.43	7.02	38.68	36.11	35.45	35.92	33.99	32.13	31.15	30.54	2.09	1.26	2.18
474.04	444.04	8.48	7.74	7.34	38.75	36.37	35.46	35.47	32.62	30.50	29.83	39.60	1.88	1.30	2.46
500.00	470.00	8.84	7.62	6.95	37.95	36.25	35.58	35.66	30.74	28.73	28.642	28.63	1.99	1.35	2.58

SRA-1H

harmonic intermodulation

(Relative to desired IF Output)

RF Input power 0dBm

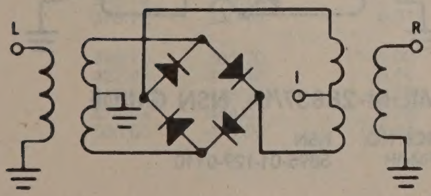
Harmonics RF Order	RF CAL	Harmonic LO Order 1	2	3	4	5	6	7	8	9	10
1	0	0	46	10	44	17	45	28	48	33	50
2	75	75	75	75	75	73	75	71	75	69	75
3	73	64	73	66	72	55	70	51	66	50	64
4	105	74	84	82	85	79	86	78	91	78	93
5	106	74	82	72	80	68	80	65	82	64	81
6	105	83	84	83	84	84	86	86	90	88	92
7	104	84	85	82	85	80	87	78	90	79	91
8	104	86	74	85	84	86	84	87	88	92	91
9	102	83	86	84	85	85	86	86	89	89	93
10	105	84	84	83	84	84	84	87	87	90	92

RF Input power −10dBm

Harmonics RF Order	RF CAL	Harmonic LO Order 1	2	3	4	5	6	7	8	9	10
1	0	0	47	10	44	18	44	30	46	36	47
2	84	78	78	76	78	72	78	70	83	70	82
3	91	73	79	70	79	65	78	62	78	62	77
4	95	64	83	82	85	83	86	86	87	88	86
5	95	84	80	84	82	83	84	86	88	88	88
6	95	82	81	83	83	84	84	86	87	87	87
7	95	81	84	81	82	83	85	85	86	86	87
8	96	82	65	84	83	83	83	85	86	88	87
9	95	81	85	82	83	82	85	85	87	88	86
10	95	83	83	83	82	83	83	85	87	87	88

test conditions RF = 10 MHZ LO = 40 MHz at +17dBm
for other test frequencies, contact factory

schematic



In Stock...Immediate Delivery

very low distortion

Frequency Mixers

LEVEL 17S (+17dBm LO, up to +14dBm RF)

case style selection

outline drawings pages 58-62

TFM-H

TAK-H

	MODEL NO.	FREQUENCY MHz		CONVERSION LOSS dB				LO-RF ISOLATION, dB						LO-IF ISOLATION, dB						PRICE, $	
		LO/RF f_L-f_U	IF	Mid-Band m		Total Range		L		M		U		L		M		U			
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
TFM-H case B02	**TFM-1H**	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	20	45	40	35	25	25	20	23.95	(5-24)
	TFM-2H	5-1000	DC-1000	6.2	7.0	7.0	10	50	45	40	30	30	20	45	40	35	25	25	17	31.95	(5-24)
	TFM-3H	.1-250	DC-250	5.0	7.0	6.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	23.95	(5-24)
case B13	**TFM-4H** NEW	5-1200	DC-1200	6.5	8.0	7.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	33.95	(5-24)
TAK-H case A05	**TAK-1H**	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	19.95	(5-24)
	TAK-1WH	5-750	DC-750	6.2	7.5	7.0	9.0	50	40	40	30	30	25	45	35	35	25	30	20	23.95	(5-24)
	TAK-3H	05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	21.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section."
2. For Quality Control procedures, see page 6.
3. For environmental specifications, see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF power 200 mW, peak IF current 40 mA, see pg. 7.
6. For connector types and case mounting options, see case style outline drawings.
7. Prices and specifications subject to change without notice.

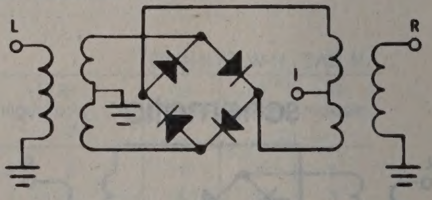
pin and coaxial connections

see case style outline drawing

Series	TFM-H	TAK-H		ZFM-H	ZLW-SH	ZAD-SH
Models	all models	−1H −3H	−1WH	all models	all models	all models
LO	4	8	8	1	1	1
RF	1	1	1	2	3	3
IF	2	3,4*	3,4*	3	2	2
GND	3	2,5,6,7	2,5,6,7	—	—	—
CASE GND	3	2	2,5,6,7	—	—	—

*pins must be connected externally

schematic



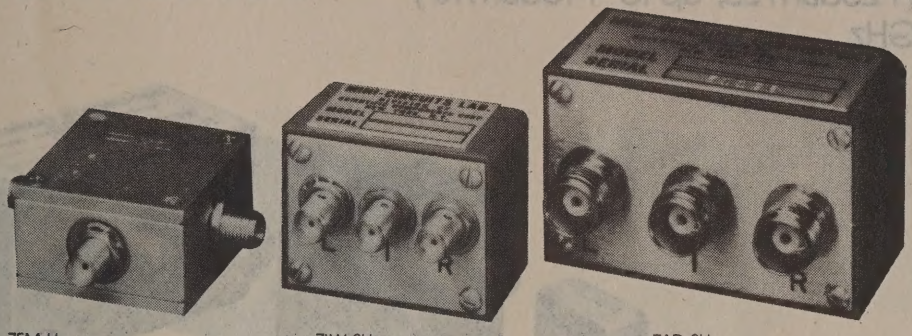
MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
TFM-1H	5895-01-129-0110

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

10 KHz to 1.2 GHz

Mini-Circuits



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
ZFM-H case K18	**ZFM-1H**	2-500	DC-500	6.0	7.5	7.0	8.5	50	45	40	30	30	25	45	35	35	25	25	20	53.95	(1-24)
	ZFM-2H	5-1000	DC-1000	6.2	7.0	7.0	10	50	40	40	30	30	20	45	40	35	25	25	17	61.95	(1-24)
	ZFM-3H	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	54.95	(1-24)
ZLW- SH case M21	**ZLW-1H**	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	50.95	(4-24)
	ZLW-1WSH	5-750	DC-750	6.2	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	54.95	(4-24)
	ZLW-3SH	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	52.95	(4-24)
ZAD-SH case M22	**ZAD-1SH**	2-500	DC-500	6.0	7.5	7.0	8.5	50	40	40	30	30	25	45	35	35	25	25	20	40.95	(4-24)
	ZAD-1WSH	5-750	DC-750	6.2	7.5	7.0	9.0	50	45	40	30	30	20	45	40	35	25	30	20	44.95	(4-24)
	ZAD-3SH	.05-300	DC-300	5.0	7.0	6.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	42.95	(4-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

computer-automated performance data

typical production unit / for data of other models consult factory

TFM-1H

RF (MHz)	LO (MHz)	CONVERSION LOSS (dB)	ISOLATION (dB) L-R	ISOLATION (dB) L-R	VSWR LO	VSWR RF	VSWR IF
10.00	40.00	5.89	52.26	54.10	1.59	1.15	1.33
35.78	65.78	6.15	47.79	50.70	1.67	1.10	1.34
61.56	91.56	6.24	45.16	47.94	1.51	1.09	1.34
87.34	57.34	6.16	48.87	51.91	1.53	1.08	1.35
113.12	83.12	6.03	46.18	48.52	1.57	1.08	1.35
138.90	108.90	6.29	43.89	45.76	1.57	1.08	1.36
164.68	134.68	6.13	41.75	44.17	1.55	1.08	1.37
190.46	160.46	5.89	40.42	42.16	1.50	1.07	1.38
216.24	186.24	6.13	38.76	40.87	1.51	1.07	1.40
242.02	212.02	6.00	37.29	38.89	1.47	1.07	1.41
267.00	237.80	5.86	36.41	37.32	1.47	1.06	1.42
293.58	263.58	6.12	35.27	36.40	1.48	1.06	1.44
319.36	289.36	6.03	34.46	34.97	1.44	1.05	1.45
345.14	315.14	5.94	33.99	34.19	1.48	1.05	1.48
370.92	340.92	6.01	33.19	32.90	1.47	1.04	1.50
396.70	366.70	6.00	32.52	32.93	1.45	1.04	1.52
422.48	392.48	6.19	32.12	32.12	1.48	1.04	1.56
448.26	418.26	6.39	31.50	31.13	1.47	1.05	1.57
474.04	444.04	6.22	31.48	30.35	1.50	1.05	1.61
500.00	470.00	6.44	31.93	29.87	1.47	1.06	1.64

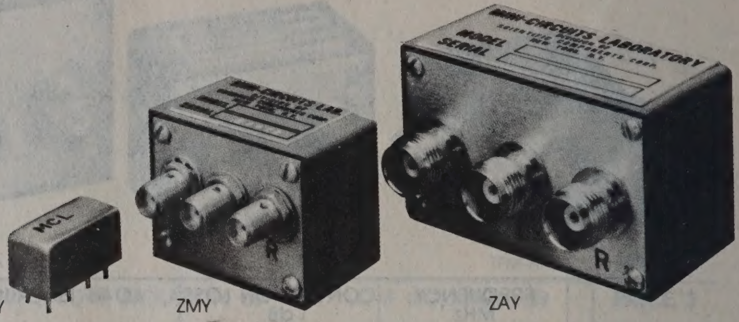
In Stock... Immediate Delivery

For More Information. Circle No. 415

ultra-low distortion

Frequency Mixers

LEVEL 23 (+23dBm LO, up to +15dBm RF)
10 KHz to 1 GHz



	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	PRICE, $ Ea.	Qty.
RAY	●RAY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	34.95	(4-9)
case A01	●RAY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	54.95	(4-9)
	●RAY-3	07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	34.95	(4-9)
	RAY-6 NEW	0.01-50	DC50	5.5	7.5	6.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	31.95	(1-24)
ZMY	●ZMY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	57.95	(1-9)
case M21	●ZMY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	77.95	(1-9)
	●ZMY-3	07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	57.95	(1-9)
ZAY	●ZAY-1	5-500	DC-500	6.0	7.5	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	47.95	(1-9)
case M22	●ZAY-2	10-1000	DC-1000	7.0	8.5	8.5	10	50	35	40	30	35	25	50	35	35	25	25	20	67.95	(1-9)
	●ZAY-3	07-300	DC-200	6.0	7.5	6.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	47.95	(1-9)

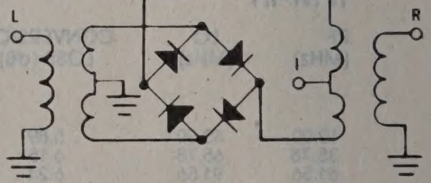
L = low range (f_L to 10 f_L)   M = mid range ($10f_L$ to $f_U/2$)   U = upper range ($f_U/2$ to f_U)

m = mid band ($2f_L$ to $f_U/2$)

NOTES:
- ● HTRB tested

1. For typical characteristics, compression level, phase detection and electronic attenuation, see "Mixer Technical Section".
2. For Quality Control procedures, see page 6.
3. For environmental specifications see page 7.
4. For High-Rel and TX description, see page 6.
5. Absolute Maximum Ratings; RF power 350 mW for level 23, 23S and 700 mW for level 27. Peak IF current 40 mA.
6. For connector types and case mounting options, see case style outline drawing.
7. Prices and specifications subject to change without notice.

schematic



pin and coaxial connections

see case style outline drawing

Series	RAY			ZMY	ZAY	SAY	ZFY	VAY
Models	−1 −3	−2	−6	all models	all models	all models	all models	all models
LO	8	8	8	1	1	8	1	8
RF	1	1	1	3	3	1	2	1
IF	3,4*	3,4*	3,4*	2	2	3	3	3
GND	2,5,6,7	2,5,6,7	2,5,6,7	—	—	2,5,6,7	—	2,5,6,7
CASE GND	2	2,5,6,7	—	—	—	2,5,6,7	—	2,5,6,7

*pins must be connected externally

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1A*
RAY-1	5825-01-105-6188	04N
RAY-1 Hi-Rel		04S
RAY-2	5895-01-111-7368	
RAY-3	5895-01-064-5082	
ZMY-2	4935-01-080-7636	

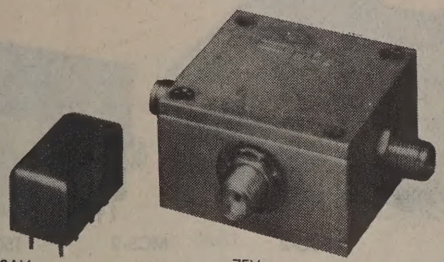
*units are not QPL listed

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

Mini-Circuits

LEVEL 23S (+23dBm LO, up to +20dBm RF)

100 KHz to 2.4 GHz



SAY ZFY

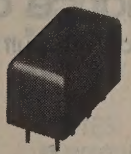
	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m		Total Range		LO-RF ISOLATION, dB L		M		U		LO-IF ISOLATION, dB L		M		U		PRICE, $	
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
SAY case A01	**SAY-1**	0.1-500	.01-500	5.3	6.0	5.3	7.5	47	40	46	35	40	30	47	40	46	35	40	30	54.95	(1-9)
	SAY-2	0.1-1000	.01-500	5.3	7.5	7.5	9.5	47	40	40	30	30	25	47	40	40	25	25	20	59.95	(1-9)
	SAY-11	10-2400	5-1000	7.0	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	64.95	(1-9)
ZFY case K18	**ZFY-1**	0.1-500	.01-500	5.3	6.0	5.3	7.5	47	40	46	35	40	30	47	40	46	35	40	30	74.95	(1-9)
	ZFY-2	0.1-1000	.01-500	5.3	7.5	7.5	9.5	47	40	40	30	30	25	47	40	40	25	25	20	79.95	(1-9)
	ZFY-11	10-2400	5-1000	7.0	8.5	8.0	10	28	20	26	20	25	20	28	20	26	20	25	20	84.95	(1-9)

L = low range (f_L to $10\ f_L$) M = mid range ($10f_L$ to $f_U/2$) U = upper range ($f_U/2$ to f_U)

m = mid band ($2f_L$ to $f_U/2$)

LEVEL 27 (+27dBm LO, up to +24dBm RF)

50 KHz to 500 MHz



VAY-1

	MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m		Total Range		LO-RF ISOLATION, dB L		M		U		LO-IF ISOLATION, dB L		M		U		PRICE, $	
				Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
VAY-1 case A01	**VAY-1**	NEW .05-500	.02-500	6.0	7.5	7.5	8.5	47	40	46	35	35	25	47	40	46	35	35	25	74.95	(1-9)

L = low range (f_L to $10\ f_L$) M = mid range ($10f_L$ to $f_U/2$) U = upper range ($f_U/2$ to f_U)

m = mid band ($2f_L$ to $f_U/2$)

CAPD
now
available!
computer-automated
performance data
(see technical section)

In Stock... Immediate Delivery

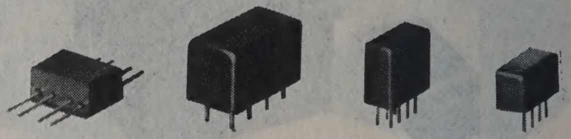
Power Splitter/Combiners

2 WAY-0°

2 KHz to 4.2 GHz

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB						INSERTION LOSS, dB Above 3dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
			L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
LPS case BB48	LPS-109 NEW	10-500	35	25	30	25	30	25	0.3	0.5	0.4	0.6	0.5	0.8	2.0	3.0	2.0	0.15	0.2	0.3	15.95	(5-24)
PSC-2 case A01	PSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.6	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	9.95	(6-49)
	PSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.6	0.5	0.9	0.7	1.0	2.0	3.0	4.0	0.15	0.2	0.3	14.95	(6-49)
	PSC-2-2	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	0.15	.25	0.3	19.95	(6-49)
	PSC-2-4	10-1000	30	25	25	20	25	20	0.6	1.0	0.6	1.2	0.7	1.2	2.0	8.0	20	0.15	0.2	0.4	19.95	(6-49)
	■ PSC-2375	55-85	—	—	35	25	—	—	—	—	0.3	0.5	—	—	—	1.0	—	—	0.1	—	19.95	(6-24)
	■ PSC-2-1-75	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	0.15	0.2	0.3	11.95	(6-49)
MSC-2 case A03	MSC-2-1	0.1-450	20	15	30	20	30	20	0.3	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	16.95	(5-24)
	MSC-2-1W	2-650	22	18	30	25	22	18	0.3	0.5	0.5	0.8	0.8	1.2	1.0	2.0	4.0	0.15	0.2	0.3	17.95	(5-24)
TSC-2 case B02	TSC-2-1 NEW	1-400	30	25	30	25	30	20	0.25	0.5	0.4	0.75	0.8	1.0	2.0	3.0	4.0	0.15	0.2	0.6	13.95	(5-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PSC-2-1

FREQUENCY MHz	INSERTION LOSS (dB) S-1	INSERTION LOSS (dB) S-2	UNBALANCE (dB) 1-2	ISOLATION (dB) 1-2	VSWR SUM	VSWR 1	VSWR 2
.10	3.33	3.33	.02	21.96	1.40	1.14	1.14
21.147	3.19	3.19	0.00	33.40	1.12	1.11	1.12
42.194	3.19	3.19	0.00	34.63	1.13	1.11	1.11
63.241	3.27	3.25	−.02	33.73	1.13	1.11	1.11
84.288	3.24	3.25	.01	32.70	1.13	1.11	1.11
105.335	3.27	3.27	.00	31.70	1.13	1.11	1.10
126.382	3.27	3.27	0.00	31.06	1.13	1.11	1.11
147.429	3.29	3.29	0.00	30.47	1.13	1.11	1.11
168.476	3.29	3.29	0.00	30.05	1.14	1.11	1.11
189.523	3.32	3.32	0.00	29.71	1.15	1.12	1.12
210.570	3.34	3.34	0.00	29.42	1.16	1.14	1.14
231.617	3.36	3.37	.01	29.18	1.18	1.15	1.15
252.664	3.37	3.41	.04	28.85	1.21	1.17	1.17
273.711	3.43	3.47	.04	28.53	1.25	1.20	1.20
294.758	3.45	3.45	0.00	27.90	1.30	1.23	1.23
315.805	3.47	3.49	.02	27.03	1.34	1.26	1.26
336.852	3.48	3.50	.03	25.92	1.40	1.29	1.29
357.899	3.50	3.56	.06	24.51	1.46	1.32	1.33
378.946	3.58	3.62	.06	22.93	1.54	1.36	1.37
400.000	3.70	3.74	.04	21.19	1.63	1.40	1.41

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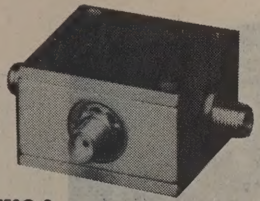
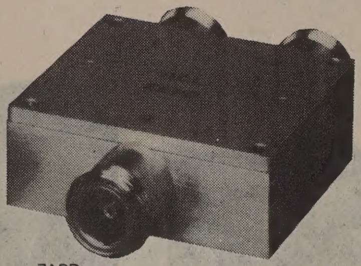
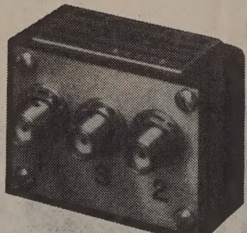
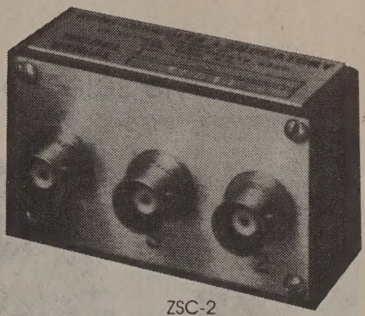
50 ohms and 75 ohms

Mini-Circuits


ZFSC-2


ZAPD


ZMSC-2


ZSC-2

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 3dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
ZFSC-2	ZFSC-2-1	5-500	30	25	28	20	25	20	0.2	0.5	0.3	0.6	0.6	0.8	2.0	4.0	4.0	.15	.15	0.3	31.95	(4-24)
case K18	■ ZFSC-2-1-75 NEW	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	32.95	(4-24)
	ZFSC-2-1W	1-750	30	20	28	20	25	20	0.2	0.5	0.4	0.8	0.8	1.0	2.0	4.0	4.0	.15	.15	0.3	35.95	(4-24)
	ZFSC-2-2	10-1000	30	20	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	39.95	(4-24)
	ZFSC-2-4	0.2-1000	20	15	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2.0	4.0	4.0	.15	.15	0.3	44.95	(4-24)
	ZFSC-2-5	10-1500	25	15	30	20	25	18	0.25	0.6	0.5	1.0	0.8	1.5	5.0	8.0	10.0	.15	0.2	0.5	49.95	(4-24)
	ZFSC-2-6	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	36.95	(4-24)
	■ ZFSC-2-6-75	0.004-60	30	20	35	20	25	20	0.5	0.8	0.4	0.8	0.7	1.0	1.0	2.0	3.0	.15	0.2	0.3	38.95	(4-24)
		GHz																				
ZAPD	ZAPD-1	0.5-1.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	1	—	—	0.2	—	39.95	(1-9)
case F14	ZAPD-2	1.0-2.0	25	19	25	19	25	19	0.25	0.6	0.25	0.6	0.25	0.6	—	2	—	—	0.2	—	39.95	(1-9)
	ZAPD-4	2.0-4.2	25	19	25	19	25	19	0.4	0.8	0.4	0.8	0.4	0.8	—	6	—	—	0.4	—	39.95	(1-9)
case F53	ZAPD-21 NEW	0.5-2.0	25	19	25	19	25	19	0.25	0.8	0.25	0.8	0.25	0.8	—	2	—	—	0.2	—	49.95	(1-9)
		MHz																				
ZMSC-2	ZMSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	37.95	(4-24)
case M21	ZMSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	42.95	(4-24)
	ZMSC-2-2	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	47.95	(4-24)
ZSC-2	ZSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	27.95	(4-24)
case M22	ZSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2.0	3.0	4.0	.15	0.2	0.3	32.95	(4-24)
	ZSC-2-2	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	.15	.25	0.3	37.95	(4-24)
	ZSC-2-4	10-1000	25	20	35	20	25	20	0.2	0.5	0.5	0.8	0.7	1.3	2.0	4.0	6.0	.15	0.2	0.3	37.95	(4-24)
	■ ZSC-2375	55-85	35	25	35	25	35	25	0.3	0.5	0.3	0.5	0.3	0.5	—	1.0	—	—	0.1	—	37.95	(4-24)
	■ ZSC-2-1-75	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	.15	0.2	0.3	29.95	(4-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For Quality Control procedures, see page 6.
2. For environmental specifications, see page 7.
3. Absolute Maximum Ratings, Matched power rating ZAPD 10W all other models 1W, Internal load dissipation 0.125W, see page 6.
4. For connector types and case mounting options, see case style outline drawing.
5. Prices and specifications subject to change without notice.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Ground
LPS	1	4	5	2,3,6,7,8
PSC-2	1	5	6	2,3,4,7,8
MSC-2	1	5	6	2,3,4,7,8
TSC-2	1	2	4	3
ZFS-2	3	1	2	—
ZAPD-2	3	1	2	—
ZMSC-2	2	1	3	—
ZSC-2	2	1	3	—

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
MSC-2-1	6625-01-124-8595	02
PSC-2-1	5820-00-548-0739	01
PSC-2-2	5825-01-044-8944	
ZFSC-2-2A	6625-01-079-7021	
ZMSC-2-1W	5895-01-127-0232	
ZSC-2-1-BNC	5895-01-036-6254	
ZSC-2-1B	5820-00-270-3055	
ZSC-2-1-B-TNC	5820-01-109-3706	
ZSC-2-2-75B	5915-01-012-8162	

*units are not QPL listed

In Stock... Immediate Delivery

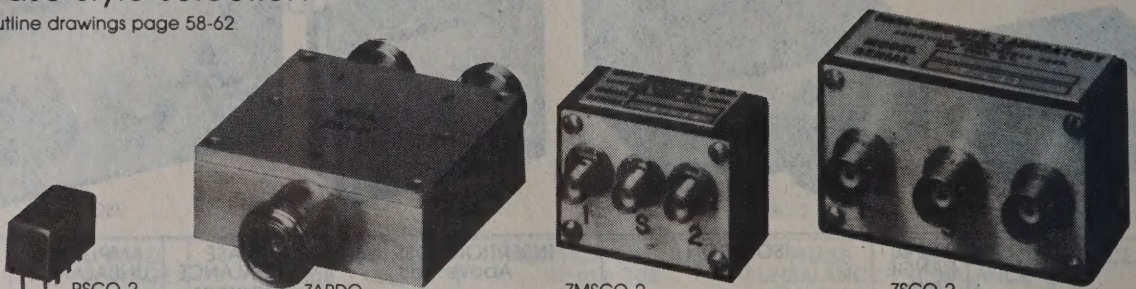
Power Splitter/Combiners

2 WAY-90°

1.4 MHz to 4.2 GHz

case style selection

outline drawings page 58-62



	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB Typ.	ISOLATION dB Min.	INSERTION LOSS dB Avg. of Coupled Outputs less 3 dB Typ.	INSERTION LOSS dB Avg. of Coupled Outputs less 3 dB Max.	PHASE UNBALANCE Degrees Max.	AMPLITUDE UNBALANCE dB Max.	PRICE $ Ea.	PRICE $ Qty.
PSCQ-2 case A01	**PSCQ-2-1.5**	1.4-1.7	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-3.4	3.0-3.8	30	25	0.4	0.7	3.8	1.2	16.95	(5-49)
	PSCQ-2-6.4	5.8-7.0	30	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-7.5	7.0-8.0	35	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-10.5	9.0-11.0	25	20	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-13	12-14	29	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-14	12-16	30	25	0.3	0.6	3.0	1.8	16.95	(5-49)
	PSCQ-2-21.4 NEW	20-23	30	25	0.4	0.7	3.0	1.2	12.95	(5-49)
	PSCQ-2-50	25-50	30	20	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-70 NEW	40-70	30	20	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	19.95	(5-49)
	PSCQ-2-120 NEW	80-120	25	18	0.3	0.7	3.0	1.5	19.95	(5-49)
	PSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	19.95	(5-49)
	PSCQ-2-250 NEW	150-250	25	18	0.4	0.8	4.0	1.5	19.95	(5-49)
	PSCQ-2-400 NEW	250-400	23	16	0.5	0.9	4.0	1.5	19.95	(5-49)
	PSCQ-2-450 NEW	350-450	23	16	0.5	0.9	5.0	1.5	19.95	(5-49)
ZAPDQ case F14	**ZAPDQ-2**	1000-2000	22	16	0.4	0.9	5.0	1.0	59.95	(1-9)
	ZAPDQ-4	2000-4200	22	16	0.4	0.9	5.0	1.0	59.95	(1-9)
ZMSCQ-2 case M21	**ZMSCQ-2-50**	25-50	30	20	0.3	0.7	3.0	1.5	49.95	(4-24)
	ZMSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	49.95	(4-24)
	ZMSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	49.95	(4-24)
ZSCQ-2 case M22	**ZSCQ-2-50**	25-50	30	20	0.3	0.7	3.0	1.5	39.95	(4-24)
	ZSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	39.95	(4-24)
	ZSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	39.95	(4-24)

NOTES:

1. For Quality Control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings, Matched power rating ZAPDQ(10W), all other models (1W), Internal load dissipation (0.125W), see page 7.
4. For connector types and case mounting options, see case style outline drawings.
5. Prices and specifications subject to change without notice.

pin and coaxial connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Ground	Terminate 50 ohms
PSCQ-2	1	2	5	3,4,7,8	6
PSCJ-2	1	5	6	2,3,4,7,8	—
ZAPDQ	3	1	2	—	—
ZMSCQ-2	2	1	3	—	—
ZSCQ-2	2	1	3	—	—
ZFSCJ-2	3	1	2	—	—
ZMSCJ-2	2	1	3	—	—
ZSCJ-2	2	1	3	—	—

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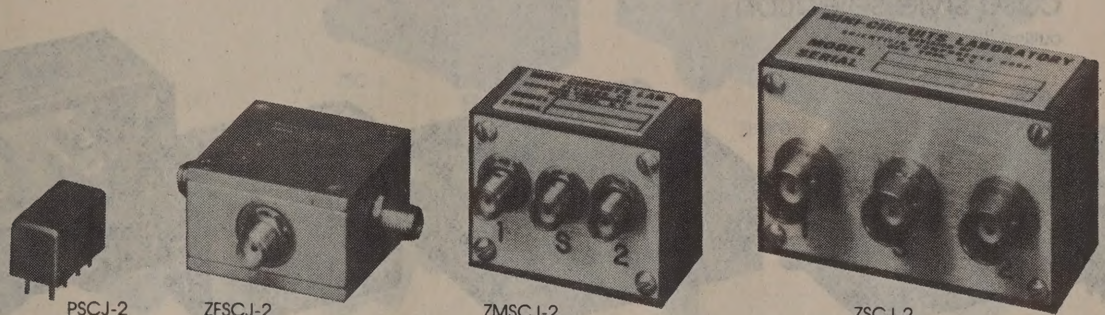
50 ohms

Mini-Circuits

2 WAY-180°

10 KHz to 500 MHz



PSCJ-2 ZFSCJ-2 ZMSCJ-2 ZSCJ-2

	MODEL NO.	FREQ RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 3dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
PSCJ-2	**PSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.5	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	19.95	(5-49)
case A01	**PSCJ-2-2**	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	29.95	(5-49)
ZFSCJ-2	**ZFSCJ-2-1**	1-500	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	49.95	(4-24)
case K18	**ZFSCJ-2-3**	5-300	30	20	33	25	30	18	1.0	1.5	1.0	1.5	1.0	1.5	2.0	4.0	6.0	.15	0.2	0.5	39.95	(4-24)
ZMSCJ-2	**ZMSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	47.95	(4-24)
case M21	**ZMSCJ-2-2**	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	57.95	(4-24)
ZSCJ-2	**ZSCJ-2-1**	1-200	35	30	35	25	30	23	.75	1.0	0.6	0.8	.75	1.2	2.0	2.5	4.0	.15	.15	0.3	37.95	(4-24)
case M22	**ZSCJ-2-2**	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1.0	2.0	2.5	0.1	0.1	0.2	47.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

CAPD

computer-automated performance data

typical production unit / for data of other models consult factory

PSCJ-2-1 FREQUENCY MHz	INSERTION LOSS (dB)		UNBAL. (dB)	ISOLATION (dB)	VSWR		
	S-1	S-2	1-2	1-2	Sum	1	2
1.20	3.79	3.64	.15	30.98	1.06	1.15	1.15
11.473	3.60	3.44	.16	32.77	1.04	1.19	1.19
21.946	3.56	3.47	.09	33.61	1.06	1.20	1.20
32.419	3.60	3.51	.09	34.38	1.08	1.21	1.22
42.892	3.61	3.52	.09	35.06	1.10	1.22	1.24
53.365	3.72	3.53	.19	35.92	1.11	1.24	1.25
63.838	3.64	3.53	.11	36.93	1.13	1.25	1.27
74.311	3.79	3.58	.21	38.25	1.15	1.26	1.29
84.784	3.77	3.57	.20	39.86	1.17	1.28	1.31
95.257	3.82	3.62	.20	41.94	1.19	1.29	1.33
105.73	3.88	3.65	.23	45.24	1.22	1.31	1.36
116.203	3.83	3.66	.17	48.23	1.24	1.33	1.38
126.676	3.92	3.66	.26	48.12	1.27	1.34	1.41
137.149	3.92	3.65	.27	44.90	1.29	1.36	1.43
147.622	3.96	3.65	.31	40.93	1.31	1.38	1.46
158.395	4.02	3.69	.33	39.29	1.34	1.40	1.50
168.568	3.97	3.68	.29	35.97	1.36	1.42	1.53
179.041	4.08	3.66	.42	34.09	1.39	1.45	1.56
189.514	4.09	3.68	.41	32.50	1.42	1.47	1.60
200.00	4.03	3.65	.38	30.89	1.44	1.49	1.64

In Stock... Immediate Delivery

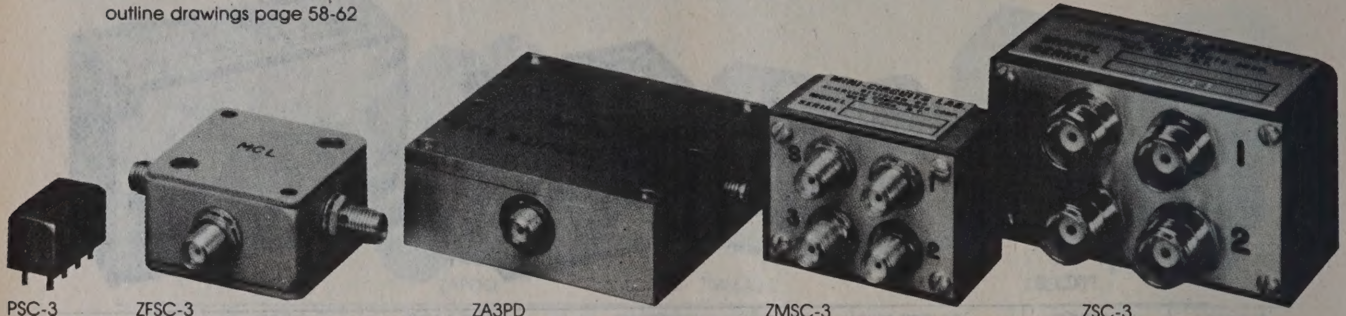
Power Splitter/Combiners

3 WAY-O°

10 KHz to 4.2 GHz

case style selection

outline drawings page 58-62



	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 4.8dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
PSC-3 case A01	• PSC-3-1	1-200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	19.95	(5-49)
	PSC-3-1W	5-500	25	20	31	15	25	15	0.4	0.8	0.4	1.4	0.8	1.4	6.0	14.	20.	0.1	0.3	0.6	29.95	(5-49)
	PSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	29.95	(5-49)
	■ PSC-3-1-75	1-200	35	30	35	25	35	25	0.6	1.0	0.3	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	20.95	(5-49)
	NEW ■ PSC-3-1-75-2	10-300	28	20	25	20	28	20	0.2	0.4	0.3	0.5	0.4	0.7	2.0	3.0	4.0	.15	0.2	0.3	22.95	(5-49)
	PSC-3-13	1-200	45	35	45	35	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	4.0	0.1	0.2	0.2	24.95	(5-49)
ZFSC-3 case J17	ZFSC-3-1	1-500	30	20	30	20	25	18	0.4	.75	0.5	0.9	0.8	1.2	2.0	3.0	4.0	0.2	0.3	0.4	39.95	(4-24)
	ZFSC-3-1W	2-750	30	20	30	20	25	18	0.4	.75	0.5	1.0	1.0	1.6	3.0	5.0	7.0	0.2	0.3	0.5	41.95	(4-24)
	ZFSC-3-13	1-200	45	30	48	35	37	30	.25	0.5	.35	0.6	.35	0.6	1.0	3.0	5.0	0.1	0.2	0.2	39.95	(4-24)
		GHz																				
ZA3PD case CC51	ZA3PD-1 NEW	0.5-1.0	20	15	20	15	20	18	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.4	0.4	0.4	79.95	(1-9)
	ZA3PD-1.5 NEW	0.75-1.5	20	16	20	16	20	16	0.3	0.7	0.3	0.7	0.3	0.7	—	—	—	0.3	0.3	0.3	79.95	(1-9)
	ZA3PD-2 NEW	1-2	20	18	20	18	20	18	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.3	0.3	0.3	79.95	(1-9)
	ZA3PD-4 NEW	2-4.2	18	14	18	14	18	14	0.7	1.0	0.7	1.0	0.7	1.0	—	—	—	0.8	0.8	0.8	79.95	(1-9)
		MHz																				
ZMSC-3 case P26	ZMSC-3-1	1-200	45	35	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	47.95	(4-24)
	ZMSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	57.95	(4-24)
ZSC-3 case P25	ZSC-3-1	1-200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1.0	1.0	2.0	4.0	.15	0.2	0.3	37.95	(4-24)
	ZSC-3-2	0.01-30	35	30	40	35	30	25	.25	.45	.15	0.3	.45	.75	1.0	2.0	4.0	0.2	0.3	0.4	47.95	(4-24)
	■ ZSC-3-1-75	1-200	35	30	35	25	35	25	0.6	1.0	0.4	0.7	0.6	1.0	2.0	3.0	4.0	.15	0.2	0.3	38.95	(4-24)
	■ ZSC-3-2-75	0.02-20	35	30	35	25	30	20	0.2	0.5	.25	0.6	.45	.75	2.0	3.0	4.0	0.2	0.3	0.4	48.95	(4-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN
PSC-3-1	5820-01-015-6027
ZSC-3-1B	5820-01-008-9566
ZSC-3-2B	5825-01-120-9320
PSC-4-1	5821-01-065-0106
PSC-4-2	5825-01-044-8945
PSC-4-3	5825-01-105-6189
ZSC-4-1B	5820-00-270-3056
ZSC-4-2B	5820-01-120-5238
ZSC-4-3B	6920-01-038-8553

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Ground
PSC-3 except PSC-3-1W, PSC-3-1-75-2	6	1	2	5	—	3,4,7,8
PSC-3-1W PSC-3-1-75-2	1	5	7	8	—	2,3,4,6
PSC-4	4	7	8	1	2	3,5,6
PSC-4A	2	8	12	5	9	1,3,4,6,7,10 11,13,14,15,16

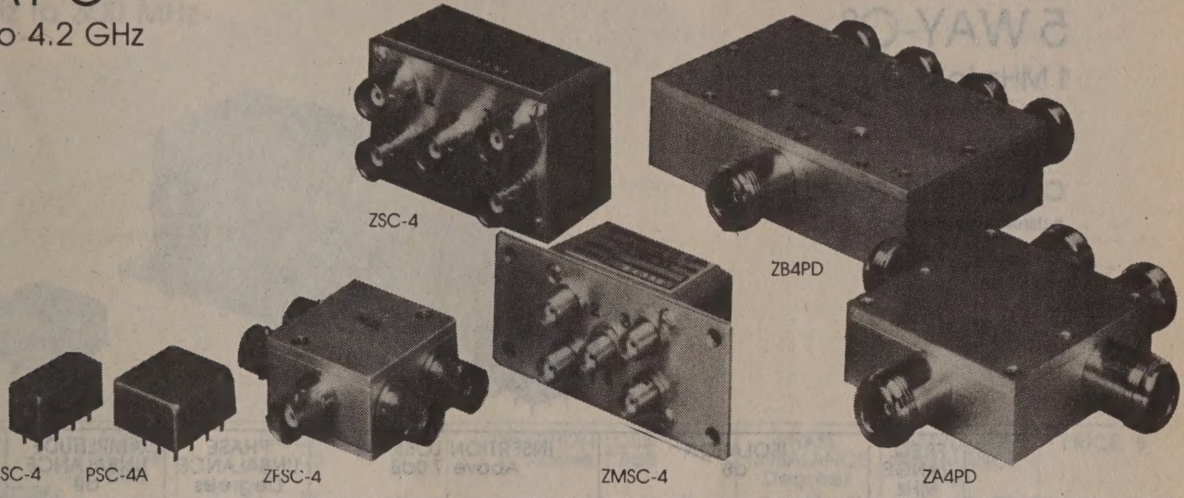
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

50 ohms and 75 ohms

Mini-Circuits

4 WAY-O°

2 KHz to 4.2 GHz



	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 6dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
PSC-4 case A01	**PSC-4-1**	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	28.95	(6-49)
	■ **PSC-4-1-75**	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.9	0.7	1.2	4.0	6.0	10.0	.15	.20	0.3	24.95	(6-49)
	PSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	8.0	.15	.20	.25	23.95	(6-49)
	PSC-4-6	0.01-40	35	29	32	25	25	18	0.4	0.8	0.3	0.5	0.5	1.0	4.0	6.0	8.0	.10	.15	.20	29.95	(6-49)
PSC-4A case C07	**PSC-4A-4**	10-1000	25	20	21	15	18	15	0.5	0.8	0.8	1.1	1.5	2.5	4.0	16.0	20.0	.20	.30	.20	49.95	(6-49)
ZFSC-4 case G15	**ZFSC-4-1**	1-1000	25	20	23	18	20	15	0.4	0.8	0.6	1.5	1.6	2.5	4.0	8.0	8.0	0.2	0.4	0.7	89.95	(1-4)
	ZFSC-4-1W	10-500	23	20	23	20	23	20	0.6	1.5	0.6	1.5	0.6	1.5	4.0	8.0	8.0	0.2	0.3	0.4	74.95	(1-4)
	ZFSC-4-3	10-300	32	28	38	30	38	30	0.5	0.8	0.6	0.9	0.9	1.2	4.0	6.0	8.0	0.1	0.1	0.2	69.95	(1-4)
	■ **ZFSC-4375** NEW	50-90	34	30	34	30	34	30	0.3	0.8	0.3	0.8	0.3	0.8	4.0	6.0	8.0	0.15	0.15	0.15	89.95	(1-4)
	▲■ **ZFSC-4-2-75-1**	200-800	25	20	25	20	25	20	0.8	1.0	0.8	1.0	0.8	1.0	4.0	16.0	20.0	0.4	0.4	0.4	74.95	(1-4)
ZMSC-4 case N24	**ZMSC-4-1**	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	1.0	.15	.20	.25	56.95	(4-24)
	ZMSC-4-2	0.002-20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	69.95	(4-24)
	ZMSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	53.95	(4-24)
ZSC-4 case N27	**ZSC-4-1**	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	.75	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	46.95	(4-24)
	■ **ZSC-4-1-75**	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.8	0.7	1.2	0.4	6.0	10.0	.15	.20	0.3	46.95	(4-24)
	ZSC-4-2	0.002-20	30	20	33	25	33	25	.45	.75	0.3	0.5	0.7	1.0	4.0	6.0	8.0	.15	.20	.25	69.95	(4-24)
	ZSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	.75	0.7	1.2	4.0	6.0	10.0	.15	.20	.25	43.95	(4-24)
		GHz																				
ZA4PD case DD52	**ZA4PD-2**	1-2	25	18	25	18	25	18	0.3	0.8	0.3	0.8	0.3	0.8	—	6.0	—	0.7	0.7	0.7	79.95	(1-9)
	ZA4PD-4	2-4.2	25	18	25	18	25	18	0.5	0.8	0.3	0.8	0.3	0.8	—	16.0	—	0.8	0.8	0.8	79.95	(1-9)
ZB4PD case EE54	**ZB4PD-42** NEW	1.7-4.2	23	16	23	16	23	16	0.5	1.1	0.5	1.1	0.5	1.1	—	8.0	—	0.8	0.8	0.8	99.95	(1-9)
	ZB4PD-4 NEW	3.7-4.2	24	16	24	16	24	16	0.6	1.1	0.6	1.1	0.6	1.1	—	16.0	—	0.8	0.8	0.8	89.95	(1-9)

L = low range (f_L to 10 f_L)　M = mid range (10f_L to f_U/2)　U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.
● Model PSC-3-1 manufactured under license protected by patent 3,428,920.
▲ On Model ZFSC-4-2-75-1, up to 15V and 15mA DC may be passed from input to all outputs.

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings;
   Matched power rating ZA3PD, ZA4PD, ZB4PD(10W.)
   all other models (1W)
   Internal load dissipation
   all 3-way models (0.375W) all 4-way models (0.25W), see page 7.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. All 3-way power dividers with exception of ZA3PD are licensed under U.S. Patent 3,428,920; reissued as RE 27,299.

CAPD now available! computer-automated performance data (see technical section)

In Stock... Immediate Delivery

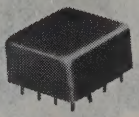
Power Splitter/Combiners

5 WAY-O°

1 MHz to 300 MHz

case style selection

outline drawings page 58-62



PSC-5

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 7.0dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
PSC-5	PSC-5-1 NEW	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2.0	4.0	8.0	0.2	0.3	0.6	59.95	(1-5)
case C07	■ PSC-5-1-75 NEW	1-300	35	25	30	23	25	18	0.4	0.6	0.6	0.9	0.9	1.3	2.0	4.0	8.0	0.2	0.3	0.6	59.95	(1-5)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt
   Internal load dissipation, 0.5 watt.
2. Refer to table of contents for qualtiy control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Ground	Not Used
PSC-5	1	4	8	12	16	15	—	2,5,7,11,13,14	3,6,9,10
PSC-6	1	3	4	8	12	16	15	2,5,7,11,13,14	6,9,10

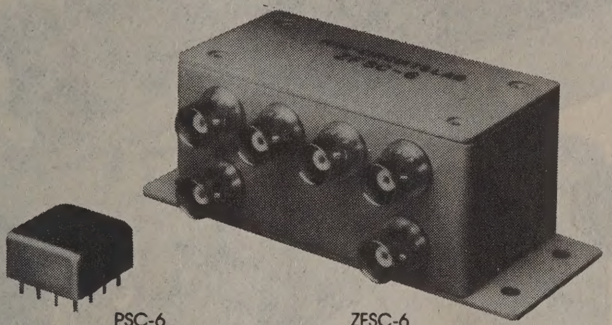
Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

50 ohms and 75 ohms

Mini-Circuits

6 WAY-O°

1 MHz to 300 MHz



MODEL NO.		FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	PRICE, $ Ea.	Qty.
PSC-6	PSC-6-1	1-175	30	24	26	18	26	18	0.5	0.8	0.7	1.0	1.0	1.5	4.0	6.0	12.0	0.2	0.4	0.8	68.95	(1-5)
case C07 ■	PSC-6-1-75 NEW	1-300	35	25	30	23	25	18	0.4	0.6	0.6	0.9	0.6	1.1	2.0	6.0	12.0	0.2	0.3	0.6	78.95	(1-5)
ZFSC-6	ZFSC-6-1	1-175	27	22	26	20	26	20	0.75	1.0	0.75	1.2	0.8	1.2	2.0	6.0	12.0	0.2	0.4	0.6	89.95	(1-4)
case Q28 ■	ZFSC-6-1-75	1-200	30	25	30	22	20	18	0.75	1.0	0.75	1.0	0.9	1.2	2.0	6.0	12.0	0.2	0.4	0.6	89.95	(1-4)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

PSC-6-1

computer-automated performance data

typical production unit / for data of other models consult factory

INSERTION LOSS MHz	S-1 (dB)	S-2 (dB)	S-3 (dB)	S-4 (dB)	S-5 (dB)	S-6 (dB)	UNBAL.
1.00	8.39	8.40	8.42	8.43	8.45	8.43	0.06
10.157	8.16	8.17	8.14	8.19	8.19	8.20	0.05
28.471	8.24	8.24	8.23	8.27	8.27	8.29	0.04
55.942	8.32	8.36	8.30	8.35	8.35	8.36	0.06
83.413	8.39	8.43	8.38	8.42	8.46	8.43	0.08
101.727	8.48	8.52	8.49	8.48	8.52	8.52	0.04
120.041	8.62	8.62	8.55	8.58	8.62	8.63	0.07
138.355	8.62	8.65	8.56	8.58	8.68	8.67	0.12
156.669	8.68	8.72	8.60	8.65	8.75	8.72	0.15
175.00	8.76	8.80	8.65	8.70	8.84	8.77	0.19

ISOLATION MHz	1-2 (dB)	1-3 (dB)	1-5 (dB)	2-3 (dB)	4-5 (dB)	4-6 (dB)	5-6 (dB)
1.00	30.19	31.52	40.69	28.79	29.26	31.97	27.69
10.157	28.66	29.66	41.38	27.98	27.74	30.15	26.56
28.471	28.10	29.10	40.68	27.35	26.92	29.51	26.09
55.942	27.03	28.32	38.27	25.95	25.40	28.46	25.26
83.413	25.99	27.54	36.33	24.53	23.90	27.41	24.34
101.727	25.30	27.03	35.43	23.65	23.00	26.76	23.74
120.041	24.71	26.59	34.81	22.91	22.22	26.24	23.22
138.355	24.15	26.16	34.29	22.19	21.43	25.74	22.69
156.669	23.57	25.72	34.02	21.43	20.75	25.27	22.17
175.00	23.01	25.22	34.07	20.74	20.09	24.76	21.57

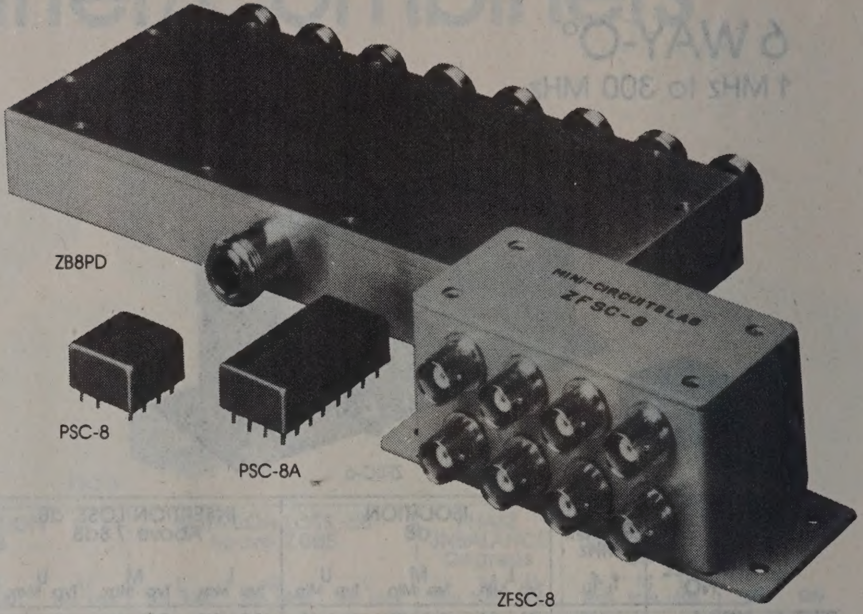
VSWR MHz	#S VSWR	#1 VSWR	#2 VSWR	#3 VSWR	#4 VSWR	#5 VSWR	#6 VSWR
1.00	1.12	1.11	1.10	1.10	1.11	1.09	1.10
10.00	1.25	1.09	1.07	1.08	1.09	1.06	1.12
27.36	1.26	1.08	1.07	1.08	1.08	1.04	1.11
53.40	1.30	1.08	1.08	1.08	1.09	1.05	1.09
88.12	1.37	1.08	1.09	1.09	1.09	1.05	1.11
105.48	1.39	1.08	1.10	1.09	1.09	1.05	1.12
122.84	1.40	1.08	1.11	1.10	1.10	1.05	1.13
140.20	1.39	1.08	1.11	1.10	1.10	1.05	1.15
157.56	1.37	1.08	1.12	1.11	1.11	1.05	1.15
175.00	1.34	1.09	1.13	1.13	1.13	1.05	1.16

In Stock... Immediate Delivery

Power Splitter/Combiners

8 WAY-O°

10 KHz to 4.2 GHz



case style selection

outline drawings pages 58-62

	MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB						INSERTION LOSS, dB Above 9dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
			L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
PSC-8	PSC-8-1	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	68.95	(1-5)
case C07	■ PSC-8-1-75	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.2	0.3	69.95	(1-5)
	PSC-8-6	0.01-10	40	30	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	79.95	(1-5)
PSC-8A	PSC-8A-4	5-500	25	20	23	18	20	15	0.7	1.2	1.0	1.8	1.4	2.0	3.0	8.0	16.0	0.2	0.3	0.5	89.95	(1-4)
case E10	■ PSC-8A4-75 NEW	1-300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	79.95	(1-4)
ZFSC-8	ZFSC-8-1	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	89.95	(1-4)
case R29	■ ZFSC-8-1-75	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.3	0.5	90.95	(1-4)
	■ ZFSC-84-75 NEW	1-300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	119.95	(1-4)
	■ ZFSC-8375	50-90	30	30	30	25	25	25	1.0	1.0	1.0	1.3	1.3	1.3	2.0	2.0	2.00	0.2	0.2	0.2	119.95	(1-4)
	ZFSC-8-4	5-700	35	25	25	20	20	17	0.8	1.2	1.2	1.8	1.8	2.5	2.0	5.0	15.0	0.2	0.4	0.7	129.95	(1-4)
	ZFSC-8-43 NEW	30-1000	23	20	25	20	26	20	1.0	1.3	1.4	1.8	2.1	2.7	5.0	10.0	20.0	0.2	0.4	0.7	139.95	(1-4)
	ZFSC-8-6	0.01-10	40	30	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	109.95	(1-4)
		GHz																				
ZB8PD	ZB8PD-2	1-2	24	16	24	16	24	16	0.8	1.3	0.8	1.3	0.8	1.3	1.3	1.3	1.3	0.7	0.7	0.7	149.00	(1-9)
case Z40	ZB8PD-4	2-4.2	23	16	23	16	23	16	0.8	1.4	0.8	1.4	0.8	1.4	—	—	—	0.9	0.9	0.9	149.00	(1-9)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt.
   internal load dissipation, 0.62 watts.
2. Refer to table of contents for quality control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	Sum Port	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8	Ground	Not Used
PSC-8	2	1	5	9	13	16	12	8	4	3,6,7,14,15	10,11
PSC-8A	29	7	16	31	24	9	2	26	17	1,3,4,5,6,8,10,11,12,13,14,15,18,19,20,21,22,23,25,27,28,30,32	

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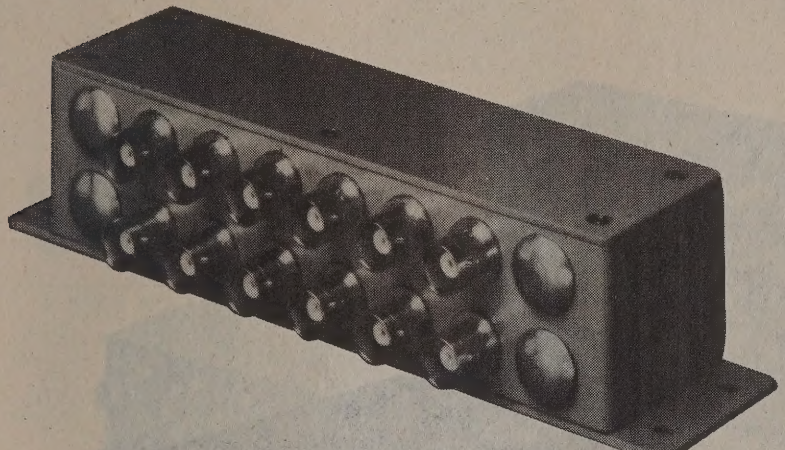
50 ohms and 75 ohms

Mini-Circuits

12 WAY-0°

1 MHz to 300 MHz



ZFSC-12

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 10.8dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
ZFSC-12 case R67	**ZFSC-12-1** NEW	1-200	30	25	35	30	28	20	0.8	1.2	1.1	1.4	1.3	1.6	2.0	4.0	6.0	0.1	0.2	0.3	174.95	(1-4)
	ZFSC-12-11 NEW	10-300	28	20	33	25	28	20	1.1	1.3	1.1	1.5	1.5	1.8	2.0	4.0	6.0	0.2	0.3	0.4	174.95	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PSC-8A-4

INSERTION LOSS, dB	MHz	S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	UNBAL.
	5.00	9.60	9.60	9.60	9.62	9.62	9.62	9.59	9.60	.03
	31.05	9.66	9.68	9.68	9.67	9.65	9.67	9.65	9.67	.03
	57.11	9.78	9.80	9.81	9.80	9.79	9.77	9.77	9.78	.04
	109.21	10.00	10.01	10.02	10.02	9.96	9.96	9.96	9.97	.06
	161.32	10.35	10.36	10.36	10.36	10.27	10.27	10.26	10.29	.10
	213.42	10.54	10.53	10.55	10.54	10.42	10.41	10.42	10.43	.14
	265.53	10.72	10.69	10.72	10.70	10.56	10.55	10.57	10.59	.17
	317.63	10.78	10.75	10.79	10.77	10.62	10.61	10.64	10.67	.18
	395.79	10.79	10.76	10.79	10.79	10.63	10.60	10.65	10.68	.19
	500.00	10.86	10.85	10.89	10.90	10.77	10.71	10.78	10.81	.19

ISOLATION, dB	MHz	1-2	1-3	1-8	3-4	5-6	5-7	7-8
	5.00	26.25	37.38	50.07	27.19	26.02	37.42	26.55
	31.05	23.99	34.75	46.72	24.18	23.73	34.49	24.07
	57.11	22.23	31.50	43.09	22.40	22.17	31.09	22.36
	109.21	21.46	27.29	38.07	21.86	22.23	26.78	21.88
	161.32	21.22	24.76	35.44	21.85	23.18	24.25	21.99
	213.42	21.19	23.24	33.61	22.06	24.75	22.78	22.46
	265.53	21.39	22.41	32.29	22.47	27.11	22.02	23.28
	317.63	21.84	22.04	31.09	22.98	30.46	21.84	24.52
	395.79	22.53	22.23	29.80	23.70	36.05	22.56	27.24
	500.00	22.74	24.07	28.71	23.44	31.27	25.96	30.63

VSWR	MHz	#S	#1	#2	#3	#4	#5	#6	#7	#8
	5.00	1.30	1.36	1.36	1.38	1.38	1.35	1.35	1.37	1.37
	31.05	1.33	1.31	1.31	1.32	1.32	1.30	1.30	1.31	1.31
	57.11	1.38	1.27	1.28	1.28	1.28	1.25	1.26	1.27	1.27
	109.21	1.51	1.28	1.29	1.29	1.29	1.23	1.24	1.26	1.26
	161.32	1.63	1.30	1.31	1.32	1.31	1.23	1.24	1.26	1.27
	213.42	1.71	1.32	1.33	1.33	1.32	1.22	1.23	1.26	1.26
	265.53	1.73	1.32	1.32	1.33	1.32	1.20	1.21	1.25	1.25
	317.63	1.68	1.31	1.31	1.31	1.30	1.17	1.18	1.23	1.23
	395.79	1.50	1.28	1.27	1.27	1.26	1.15	1.15	1.20	1.21
	500.00	1.19	1.27	1.25	1.23	1.23	1.17	1.15	1.22	1.22

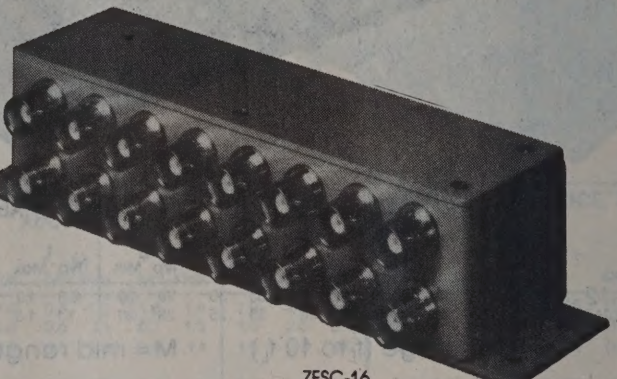
Power Splitter/Combiners

16 WAY-O°

10 KHz to 200 MHz

case style selection

outline drawings page 58-62



ZFSC-16

	MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 12dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
			L		M		U		L		M		U		L	M	U	L	M	U		
		f_L-f_U	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Ea.	Qty.
ZFSC-16 case R30	ZFSC-16-1	0.5-125	30	24	25	18	20	15	1.0	1.2	1.1	1.3	1.2	1.4	1.0	3.0	5.0	0.1	0.2	0.5	174.95	(1-4)
	ZFSC-16-3 NEW	1-30	45	40	45	40	41	35	0.5	0.9	0.5	0.9	0.5	0.9	1.0	2.0	3.0	0.1	0.1	0.1	174.95	(1-4)
	■ ZFSC-16-675 NEW	0.01-25	25	20	40	25	25	20	0.8	1.1	0.4	0.8	1.0	1.6	1.0	3.0	5.0	0.1	0.2	0.4	189.95	(1-4)
	ZFSC-16-12 NEW	0.1-200	33	20	27	20	26	20	0.6	1.5	0.7	1.0	0.9	1.2	2.0	6.0	9.0	0.1	0.2	0.4	189.95	(1-4)

L = low range (f_L to 10 f_L)　M = mid range (10f_L to f_U/2)　U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. Matched power rating, 1 watt
   Internal load dissipation, 0.87 watt.
2. Refer to table of contents for qualtiy control procedures, environmental specifications, and absolute maximum ratings.
3. For connector types, see case style outline drawing.
4. Prices and specifications subject to change without notice.

MIL-P-23971, *NSN GUIDE

MCL NO.	NSN
ZFSC-16-1	5820-01-120-9321

*Units are not QPL listed.

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computer-automated performance data
(see technical section)

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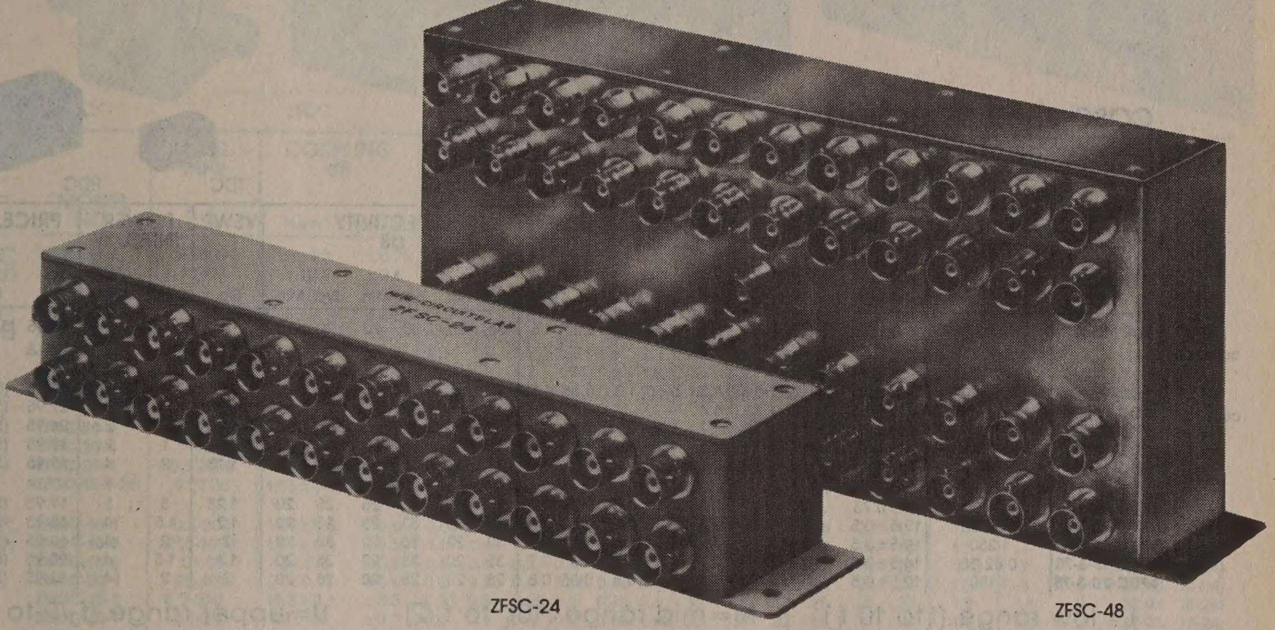
50 ohms and 75 ohms

Mini-Circuits

24 WAY-O°
25 KHz to 200 MHz

48 WAY-O°
10 MHz to 300 MHz



ZFSC-24

ZFSC-48

MODEL NO.		FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB 24 way (above 13.8dB) 48 way (above 16.8dB)						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			PRICE, $	
		f_L-f_U	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Ea.	Qty.
ZFSC-24 case R31	ZFSC-24-1	0.2-100	25	20	25	20	25	20	1.0	2.0	1.0	2.0	1.0	2.0	2.0	3.0	5.0	0.2	0.4	0.5	264.95	(1-4)
	ZFSC-24-11 NEW	1-200	33	25	22	20	20	17	0.4	0.8	0.6	1.0	1.3	2.0	2.0	4.0	8.0	0.2	0.4	0.6	274.95	(1-4)
	ZFSC-24-6 NEW	0.025-50	30	25	39	30	30	25	0.4	1.0	0.4	0.8	0.6	1.2	2.0	4.0	6.0	0.2	0.3	0.4	274.95	(1-4)
ZFSC-48 case HH68	ZFSC-48-1 NEW	10-300	30	25	28	20	23	20	1.0	1.5	1.8	2.2	2.0	2.5	—	—	—	0.6	0.7	0.9	595.00	(1-4)
	■ ZFSC-48-1-75 NEW	10-300	30	25	28	20	23	20	1.2	2.0	2.1	2.5	2.3	3.0	—	—	—	0.6	0.7	1.0	595.00	(1-4)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

In Stock... Immediate Delivery

very broadband
Directional Couplers

10 to 30dB
10KHz to 2000 MHz

case style selection
outline drawings pages 58-62

TDC

PDC

	MODEL NO.	FREQUENCY MHz	COUPLING dB		MAINLINE LOSS* dB						DIRECTIVITY dB						VSWR	POWER INPUT, W		PRICE, $	
		f_L-f_U	Nom.	Flatness	L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	Typ.	L Max.	M,U Max.	Ea.	Qty.
TDC case B02	TDC 10-1	1-400	10.0±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	20	15	1.5	1	2	15.95	(5-49)
PDC case A01	PDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	11.95	(5-49)
	PDC-10-2	250-1000	10.5±0.5	±1.0	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	27.95	(5-49)
	▲PDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.2	1.6	2	40	30	25	20	25	20	1.2	1	2	24.95	(5-49)
	PDC-10-22	5-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.6	1.9	35	30	25	20	25	20	1.25	1	2	19.95	(5-49)
	PDC-15-6	0.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	19.95	(5-49)
	†PDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	19.95	(5-49)
	PDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	13.95	(5-49)
	■PDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	12.95	(5-49)
	■PDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	20.95	(5-49)
	■PDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	20	2	2	4	12.95	(5-49)

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:
- * Includes theoretical power loss at coupled port.
- ■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.
- † Models PDC-20-1, ZDC-20-1, ZMDC-20-1:
  L = 25-50 MHz, M = 50-300 MHz, U = 300-400 MHz
- ● Model ZFDC-20-5: above 1000 MHz, coupling flatness ±1.5dB
- ▲ Models PDC-10-21, ZFDC-10-21: Upper range coupling ±0.75dB

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. For connector types and case mounting options, see case style outline drawing.
4. Prices and specifications subject to change without notice.
5. All models are licensed under U.S. Patent 3,426,298.

MIL-M-15370/18, NSN GUIDE

MCL NO.	NSN	MIL-M-15370/18*
PDC-10-1		002
PDC-10-2		008
PDC-10-21	5985-01-130-0177	003
PDC-20-3	5985-01-076-8477	001
ZDC-10-1-BNC	5985-01-125-3467'	
ZDC-20-3-BNC	5985-01-096-5007	
ZFDC-20-5	5985-01-097-2192	

*units are not QPL listed

pin and coaxial connections
see case style outline drawing

Series	In	Out	Cpl	Case Ground	Not Used
PDC	1	4	3	2,5,7,8	6
TDC	1	2	4	3	—
ZEDC	1	2	3	—	—
ZMDC	3	2	1	—	—
ZDC	3	2	1	—	—
ZFDC (except 20—4, —5)	1	2	3	—	—
ZFDC 20—4, —5	3	1	2	—	—

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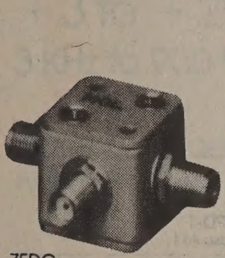
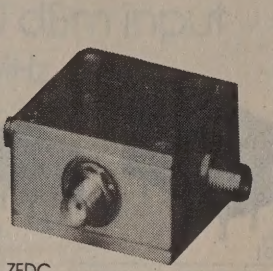
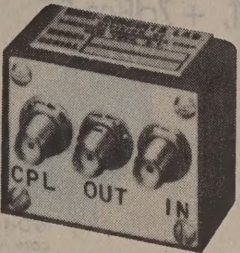
50 ohms and 75 ohms

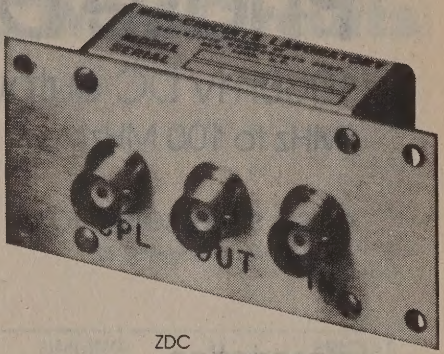
Mini-Circuits


ZEDC


ZFDC



ZMDC



ZDC

	MODEL NO.	FREQ. MHz	COUPLING dB		MAINLINE LOSS* dB						DIRECTIVITY dB						VSWR	POWER INPUT, W		PRICE, $	
					L		M		U		L		M		U			L	M,U		
		f_L-f_U	Nom.	Flatness	Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Max.	Ea.	Qty.
ZEDC case V37	ZEDC-10-2	1-1000	11±0.5	±0.75	1.3	1.5	1.5	1.8	1.5	1.8	35	30	30	20	18	13	1.3	1.5	3	54.95	(4-24)
	ZEDC-15-2	1-1000	15±0.5	±0.5	0.5	1.0	0.8	1.2	1.0	1.4	35	30	30	25	25	15	1.15	1.5	3	54.95	(4-24)
ZFDC case K18	ZFDC-10-1	1-500	10.5±0.25	±0.6	1.0	1.3	0.8	1.1	1.0	1.3	32	25	33	25	22	15	1.2	1.5	3	29.95	(4-24)
	ZFDC-10-2	10-1000	10.75±0.5	±0.5	1.5	2.0	1.2	1.6	1.5	2.0	35	28	30	25	27	20	1.5	1.5	3	39.95	(4-24)
	▲ZFDC-10-21	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2.0	40	30	25	20	25	20	1.2	1	2	44.95	(4-24)
	ZFDC-10-22	1-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.4	1.9	35	30	25	20	25	20	1.25	1	2	34.95	(4-24)
	ZFDC-15-6	0.03-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	34.95	(4-24)
	ZFDC-20-3	0.2-250	19.5±0.5	±0.25	0.35	0.6	0.25	0.5	0.35	0.6	36	25	33	25	25	20	1.2	1.5	4	29.95	(4-24)
	ZFDC-20-4	1-1000	19.5±0.5	±0.5	1.2	1.5	0.6	0.8	1.2	1.5	36	28	27	20	23	18	1.1	5	2	59.95	(1-4)
	•ZFDC-20-5	0.1-2000	19.5±0.5	±0.5	0.3	1	0.7	1.4	1.5	2.3	30	20	27	20	22	10	1.2	.5	2	79.95	(1-4)
	■ZFDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	35.95	(4-24)
ZMDC case M21	ZMDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	39.95	(4-24)
	ZMDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	47.95	(4-24)
	ZMDC-15-6	.01-35	15±0.5	±0.5	0.4	0.6	0.2	0.4	0.4	0.6	38	30	35	25	28	20	1.15	2	4	47.95	(4-24)
	†ZMDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	47.95	(4-24)
	ZMDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.5	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	39.95	(4-24)
	ZMDC-30-1	0.1-250	30±0.5	±0.5	0.4	0.6	0.5	0.8	0.55	0.85	23	18	20	15	17	10	1.5	1.0	3	39.95	(4-24)
ZDC case M22	ZDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	29.95	(4-24)
	ZDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	30	30	20	20	15	1.5	—	5	37.95	(4-24)
	ZDC-15-6	.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	37.95	(4-24)
	†ZDC-20-1	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	37.95	(4-24)
	ZDC-20-3	0.2-250	19±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	29.95	(4-24)
	■ZDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	29.95	(4-24)
	■ZDC-15-6-75	.02-35	14.5±0.5	±0.6	0.3	0.6	0.2	0.4	0.4	0.6	35	30	35	25	28	20	1.5	2	4	38.95	(4-24)
	■ZDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	15	2	2	4	30.95	(4-24)
	■ZDC-2375	55-85	10.5±0.5	±0.5	1.6	2.1	1.6	2.1	1.6	2.1	35	30	35	30	35	30	1.3	—	4	38.95	(4-24)
	■ZDC-20-3-75-1	55-90	18.6±0.5	±0.3	0.4	0.6	0.4	0.6	0.4	0.6	35	30	35	30	35	30	1.2	—	4	38.95	(4-24)

L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

computer-automated performance data

typical production unit / for data of other models consult factory

PDC-10-1

FREQUENCY (MHz)	MAINLINE LOSS (dB)	COUPLING (dB)	DIRECTIVITY (dB)	VSWR IN	VSWR OUT	VSWR CPL
.50	.73	11.17	37.21	1.11	1.13	1.09
26.789	.62	11.50	36.92	1.10	1.13	1.06
53.078	.66	11.49	36.96	1.09	1.13	1.08
105.656	.72	11.52	36.48	1.06	1.14	1.09
158.234	.74	11.52	35.07	1.04	1.14	1.12
210.812	.81	11.60	32.60	1.02	1.15	1.12
263.39	.84	11.59	30.32	1.01	1.15	1.12
315.968	.92	11.56	27.36	1.01	1.15	1.13
368.546	.95	11.50	24.22	1.01	1.15	1.15
421.124	1.02	11.49	21.84	1.01	1.14	1.17
500.00	1.12	11.43	18.71	1.01	1.12	1.22

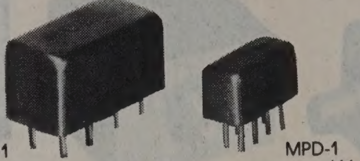
In Stock...Immediate Delivery

highest figure of merit

Phase Detectors

1000mV DC output, +7dBm RF
1MHz to 100 MHz

case style selection
outline drawings pages 58-62


RPD-1
case A01

MPD-1
case A11

description

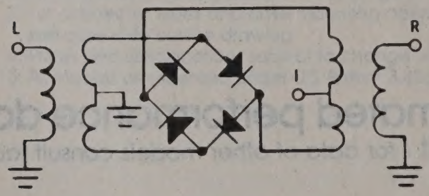
These new high efficiency phase detectors are the only units in the world offering a figure-of-merit greater than 125 for only $15.95.

The figure-of-merit M or efficiency of a phase detector can be defined as the ratio of maximum DC output voltage (in mV) divided by the RF power (in dBm). The maximum DC output from these units is 1000 mV with +7 dBm applied to the LO and RF ports, and DC offset is typically 400 micro-volts. Thus, its figure-of-merit M is 143, which indicates a highly efficient phase detector. For comparison, a double-balanced mixer used as a phase detector offers 350 mV DC output with the same LO and RF inputs for a figure-of-merit M of 50.

Both the RPD-1 and MPD-1 are packaged in a hermetically-sealed EMI-shielded metal case. The miniature RPD-1 measures 0.4 x 0.8 x 0.4 in. and the micromin MPD-1 is only 0.2 x 0.5 x 0.25 in.

So when your system requires a high output phase detector, specify the new RPD or MPD series.

NOTES:
1. Maximum RF input power, 50mW.
   peak IF current, 20mA.
2. Refer to table of contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.



pin connections
see case style outline drawing

Series		RPD-1	MPD-1
REF.	L	8	8
RF in:	R	1	1
DC out:	I	*3,4	*3,4
GND.		2,5,6,7	2,5,6,7
CASE GND.		2	2

*pins must be externally connected together

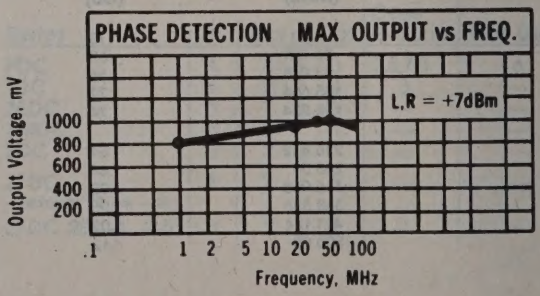
applications
- Radar
- ECM Systems
- Test Instruments
- Phase-lock loops

cost (5-24)
RPD-1 $15.95 MPD-1 $18.95

RPD-1, MPD-1 specifications

FREQUENCY RANGE:	
L and R ports	1-100 MHz
Output ports	DC-50 MHz
SCALE FACTOR	8 mV/Degree
IMPEDANCE	
L and R ports	50 ohms
I port	500 ohms
L and R SIGNAL LEVELS	+7 dBm
ISOLATION, L-R	40 dB min
MAXIMUM DC OUTPUT, mV	1000 mV typ 750 mV min
DC OUTPUT POLARITY (L and R in-phase)	Negative
DC OUTPUT OFFSET	0.2 mV typ 1 mV max
FIGURE-OF-MERIT, M	143 Typical
SIZE	
RPD-1	0.4 X 0.8 X 0.4
MPD-1	0.2 X 0.5 X 0.25

Model RPD-1



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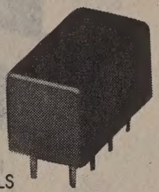
broadband, minimal phase change

Limiters

50 ohms **Mini-Circuits**

+3 to +20 dBm input

3 KHz to 900 MHz


PLS

case style selection

outline drawings pages 58-62

	Model No.	FREQUENCY MHz f_L f_U	INPUT dBm Min.	INPUT dBm Max.	*OUTPUT dBm Typ.	CONTROL CURRENT (mA) Typ.	LIMITING Input range, dBm	LIMITING Δ Output/Δ 1dB Input amp, dB	LIMITING Δ Output/Δ 1dB Input phase, deg.	PRICE, $ Ea.	PRICE, $ Qty.
PLS case A01	**PLS-1**	0.1-150	6	20	−1.6	3	6 to 10	0.1	0.5	18.95	5-49
							10 to 16	0.1	0.5		
							16 to 20	0.2	1.0		
	PLS-2	100-900	3	15	−5.0	10	3 to 8	0.2	2.0	18.95	5-49
							8 to 12	0.4	2.0		
							12 to 15	0.2	2.0		
	PLS-6	0.003-1	6	20	−3.0	5	6 to 10	0.2	1.0	29.95	5-49
							10 to 16	0.1	1.0		
							16 to 20	0.2	1.0		

* Typical output level at typical control current. Level may be changed by varying current.

pin connections

see case style outline drawing

Series	PLS		
Model	−1	−2	−6
INPUT	1	1	1
OUTPUT	8	8	8
CONTROL	*3,4	*3,4	*3,4
GND.	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND.	2	2,5,6,7	—

*Pins must be externally connected together

NOTES:

1. Maximum RF input power, 100mW.
   Maximum control current, 10 mA.
2. Refer to table of contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. Prices and specifications subject to change without notice.

NSN GUIDE

MCL NO.	NSN
PLS-1	5825-01-105-7820

PLS-1 LIMITING

computer-automated performance data

typical production unit / for data of other models consult factory

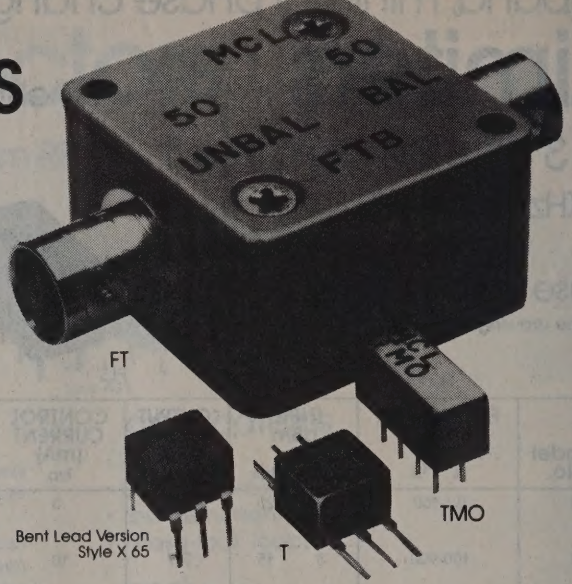
MHz	Output (20 dBm IN)	Output (16 dBm IN)	Output (10 dBm IN)	Output (6 dBm IN)	Delta, Out (20 to 16 dBm IN)	Delta, Out (16 to 10 dBm IN)	Delta, Out (10 to 6 dBm IN)
.100	−1.36	−1.47	−1.77	−2.15	.11	.30	.38
7.990	−.77	−1.02	−1.28	−1.65	.25	.26	.37
15.880	−.81	−.97	−1.35	−1.65	.16	.38	.30
23.769	−.79	−.95	−1.35	−1.64	.16	.40	.29
31.658	−.77	−.94	−1.38	−1.54	.17	.44	.16
39.547	−.71	−.93	−1.34	−1.47	.22	.41	.13
47.437	−.86	−1.08	−1.41	−1.46	.22	.33	.05
55.327	−.88	−1.03	−1.40	−1.73	.15	.37	.33
63.217	−.86	−1.05	−1.48	−1.63	.19	.43	.15
71.105	−1.02	−1.01	−1.42	−1.78	−.01	.41	.36
78.995	−1.05	−1.05	−1.37	−1.57	0.00	.32	.20
86.884	−.95	−1.08	−1.49	−1.78	.13	.41	.29
94.775	−.98	−1.12	−1.40	−1.73	.14	.28	.33
102.661	−1.06	−1.15	−1.50	−1.59	.09	.35	.09
110.551	−1.14	−1.29	−1.58	−2.32	.15	.29	.74
118.440	−1.09	−1.19	−1.58	−1.98	.10	.39	.40
126.330	−1.03	−1.21	−1.53	−1.65	.18	.32	.12
134.221	−1.10	−1.31	−1.59	−2.28	.21	.28	.69
142.111	−1.19	−1.44	−1.70	−1.98	.25	.26	.28
150.000	−1.16	−1.47	−1.72	−2.07	.31	.25	.35

REMARK: Control Current: 5.6mA

In Stock... Immediate Delivery

wideband RF Transformers

3KHz to 800MHz



case style selection

outline drawings pages 58-62

T, TH, case W 38, X 65
TMO, case A 11, †case B 13
FT, FTB, case H 16

For PC applications, select from the low-cost, plastic-case T series (small enough to be inserted into a standard 1/3 DIP socket), or the hermetically-sealed RFI shielded TMO metal-case series (requiring less PC area than a flatpack or TO-5 can), or the plastic-case T-H series designed to handle up to 100 mA in the primary winding without appreciable saturation or change in RF characteristics.

Transformer core saturation is influenced by (1) dc current through the winding, (2) RF input power, and (3) frequency of operation. These three variables interact to affect the point at which saturation occurs, see Figs. (1) and (2). These curves show the point where distortion occurs, by visual observation, and illustrate how saturation is influenced by dc current through the winding, RF input power level and frequency of operation: See that (1) if the dc current through the winding increases, the allowable RF input power decreases and the minimum frequency of operation will increase, (2) if RF input power increases, the maximum allowable dc current through the winding will decrease and the minimum frequency of operation will increase, (3) if the frequency of operation increases, then the RF input power can be increased and the dc current through the winding can also be increased.

Now comparing the T-H series to the conventional T-series in Figs. (1) and (2), note that saturation effects are negligible with the T16-1H; so for wide dynamic range applications, specify the T-H series.

Coaxial connector models are available from 10 KHz to 500 MHz and are offered with 50 ohm and 75 ohm impedances; 75 ohm connectors are used at 75 ohm ports. The FT1.5-1, with unbalanced input and output, is especially useful for 50 ohm to 75 ohm matching applications. The FTB series with unbalanced output and balanced input (connector ground insulated from the case) helps eliminate ground loop problems, especially when long cable runs are involved.

As shown in the data chart on the following page, models are available in five basic configurations.

These transformers may be operated as low as 12.5 ohms at the primary with essentially the same impedance matching ratio and only a slight change in frequency response.

For each RF transformer model, the minimum and maximum frequency is given for the insertion loss at the 3 dB, 2 dB and 1 dB points, as shown in Fig. (3) and listed in the data chart. For example, the T1-1 insertion loss is 1 dB from 2 to 50 MHz and 3 dB from 0.15 to 400 MHz.

performance saturation curves T, TH series

(RF power & DC current at which signal saturation begins)

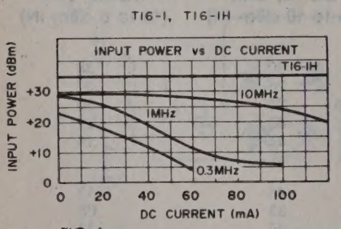


FIG. 1

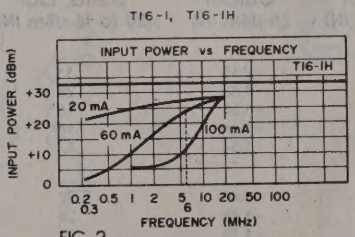


FIG. 2

frequency response curve

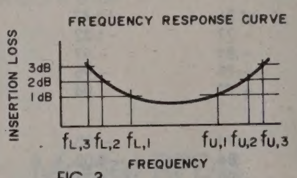


FIG. 3

NSN GUIDE

MCL NO.	NSN
T1-1	5950-01-128-3745
T2-1	5950-01-106-1218
T4-1	5950-01-024-7626
TMO4-1	5950-01-067-1012
TMO4-2	5950-01-091-3553
T9-1	5950-01-105-8153
TMO9-1A	5950-01-098-6315
T16-1	5950-01-094-7439

*FOR A AND B CONFIGURATIONS

Maximum Amplitude Unbalance	Maximum Phase Unbalance
0.1 dB over 1 dB frequency range	1.0° over 1 dB frequency range
0.5 dB over entire frequency range	5.0° over entire frequency range

NOTES:

■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For Quality Control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings, see page 7, except for T & TH Series, temperature range is −20 to +85°C.
4. For connector types and case mounting options, see case style outline drawings.
5. Prices and specifications subject to change without notice.

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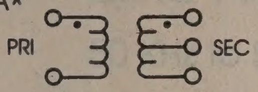
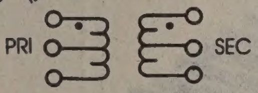
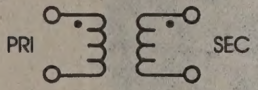
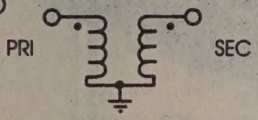
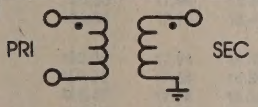
12.5 to 800 ohms

Mini-Circuits

case style number see opposite page.		MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS 3dB MHz	INSERTION LOSS 2dB MHz	INSERTION LOSS 1dB MHz	PRICE $ Ea.	PRICE $ Qty.
A* 	T	T1-1T	1	.05-200	.05-200	.08-150	.2-80	3.95	(10-49)
		T1-6T NEW	1	.003-300	.003-300	.01-150	.02-50	5.95	(10-49)
		T2-1T	2	.07-200	.07-200	.1-100	.5-50	4.25	(10-49)
		T2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	4.25	(10-49)
		T3-1T	3	.05-250	.05-250	.1-200	.5-70	3.95	(10-49)
		T4-1	4	.2-350	.2-350	.35-300	2-100	2.95	(10-49)
		T4-6T	4	.02-250	.02-250	.05-150	0.1-100	3.95	(10-49)
		T5-1T	5	.3-300	.3-300	.6-200	.5-100	4.25	(10-49)
		T8-1T NEW	8	.03-140	.03-140	.10-90	1-60	6.95	(10-49)
		T13-1T	13	.3-120	.3-120	.7-80	5-20	4.25	(10-49)
		T16-6T	16	.03-75	.03-75	.06-30	.1-20	4.95	(10-49)
	TH	T4-1H	4	8-350	8-350	15-300	25-200	4.95	(10-49)
	TMO	TMO1-1T	1	.05-200	.05-200	.08-150	.2-80	6.45	(10-49)
		TMO2-1T	2	.07-200	.07-200	.1-100	.5-50	6.75	(10-49)
		† TMO2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	6.75	(10-49)
		† TMO3-1T	3	.05-250	.05-250	.1-200	.5-70	6.45	(10-49)
		TMO4-1	4	.2-350	.2-350	.35-300	2-100	4.95	(10-49)
		TMO5-1T	5	.3-300	.3-300	.6-200	5-100	6.75	(10-49)
		TMO13-1T	13	.3-120	.3-120	.7-80	5-20	6.75	(10-49)
B* NEW 	TT	TT1-6	1	.004-500	.004-500	.02-200	.1-50	5.95	(10-49)
		TT1.5-1	1.5	.075-500	.075-500	.2-100	.1-50	4.95	(10-49)
		TT2.5-6	2.5	.01-50	.01-50	.025-25	.05-10	5.25	(10-49)
		TT4-1	4	.05-200	.05-200	.2-50	1-30	4.95	(10-49)
		TT25-1	25	.02-30	.02-30	.05-20	.1-10	7.95	(10-49)
	TTMO	TTMO1-1	1	.005-100	.005-100	.01-75	.05-40	10.95	(10-49)
C 	T	T1-1	1	.15-400	.15-400	.35-200	2-50	2.95	(10-49)
		T1-6 NEW	1	.01-150	.01-150	.02-100	.05-50	4.95	(10-49)
		T1.5-1	1.5	.1-300	.1-300	.2-150	.5-80	3.95	(10-49)
		T1.5-6 NEW	1.5	.02-100	.02-100	.05-50	0.1-25	4.95	(10-49)
		T2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	3.95	(10-49)
		T4-6	4	.02-200	.02-200	.05-150	.1-100	3.95	(10-49)
		T9-1	9	.15-200	.15-200	.3-150	2-40	3.45	(10-49)
		T16-1	16	.3-120	.3-120	.7-80	.5-20	3.95	(10-49)
		T36-1	36	.03-20	.03-20	.05-10	.1-5	5.95	(10-49)
	TH	T1-1H	1	8-300	8-300	10-200	25-100	4.95	(10-49)
		T9-1H	9	2-90	2-90	3-75	6-50	5.45	(10-49)
		T16-1H	16	7-85	7-85	10-65	15-40	5.95	(10-49)
	TMO	TMO1-1	1	.15-400	.15-400	.35-200	2-50	4.95	(10-49)
		TMO1.5-1	1.5	.1-300	.1-300	.2-150	.5-80	6.75	(10-49)
		† TMO2.5-6	2.5	.01-100	.01-100	.02-50	.05.20	6.45	(10-49)
		† TMO4-6	4	.02-200	.02-200	.05-150	.1-100	6.45	(10-49)
		TMO6-1	6	.3-200	.3-200	.5-150	5-50	6.45	(10-49)
		TMO9-1	9	.15-200	.15-200	.3-150	2-40	6.45	(10-49)
		TMO1 6-1	16	.3-120	.3-120	.7-80	5-20	6.45	(10-49)
D 	T	T2-1	2	.025-600	.025-600	.05-400	.5-200	3.45	(10-49)
		T3-1	3	.5-800	.5-800	.2-400	—	4.25	(10-49)
		T4-2	4	.2-600	.2-600	.5-500	.2-250	3.45	(10-49)
		T8-1	8	.15-250	.15-250	25-200	2-100	3.45	(10-49)
		T14-1	14	.2-150	.2-150	.5-100	2-50	4.25	(10-49)
	TMO	TMO2-1	2	.025-600	.025-600	.05-400	.5-200	5.95	(10-49)
		TMO3-1	3	.5-800	.5-800	2-400	—	6.95	(10-49)
		TMO4-2	4	.2-600	.2-600	.5-500	2-250	5.95	(10-49)
		TMO8-1	8	.15-250	.15-250	25-200	2-100	5.95	(10-49)
		TMO14-1	14	.2-150	.2-150	.5-100	2-50	6.75	(10-49)
E 	FT	FT1.5-1	1.5	.1-400	.1-400	.5-200	1-100	29.95	(1-4)
	FTB	FTB1-1	1	.2-500	.2-500	.5-300	10-100	29.95	(1-4)
		FTB1-6	1	.01-125	.01-125	.05-50	.1-25	29.95	(1-4)
		■ FTB1-1-75	1	.5-500	.5-500	5-300	10-100	29.95	(1-4)

pin connections see case style outline drawings

CONFIGURATION	*A DC Isolated Center-Tap Secondary		*B DC Isolated Center-Tap Primary, Secondary		C,E DC Isolated		D Unbalanced Primary, Secondary	
SERIES	T, TH	TMO	T	TMO	T, TH	TMO	T	TMO
Primary DOT	4	1	4	1	4	1	6	1
Primary	6	5	6	5	6	5	3◇	6◇◇
Primary CT	—	—	5	3	—	—	—	—
Secondary Dot	3	2	3	2	3	2	1	2
Secondary	1	6	1	6	1	6	3◇	6◇◇
Secondary CT	2	4	2	4	—	—	—	—
Case Gnd.	—	7,8	—	7,8	—	7,8	—	7,8

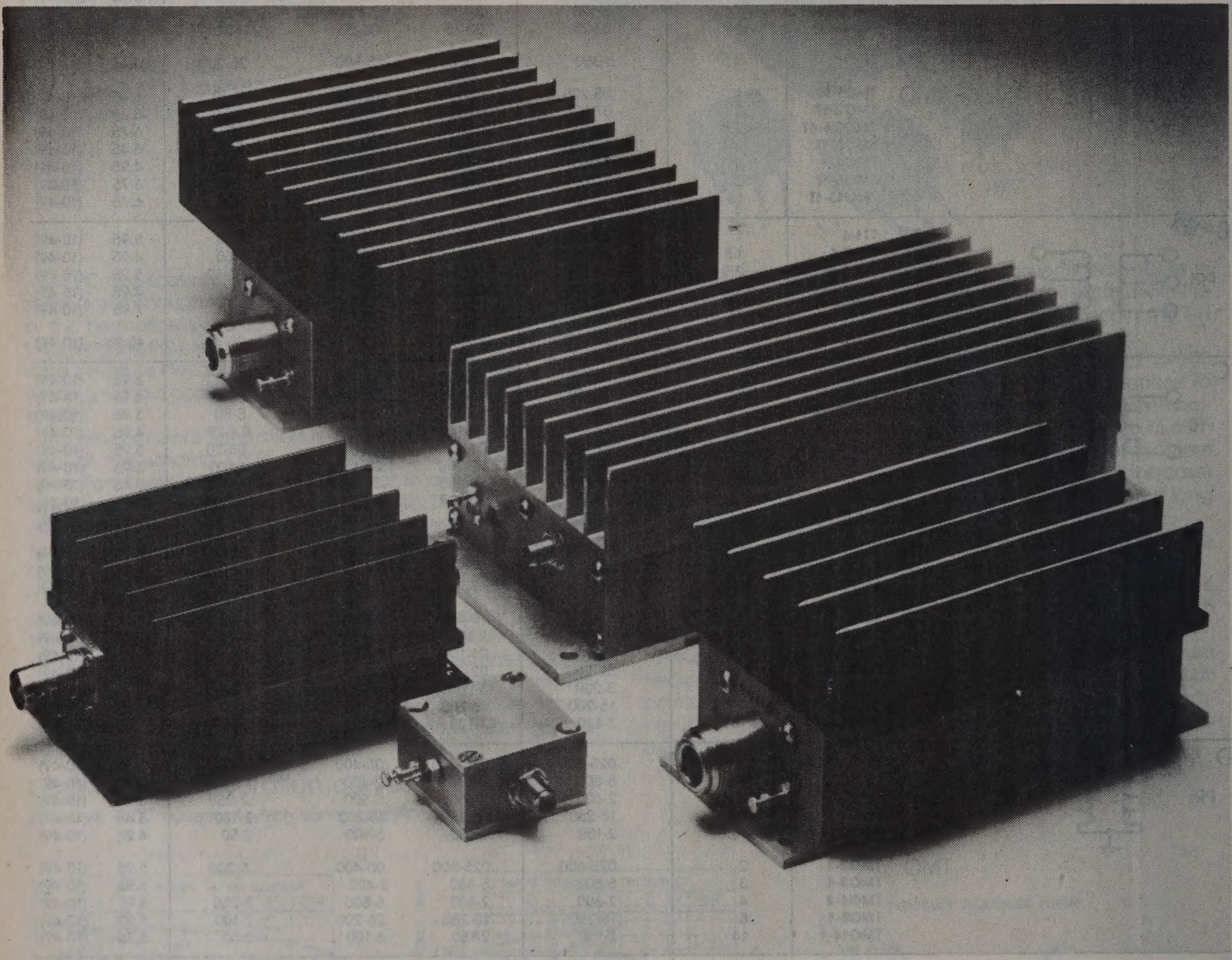
◇pin 3 must be grounded
◇◇pin 6 must be grounded

broadband linear

Power Amplifiers

up to 2 Watts (+33 dBm)

50 KHz to 4.2 GHz



Up to 1 watt linear output at 4.2 GHz, 2 watts at 800 MHz are now available at exceptionally low prices with Mini-Circuits' line of broadband amplifiers. Ultra-linear Class A design provides unconditional stability so any load impedance may be connected without concern for damage or oscilation. These amplifiers are ideally suited for TACAN, mobile radio, telemetry, anti-collision and satellite communications systems. Use these amplifiers to boost signal/sweep generator output to achieve broadband isolation, and to provide four test setups, using only one generator with a 4-way splitter...to name just a few applications.

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

For More Information. Circle No. 415

50 ohms

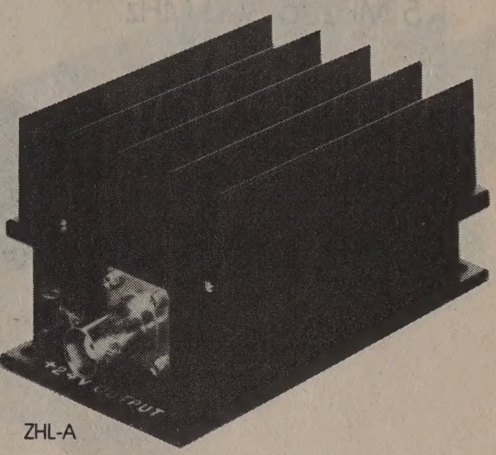
Mini-Circuits

up to 1 Watt (+30 dBm)

50 KHz to 500 MHz

case style selection

outline drawings pages 58-62



ZHL-A

	MODEL NO.	FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-A case S 32	**ZHL-1A**	2-500	16	±1.0	+28	+20	11	+38	2:1	2:1	+24V	0.6A	199	1-9
	ZHL-3A	0.4-150	24	±1.0	+29.5	+10	11	+38	2:1	2:1	+24V	0.6A	199	1-9
	ZHL-32A	0.05 -130	25	±1.0	+29	+10	10	+38	2:1	2:1	+24V	0.6A	199	1-9

NOTES:

1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

MIL-M-28837/1A, NSN GUIDE

MCL NO.	NSN
ZHL-1A	6130-01-088-2322

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-1A

FREQ. (MHz)	GAIN (dB) 12V	GAIN (dB) 15V	GAIN (dB) 20V	GAIN (dB) 24V	REVERSE GAIN (dB) 12V	REVERSE GAIN (dB) 15V	REVERSE GAIN (dB) 20V	REVERSE GAIN (dB) 24V	VSWR (IN) 12V	VSWR (IN) 15V	VSWR (IN) 20V	VSWR (IN) 24V	VSWR (OUT) 12V	VSWR (OUT) 15V	VSWR (OUT) 20V	VSWR (OUT) 24V
2.00	17.90	18.27	18.46	18.52	29.03	29.07	28.96	28.88	1.09	1.13	1.14	1.14	1.10	1.16	1.15	1.15
28.21	17.88	18.27	18.48	18.52	29.53	29.72	29.54	29.24	1.09	1.11	1.13	1.14	1.20	1.19	1.19	1.18
54.42	17.88	18.33	18.54	18.59	29.57	29.62	29.58	29.39	1.12	1.12	1.13	1.14	1.24	1.24	1.24	1.24
80.63	17.94	18.41	18.65	18.70	29.91	29.78	29.64	29.56	1.19	1.17	1.16	1.16	1.30	1.29	1.30	1.30
106.84	17.90	18.41	18.69	18.78	29.85	30.12	29.97	29.75	1.31	1.24	1.21	1.21	1.36	1.36	1.37	1.37
133.05	17.91	18.42	18.75	18.83	30.02	30.06	30.15	29.87	1.42	1.32	1.28	1.27	1.41	1.41	1.42	1.44
159.26	17.68	18.34	18.71	18.81	30.25	30.32	30.03	30.00	1.56	1.42	1.36	1.34	1.46	1.48	1.50	1.52
185.47	17.64	18.34	18.78	18.84	30.50	30.36	30.12	29.99	1.71	1.553	1.45	1.43	1.50	1.53	1.57	1.60
211.68	17.52	18.25	18.74	18.82	30.50	30.64	30.19	30.05	1.83	1.63	1.52	1.50	1.51	1.56	1.63	1.67
237.89	17.46	18.20	18.73	18.81	30.85	30.64	30.35	30.32	1.96	1.72	1.59	1.57	1.52	1.58	1.67	1.73
264.10	17.34	18.09	18.66	18.74	30.99	30.75	30.40	30.43	2.04	1.79	1.64	1.62	1.48	1.56	1.66	1.75
290.31	17.28	18.03	18.58	18.69	31.08	30.89	30.66	30.58	2.14	1.86	1.69	1.66	1.44	1.53	1.66	1.76
316.52	17.33	18.08	18.69	18.79	30.64	30.77	30.51	30.49	2.16	1.88	1.70	1.67	1.40	1.50	1.64	1.75
342.73	17.32	18.06	18.69	18.79	30.50	30.44	30.41	30.44	2.17	1.87	1.69	1.65	1.33	1.43	1.59	1.71
368.94	17.30	18.04	18.71	18.79	30.09	30.23	30.24	30.27	2.09	1.81	1.63	1.59	1.27	1.35	1.49	1.62
395.15	17.23	18.02	18.67	18.82	29.81	29.95	29.91	30.18	2.03	1.75	1.57	1.53	1.24	1.28	1.41	1.55
421.36	17.32	18.13	18.83	18.98	29.19	29.36	29.52	29.85	1.96	1.68	1.49	1.44	1.32	1.29	1.36	1.50
447.57	17.37	18.23	18.96	19.08	28.50	28.79	29.05	29.22	1.90	1.61	1.41	1.36	1.47	1.36	1.34	1.43
473.78	17.17	18.10	18.90	19.08	27.94	28.28	28.64	28.82	1.93	1.64	1.42	1.37	1.68	1.51	1.39	1.42
500.00	17.07	18.14	19.06	19.26	27.68	27.17	28.22	28.50	2.07	1.79	1.57	1.54	1.01	1.79	1.61	1.58

In Stock... Immediate Delivery

broadband linear

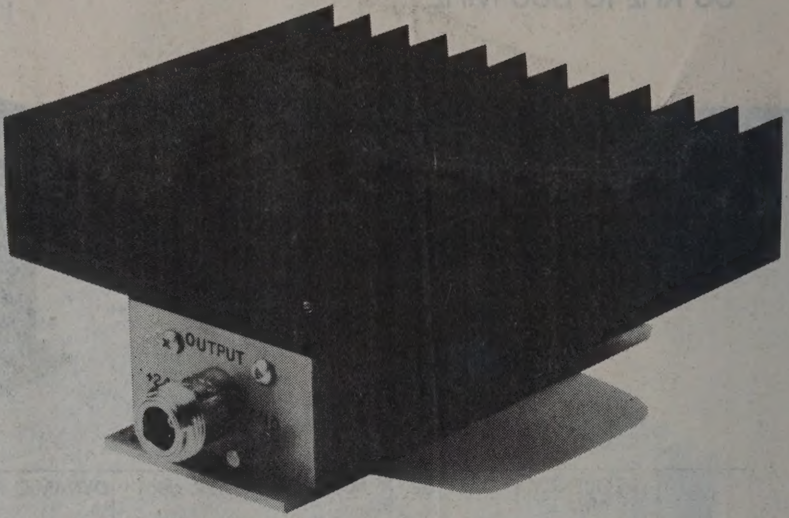
Power Amplifiers

up to 2 Watts (+33 dBm)

5 MHz to 800 MHz

case style selection

outline drawings pages 58-62



ZHL-2W

	MODEL NO.	FREQUENCY MHz	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-2W case T 35	**ZHL-1-2W**	5-500	29	±1.0	+33	+10	12	+44	2:1	2:1	+24V	0.9A	495	1-9
	ZHL-7-2W NEW	600-800	28	±1.0	+33	+10	12	+43	2:1	2:1	+24V	0.9A	525	1-9

NOTES:

1. Operating temperature −20°C to +65°C.
   Storage temperature −55°C to +100°C.
2. With no load on output, derate maximum input power (no damage) by 10dB.
3. Prices and specifications subject to change without notice.

ZHL-1-2W

FREQ. (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY P_{out} (dBm)	LINEARITY Comp. (dB)
5.00	32.25	16.59	1.46	1.65	32.86	0.25
031.05	31.64	17.55	1.39	1.67	32.74	0.26
057.10	31.58	16.46	1.38	1.70	32.70	0.36
083.15	31.59	17.70	1.36	1.74	32.58	0.42
109.20	31.51	16.92	1.33	1.80	32.56	0.39
135.25	31.43	17.30	1.28	1.85	32.48	0.51
161.30	31.49	17.02	1.22	1.91	32.49	0.52
187.35	31.46	16.61	1.15	1.99	32.39	0.61
213.40	31.39	16.91	1.08	2.05	32.38	0.60
239.45	31.39	17.63	1.03	2.07	32.38	0.62
265.50	31.32	16.44	1.12	2.03	32.34	0.66
291.55	31.25	17.19	1.24	1.89	32.31	0.64
317.60	31.22	18.48	1.36	1.67	32.38	0.64
343.65	31.11	20.85	1.49	1.43	32.33	0.70
369.70	30.89	21.35	1.59	1.20	32.35	0.58
395.75	30.74	15.87	1.67	1.04	32.43	0.66
421.80	30.70	15.95	1.73	1.24	32.41	0.67
447.85	30.73	15.78	1.78	1.49	32.38	0.64
473.90	31.07	15.83	1.83	1.76	32.31	0.77
500.00	31.95	15.87	1.90	1.99	32.02	1.00

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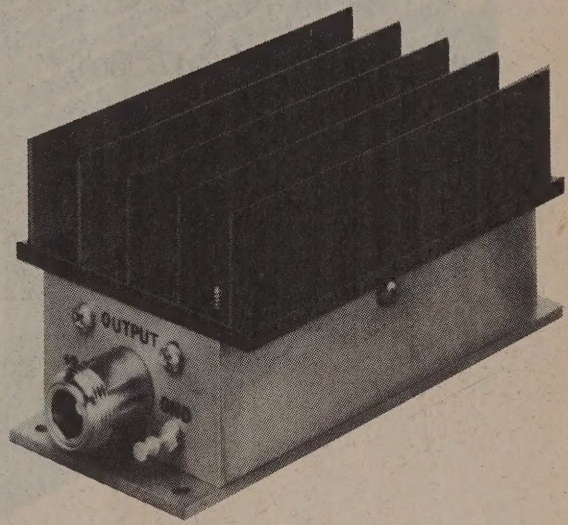
Mini-Circuits

50 ohms

up to 1 Watt (+30 dBm)

10 MHz to 1200 MHz



ZHL

	MODEL NO.	FREQUENCY MHz	GAIN, dB		MAXIMUM POWER, dBm		DYNAMIC RANGE		VSWR		DC POWER		PRICE $	
			Min.	Flatness Max.	Output (1dB) Compression	Input (no damage)	NF, dB Typ.	Intercept pt., dBm 3rd order Typ.	In	Out	Volt.	Current	Ea.	Qty.
ZHL case T 34	ZHL-2	10-1000	16	±1.0	+29	+20	18	+38	2:1	2:1	+24V	0.6A	349	1-9
	ZHL-2-8	10-1000	27	±1.0	+29	+10	10	+38	2:1	2:1	+24V	0.6A	474	1-9
	ZHL-2-12 ★	10-1200	24	±1.0	+29★	+10	10	+38	2:1	2:1	+24V	0.75A	599	1-9

★ +28.5 dBm maximum output 1000 to 1200 MHz; available only with SMA

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-2

FREQ. (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY P_{out} (dBm)	LINEARITY Comp. (dB)
10.00	16.85	39.91	1.12	1.88	29.81	0.24
62.05	17.06	39.66	1.19	1.80	29.77	0.27
114.10	17.19	39.40	1.28	1.70	29.66	0.32
166.15	12.18	39.08	1.38	1.61	29.50	0.42
218.20	17.17	39.18	1.49	1.54	29.46	0.48
270.25	17.23	38.58	1.57	1.48	29.51	0.40
322.30	17.29	37.81	1.64	1.44	29.45	0.58
374.35	17.15	37.43	1.68	1.42	29.41	0.53
426.40	17.10	36.70	1.70	1.36	29.42	0.59
478.45	17.11	36.23	1.72	1.28	29.39	0.55
530.50	17.09	35.35	1.75	1.19	29.37	0.59
582.55	17.15	35.20	1.77	1.14	29.37	0.63
634.60	17.38	34.64	1.74	1.29	29.41	0.59
686.65	17.28	33.51	1.69	1.53	29.39	0.52
738.70	17.14	32.25	1.67	1.71	29.39	0.57
790.75	17.25	30.98	1.71	1.76	29.37	0.56
842.80	17.32	29.64	1.80	1.61	29.27	0.72
894.85	17.44	28.71	1.90	1.31	29.25	0.66
946.90	17.49	28.01	1.88	1.12	29.22	0.75
999.00	16.89	28.24	1.63	1.48	29.06	0.96

ZHL-2-8

FREQ. (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY P_{out} (dBm)	LINEARITY Comp. (dB)
10.00	39.33	50.00	2.48	2.74	39.73	0.40
62.05	29.38	40.00	1.41	1.66	29.51	0.45
114.10	29.22	40.00	1.36	1.60	29.46	0.54
166.15	29.13	40.00	1.31	1.59	29.40	0.63
218.20	29.08	40.00	1.26	1.61	29.37	0.67
270.25	29.03	40.00	1.23	1.66	29.27	0.71
322.30	28.97	40.00	1.27	1.74	29.29	0.72
374.35	29.00	40.00	1.36	1.81	29.37	0.64
426.40	28.82	40.00	1.45	1.80	29.40	0.64
478.45	28.58	40.00	1.53	1.68	29.41	0.52
530.50	28.39	40.00	1.58	1.50	29.51	0.59
582.55	28.30	40.00	1.59	1.29	29.45	0.60
634.60	28.47	40.00	1.55	1.08	29.36	0.61
686.65	28.73	40.00	1.47	1.13	29.43	0.53
738.70	28.94	40.00	1.42	1.34	29.52	0.49
790.75	29.04	40.00	1.48	1.50	29.45	0.48
842.80	28.99	40.00	1.62	1.51	29.42	0.60
894.85	28.86	40.00	1.76	1.41	29.38	0.62
946.90	28.61	40.00	1.82	1.36	29.24	0.73
999.00	28.11	40.00	1.83	•1.53	29.14	0.81

In Stock...Immediate Delivery

For More Information. Circle No. 415

broadband linear

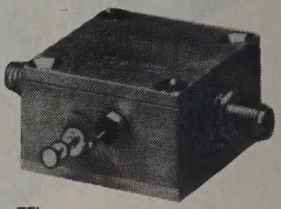
Power Amplifiers

up to 50mW (+17 dBm)

10 MHz to 2000 MHz

case style selection

outline drawings pages 58-62



ZFL

	MODEL NO.	FREQUENCY MHz	GAIN, dB		MAXIMUM POWER, dBm		DYNAMIC RANGE		VSWR		DC POWER		PRICE $	
			Min.	Flatness Max	Output (1dB) Compression	Input (no damage)	NF, dB Typ.	Intercept pt., dBm 3rd order Typ.	In	Out	Volt.	Current	Ea.	Qty.
ZFL case Y 39	**ZFL-2000**	10-2000	20	±1.5	+17*	+5	7.0	+25	2:1	2:1	+15V	100mA	179	(1-9)

NOTES:

* +16dBm at 1000 MHz.

1. Operating temperature −55°C to +100°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

ZFL-2000

FREQUENCY (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
10.00	22.68	33.41	1.44	1.28	15.44	1.26
105.42	22.58	33.31	1.46	1.21	15.35	1.26
200.83	22.60	33.35	1.44	1.13	15.32	1.30
296.25	22.48	33.37	1.35	1.09	15.24	1.28
391.67	22.32	33.45	1.24	1.13	15.19	1.05
487.08	21.96	33.60	1.18	1.14	15.11	0.92
582.50	21.63	34.05	1.21	1.18	14.74	0.80
677.92	21.60	34.33	1.37	1.24	14.86	0.82
773.33	22.03	34.03	1.48	1.30	15.28	0.74
868.75	22.42	33.59	1.53	1.36	15.74	0.71
964.17	22.64	33.12	1.49	1.45	15.98	0.62
1059.40	22.89	32.74	1.39	1.59	16.25	0.68
1154.70	23.14	32.22	1.25	1.71	16.42	0.79
1250.20	23.44	31.64	1.05	1.76	16.54	0.88
1345.80	23.34	31.15	1.19	1.67	16.57	0.73
1441.00	23.18	30.81	1.44	1.52	16.55	0.63
1535.90	22.96	30.64	1.64	1.31	16.45	0.49
1631.50	22.64	30.73	1.77	1.10	16.22	0.38
1726.90	22.32	30.57	1.78	1.11	15.97	0.33
1822.20	22.08	30.05	1.67	1.28	15.80	0.26
1917.60	21.70	29.21	1.54	1.43	15.67	0.03
2014.80	21.03	29.26	1.55	1.53	15.58	−0.46
2108.20	20.24	28.70	1.97	1.57	15.20	−0.89
2204.00	19.23	28.44	2.93	1.48	14.47	−1.17
2299.70	18.26	28.28	4.15	1.29	13.35	−1.11

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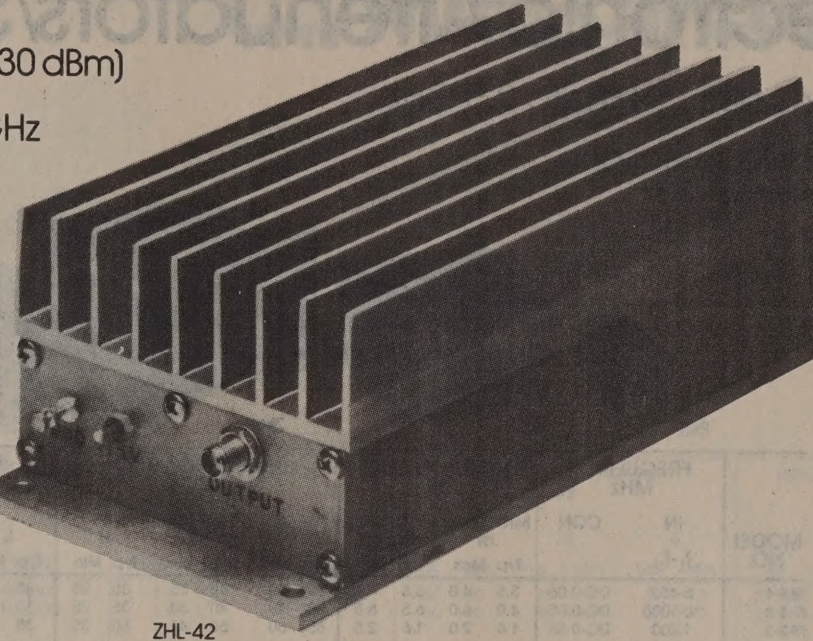
Mini-Circuits

50 ohms

up to 1 Watt (+30 dBm)

700 MHz to 4.2 GHz

NEW



ZHL-42

	MODEL NO.	FREQUENCY GHz	GAIN, dB Min.	GAIN, dB Flatness Max	MAXIMUM POWER, dBm Output (1dB) Compression	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF, dB Typ.	DYNAMIC RANGE Intercept pt., dBm 3rd order Typ.	VSWR In	VSWR Out	DC POWER Volt.	DC POWER Current	PRICE $ Ea.	PRICE $ Qty.
ZHL-42 case U 36	ZHL-42	0.7-4.2	30	±1.0	+29	+10	10	+38	2.5:1	2.5:1	15	0.69A	895	(1-9)

NOTES:
1. Operating temperature −20°C to +65°C
   Storage temperature −55°C to +100°C
2. With no load output, derate maximum input power (no damage) by 10 dB.
3. Prices and specifications subject to change without notice.

computer-automated performance data

typical production unit / for data of other models consult factory

ZHL-42 FREQUENCY (MHz)	GAIN (dB)	REVERSE GAIN (dB)	VSWR in	VSWR out	LINEARITY Pout (dBm)	LINEARITY Comp. (dB)
700.25	33.56	47.42	1.57	1.98	28.91	1.18
845.84	33.44	47.61	1.54	1.67	28.82	1.05
991.85	33.61	47.66	1.51	1.42	29.29	0.86
1137.60	34.37	47.97	1.46	1.37	29.98	0.93
1283.50	34.54	47.96	1.43	1.36	30.42	0.61
1429.70	34.09	48.08	1.60	1.33	30.65	0.07
1575.50	34.06	48.00	1.67	1.47	30.53	0.16
1720.90	34.65	48.03	1.72	1.43	30.65	0.80
1866.60	35.05	48.15	1.62	1.32	30.46	1.41
2013.10	35.42	48.30	1.57	1.20	30.57	1.75
2158.00	35.21	48.36	1.47	1.21	30.53	1.40
2304.20	34.72	48.35	1.48	1.16	30.13	1.30
2448.60	34.42	48.27	1.49	1.15	29.77	1.22
2595.20	34.55	48.36	1.51	1.18	29.91	1.05
2741.40	33.78	48.26	1.37	1.24	30.01	0.31
2887.60	34.03	48.29	1.34	1.52	30.35	0.32
2999.40	34.25	48.39	1.28	1.94	30.38	0.49
3033.30	34.05	48.50	1.24	1.99	30.50	0.29
3179.70	33.85	48.35	1.24	1.74	30.27	0.36
3324.30	34.01	48.62	1.30	1.56	30.04	0.77
3470.30	34.34	48.51	1.39	1.43	30.19	0.79
3616.70	34.49	48.76	1.58	1.28	29.91	1.07
3763.00	34.65	48.61	1.67	1.11	29.73	0.72
3909.00	32.36	48.49	1.54	1.21	29.69	0.33
4053.50	33.32	48.74	1.39	1.39	30.30	0.05
4199.90	34.60	48.69	1.44	1.84	30.04	0.08

In Stock... Immediate Delivery

For More Information. Circle No. 415

low current, low voltage

Electronic Attenuators/Switches

1.4 to 60 dB 1 MHz to 2.5 GHz

case style selection

outline drawings pages 58-62

PAS
ZFAS
ZMAS
OUT
CON
IN
ZAS

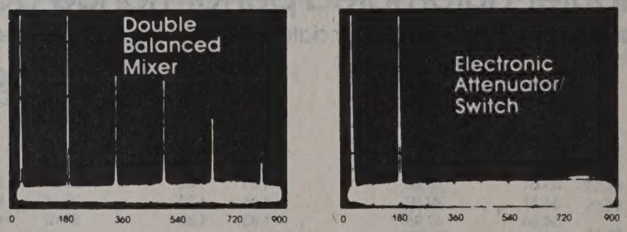
	MODEL NO.	FREQUENCY MHz		INSERTION LOSS dB				IN-OUT ISOLATION dB						IN-CON ISOLATION dB						PRICE, $	
		IN	CON	Mid-Band m		Total Range		L		M		U		L		M		U			
		f_L-f_U		Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
PAS case A01	**PAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	45	35	35	25	35	25	25	15	20	10	27.95	(5-24)
	PAS-2	10-1000	DC-0.05	4.0	6.0	6.5	8.5	50	40	40	30	35	25	30	20	17	10	17	10	37.95	(5-24)
	PAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	28.95	(5-24)
ZFAS case K18	**ZFAS-15**	10-2500	DC-200	3.5	4.0	3.5	5.0	20	18	35	25	30	20	19	15	28	20	20	15	89.95	(1-4)
ZMAS case M21	**ZMAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	55.95	(4-24)
	ZMAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	56.95	(4-24)
ZAS case M22	**ZAS-1**	5-450	DC-0.05	3.5	4.0	3.5	4.7	65	50	55	45	35	25	35	25	25	15	20	10	45.95	(4-24)
	ZAS-3	1-200	DC-0.05	1.4	2.0	1.6	2.5	65	50	50	40	50	35	35	25	20	15	15	10	46.95	(4-24)

L = low range (f_L to 10 f_L) M = mid range (10f_L to $f_U/2$) U = upper range ($f_U/2$ to f_U)

m = mid band (2f_L to $f_U/2$)

typical harmonic spectrum comparing attenuators

Double Balanced Mixer Vs. Electronic Attenuator



NOTES: (both pages)

1. Maximum RF input power, 1 watt.
   Maximum control current, 40 mA.
2. Refer to table of contents for quality control procedures, environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. For PSW and ZMSW models
   a) VSWR 1.5 max. ("on" state)
   b) Switching speed 1μ sec. max.
   c) Maximum RF input +20 dBm
   d) Control voltage +5V (5mA max.) on condition
   0V off condition
5. Prices and specifications subject to change without notice.

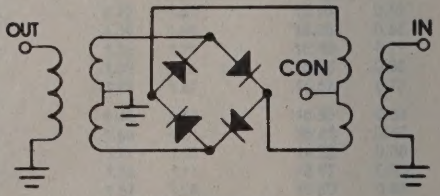
pin and coaxial connections

see case style outline drawings

Series	PAS		ZFAS	ZMAS	ZAS
Models	−1 −3	−2	all models	all models	all models
OUT	8	8	1	1	1
IN	1	1	2	3	3
CONTROL	*3,4	*3,4	3	2	2
GND	2,5,6,7	2,5,6,7	—	—	—
CASE GND	2	2,5,6,7	—	—	—

*pins 3 and 4 must be connected together externally

schematic



NSN GUIDE

MCL NO.	NSN
PAS-3	5985-01-067-3035

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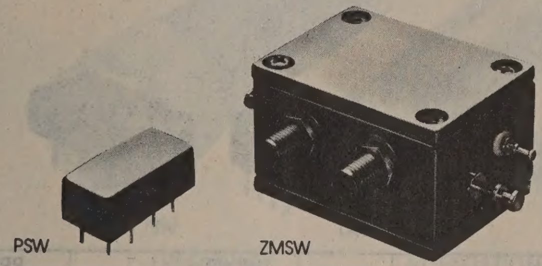
pin diode Switches

SPST/SPDT

10 to 2500 MHz

Mini-Circuits

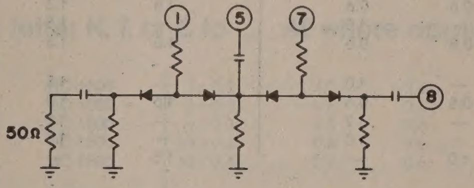


	MODEL NO.	TYPE	FREQUENCY MHz	INSERTION LOSS dB				IN-OUT ISOLATION dB						PRICE, $	
				low-band lw		Upper band U		L		M		U			
			f_L-f_U	Typ.	Max.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
PSW case A06	**PSW-1111**	SPST	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	29.95	(6-24)
	PSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	29.95	(6-24)
ZMSW case JJ77	**ZMSW-1111**	SPST	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	59.95	(1-4)
	ZMSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	59.95	(1-4)

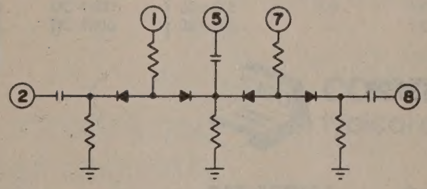
L = low range (f_L to 10 f_L)   M = mid range (10f_L to f_U/2)   U = upper range (f_U/2 to f_U)

lw = low-band (f_L to f_U/2)

Model
PSW-1111



Model
PSW-1211



pin and coaxial connections

see case style outline drawings

Series	PSW		ZMSW	
Models	1111	1211	1111	1211
RF COMMON	5	5	com	com
RF-1 port	8	2	—	RF-1
RF-2 port	—	8	RF-2	RF-2
CONTROL RF-1	7	1	—	1
CONTROL RF-2	—	7	2	2
CONTROL 50 ohm	1	—	1	—
TERMINATION			—	—
GND	2,4	4	—	—
CASE GND	3,6	3,6	—	—

computer-automated performance data

typical production unit / for data of other models consult factory

PSW-1211

RF (MHz)	INSERTION LOSS, dB com RF-1	INSERTION LOSS, dB com RF-2	ISOLATION, dB com RF-1	ISOLATION, dB com RF-2
10	−1.29	−1.38	−49.04	−49.44
110	− .93	− .97	−49.74	−49.78
210	− .91	− .90	−48.87	−44.32
310	− .92	− .84	−44.55	−45.60
410	− .83	− .71	−42.88	−44.53
610	−1.09	− .96	−39.47	−39.28
810	−1.13	−1.12	−37.53	−36.80
1010	−1.12	−1.09	−35.83	−34.95
1310	−1.14	−1.10	−33.28	−32.77
1510	−1.16	−1.12	−32.93	−32.41
1810	−1.30	−1.26	−31.80	−31.32
2010	−1.40	−1.32	−30.31	−29.93
2110	−1.45	−1.34	−28.33	−28.99
2310	−1.44	−1.31	−28.08	−28.09
2510	−1.59	−1.45	−27.89	−28.11

In Stock... Immediate Delivery

For More Information. Circle No. 415

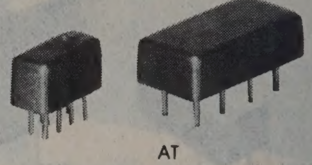
rugged, one-piece design

Fixed Attenuators NEW

3 to 40 dB
DC to 1500 MHz

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQUENCY MHz	ATTENUATION dB Nom.	Flatness Total Range	Flatness DC-1000MHz	VSWR Max. Total Range	VSWR Max. DC-1000 MHz	PRICE $ Ea.	PRICE $ Qty.
MAT case A11	MAT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	4.95	(10-49)
	MAT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-9	DC-1500	9±0.3	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-10	DC-1500	10±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-12	DC-1500	12±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-15	DC-1500	15±0.4	0.8	0.6	1.5	1.3	4.95	(10-49)
	MAT-20	DC-1500	20±0.5	1.0	0.6	1.5	1.3	4.95	(10-49)
	MAT-30	DC-1000	30±0.5	—	1.0	—	1.5	4.95	(10-49)
AT case A04	AT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	3.95	(10-49)
	■ AT-3-75	DC-1000	3±0.3	—	1.0	—	1.5	3.95	(10-49)
	AT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ AT-6-75	DC-1000	6±0.4	—	1.0	—	1.5	3.95	(10-49)
	AT-10	DC-1500	10±0.3	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ AT-10-75	DC-1000	10±0.5	—	1.0	—	1.5	3.95	(10-49)
	AT-20	DC-1500	20±0.4	0.8	0.6	1.5	1.3	3.95	(10-49)
	■ AT-20-75	DC-1000	20±0.6	—	1.2	—	1.5	3.95	(10-49)
	AT-30	DC-1000	30±0.5	—	1.0	—	1.5	3.95	(10-49)
	AT-40	DC-500	40±0.6	1.0	—	1.5	—	3.95	(10-49)

designers kit available

KAT-1... 4 of each (3, 6, 10, 20 dB), only $39.95
KMAT-1... 2 of each (3, 6, 9, 10, 12, 15, 20), only $39.95

NOTES:
■ Denotes 75 ohm models, 75 ohm BNC connectors are standard.

1. For quality control procedures, see page 6.
2. For environmental specifications see page 7.
3. Absolute Maximum Ratings, see page 7; maximum RF power; AT, CAT, NAT, TAT series (1 watt). MAT, SAT series (0.5 watt).
4. Connector models available with female/male connectors. For other versions consult factory.
5. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

SERIES	In	Out	Ground
MAT	1	8	2,3,4,5,6,7
AT	1	8	2,3,4,5,6,7

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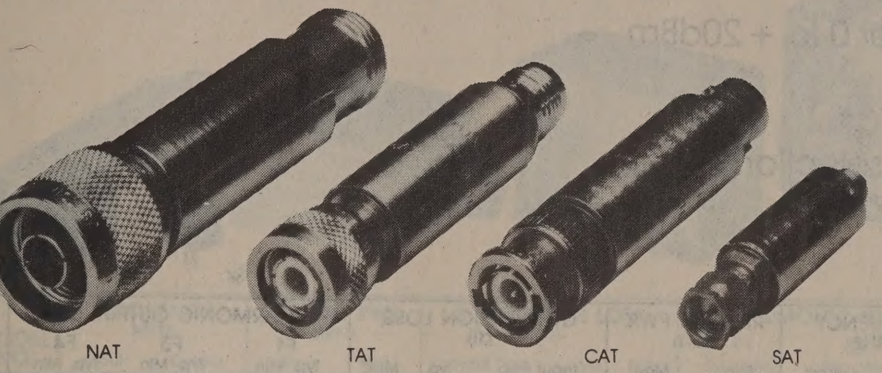
50 ohms and 75 ohms

Mini-Circuits



	MODEL* NO.	FREQUENCY MHz	ATTENUATION dB			VSWR Max.		PRICE, $ Ea.			
			Nom.	Flatness Total Range	Flatness DC-1000MHz	Total Range	DC-1000 MHz	NAT	TAT	CAT	Qty.
	__AT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
	■ CAT-3-75	DC-1000	3±0.3	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
	__AT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
*NAT	■ CAT-6-75	DC-1000	6±0.4	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
case FF57	__AT-10	DC-1500	10±0.3	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
*TAT	■ CAT-10-75	DC-1000	10±0.5	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
case FF58	__AT-20	DC-1500	20±0.4	0.8	0.6	1.5	1.3	15.95	12.95	11.95	(1-49)
*CAT	■ CAT-20-75	DC-1000	20±0.6	—	1.2	—	1.5	15.95	12.95	11.95	(1-49)
case FF55	__AT-30	DC-1000	30±0.5	—	1.0	—	1.5	15.95	12.95	11.95	(1-49)
	__AT-40	DC-500	40±0.5	1.0	—	1.5	—	15.95	12.95	11.95	(1-49)

*add suffix letter N, T, or C to ____AT, where applicable.

								SAT	
SAT case FF56	SAT-3	DC-1500	3±0.2	1.0	0.6	1.5	1.3	14.95	(1-49)
	SAT-6	DC-1500	6±0.3	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-9	DC-1500	9±0.3	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-10	DC-1500	10±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-12	DC-1500	12±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-15	DC-1500	15±0.4	0.8	0.6	1.5	1.3	14.95	(1-49)
	SAT-20	DC-1500	20±0.5	1.0	0.6	1.5	1.3	14.95	(1-49)
	SAT-30	DC-1000	30±0.5	—	1.0	—	1.5	14.95	(1-49)

computer-automated performance data

typical production unit / for data of other models consult factory

SAT-SERIES FREQUENCY (MHz)	SAT-3	SAT-6	SAT-10	SAT-20
1.00	2.93	5.86	9.87	19.97
53.526	2.98	5.87	9.91	20.01
106.052	3.01	5.90	9.93	20.01
158.578	3.02	5.92	9.94	20.02
211.104	3.03	5.92	9.95	20.02
263.63	3.05	5.93	9.95	20.02
316.156	3.09	5.96	9.97	20.06
368.682	3.08	5.97	9.99	20.04
421.208	3.07	5.94	9.96	20.01
473.734	3.12	5.98	9.98	20.00
526.26	3.11	5.96	9.98	19.99
578.786	3.11	5.94	9.96	19.96
631.312	3.14	5.98	9.98	19.97
683.838	3.18	6.01	10.04	19.99
736.364	3.19	5.99	10.01	19.94
788.89	3.23	6.03	10.04	19.95
841.416	3.21	6.01	10.00	19.89
893.942	3.25	6.04	10.05	19.92
946.468	3.26	6.01	9.99	19.82
999.00	3.33	6.06	10.07	19.85
1250.00	3.52	6.20	10.36	19.77
1500.00	3.65	6.29	10.52	19.77

In Stock... Immediate Delivery

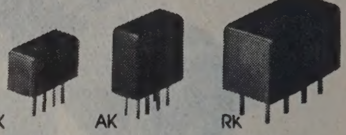
high rejection of 1st and 3rd harmonics

Frequency Doublers

input power 0 to +20dBm

case style selection

outline drawings pages 58-62



	MODEL NO.	FREQUENCY MHz		RF INPUT PWR. dBm		CONVERSION LOSS, dB			*HARMONIC OUTPUT, dB						PRICE, $	
									F1		F3		F4			
		Input	Output	Min.	Max.	Input freq.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
SK case B02	SK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	21.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
AK case A03	AK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	19.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
RK case A01	RK-2	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	15.95	(5-24)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	RK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	14.95	(5-24)
						50-150	11.5	15.0	35	20	40	20	16	12		
	RK-6 NEW	0.005-25	0.01-50	0	10	0.005-1	11.0	13.0	40	30	45	30	16	12	21.95	(5-24)
						1-25	11.5	15.0	35	20	40	20	16	12		

*Harmonic Output below power of F2.

NOTES:

1. Maximum RF input power, 200mW.
2. Refer to table of contents for quality control procedures; environmental specifications, absolute maximum ratings, and hi-rel testing.
3. For connector types and case mounting options, see case style outline drawings.
4. Prices and specifications subject to change without notice.

pin connections

see case style outline drawing

Series	SK	RK			AK
Models	all models	−2	−3	−6	all models
IN	*1,2	*1,3,4	*1,3,4	*1,3,4	*1,3,4
OUT	4	8	8	8	8
GND	3	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND	3	2,5,6,7	2	—	2,5,6,7

*pins must be connected together externally

applications

- Wideband frequency multiplier chains
- Low spurious frequency multiplier chains
- FM, PM modulation chains
- Double frequency range of signal generators

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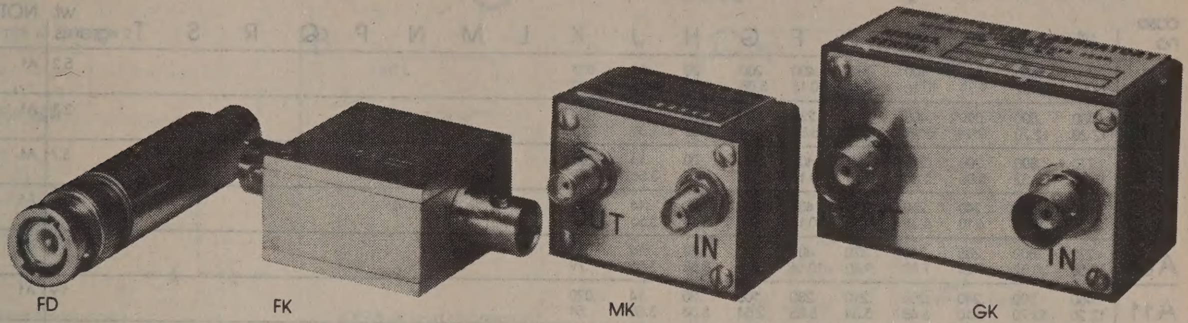
5 KHz to 2000 MHz

Mini-Circuits



	MODEL NO.	FREQUENCY MHz		RF INPUT PWR. dBm		CONVERSION LOSS, dB			*HARMONIC OUTPUT, dB						PRICE, $	
									F1		F3		F4			
		Input	Output	Min.	Max.	Input freq.	Typ.	Max.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Ea.	Qty.
FD case FF55	**FD-2**	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	32.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
FK case H16	**FK-5**	10-1000	20-2000	**10	20	10-600	13.0	15.0								
						600-1000	14.0	17.0	20	15	25	20	—	—	59.95	(1-4)
MK case L19	**MK-2**	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	42.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-500	14.0	16.5	20	15	30	25	16	12		
	MK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	37.95	(1-4)
						50-150	11.5	15.0	35	20	40	20	16	12		
	MK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0							67.95	(1-4)
						600-1000	14.0	17.0	20	15	25	20	—	—		
GK case L20	**GK-2**	1-500	2-1000	1	15	1-100	13.0	15.0	40	30	50	40	16	12	32.95	(1-4)
						100-300	13.5	15.5	25	20	40	30	16	12		
						300-600	14.0	16.5	20	15	30	25	16	12		
	GK-3	0.05-150	0.1-300	0	13	0.05- 50	11.0	13.0	40	30	45	30	16	12	30.95	(1-4)
						50-150	11.5	15.0	35	20	40	20	16	12		
	GK-5	10-1000	20-2000	**10	20	10-600	13.0	15.0								
						600-1000	14.0	17.0	20	15	25	20	—	—	57.95	(1-4)

*Harmonic Output below power of F2.
**ABOVE 700 MHz, min. input power +13dBm

computer-automated performance data

typical production unit / for data of other models consult factory

harmonic* attenuation tables

MODEL FD-2

IN FREQ. MHz	1	2	3	4	5
30	47.1	13.4	51.3	14.9	55.4
35	47.0	13.5	51.0	14.8	54.0
40	46.5	13.6	50.9	15.0	52.6
45	45.9	13.6	50.7	15.2	51.4
50	45.4	13.5	49.8	15.8	50.6
55	43.7	13.4	47.4	15.8	50.2
60	43.7	13.7	46.5	15.6	49.3
65	43.4	13.7	45.4	14.7	48.7
70	43.1	13.7	44.7	14.5	47.7
75	43.1	13.7	44.2	14.2	47.2
80	43.1	13.7	43.6	13.9	46.5

Harmonics Order
INPUT POWER, +5dBm

MODEL FK-5

IN FREQ. MHz	1	2	3	4	5
10	14.9	13.6	34.7	18.1	34.1
20	16.5	13.0	34.8	17.3	34.5
50	15.3	13.4	31.0	17.5	32.8
100	15.2	13.1	26.9	16.5	29.5
250	16.0	12.8	21.7	17.4	29.4
500	25.4	12.6	33.6	22.5	45.7
600	22.8	13.0	31.2	16.3	28.9
700	22.5	13.9	38.1	16.2	26.7
800	17.7	14.6	30.6	14.6	35.4
900	17.5	14.6	28.0	16.2	37.2
999	19.1	14.2	19.7	20.3	41.6

Harmonics Order
INPUT POWER, +13dBm

* all harmonics except 2nd order, are relative to F2
second order is relative to IN PWR

case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
A01	.770 19.56	.800 20.32	.385 9.78	.400 10.16	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1
A03	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									2.3	A1
A04	.770 19.56	.800 20.32	.200 5.08	.210 5.33	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1
A05	.770 19.56	.800 20.32	.240 6.10	.250 6.35	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1
A06	.770 19.56	.800 20.32	.285 7.24	.310 7.88	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1
A11	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.100 2.54	.20 5.08	.14 3.56	.020 .51									1.9	A1
B02	.480 12.20	.500 12.70	.240 6.10	.255 6.48	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								1.9	A1
B13	.480 12.20	.500 12.70	.390 9.91	.405 10.29	.210 5.34	.230 5.85	.16 4.07	.100 2.54	.14 3.56	.20 5.08	.020 .51								2.3	A1
C07	.770 19.56	.810 20.58	.380 9.66	.410 10.42	.030 .77	.200 5.08	.20 5.08	.14 3.56											11.0	A1
D08	1.000 25.40	1.025 26.04	.390 9.91	.430 10.93	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					8.5	A1
D09	1.000 25.40	1.025 26.04	.240 6.10	.280 7.12	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.31	.150 3.81	.20 5.08	.14 3.56					7.5	A1
E10	1.540 39.12	1.620 41.15	.380 9.66	.410 10.42	.770 19.56	.810 20.58	.030 .77	.200 5.08	.10 2.54	.20 5.08	.14 3.56								23.0	A1
F14	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.25 6.35	1.500 38.10	.13 3.31	.39 9.91											170.0	A4, B1, D2
F53	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.13 3.31	1.750 44.45	.13 3.31	.39 9.91											170.0	A4, B1, D2
G15	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	.63 16.01	— —	.800 20.32	.800 20.32	.76 19.31	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				85.0	A4, B1, D1
H16	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A4, A5, B1 D2, D3, D4
J17	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				75.0	A4 or A5 B1, D2, D3
K18	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.38 9.66	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				70.0	A4 or A5 B1, C1, D2, D3
L19	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	1.19 30.23	— —	.66 16.77	— —	— —	.150 3.81		37.0	A4 or A6 B2, D6
L20	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.86 47.25	— —	.64 16.26	— —	— —	.150 3.81		74.0	A4 or A6 B2, D5
M21	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.88	.75 19.05	1.19 30.23	.66 16.76	— —	— —	.150 3.81		40.0	A4 or A6 B2, C1, D6
M22	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.15 29.21	1.86 47.25	.64 16.26	— —	— —	.150 3.81		74.0	A4 or A6 B2, C1, D5
M23	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.63 16.00	1.06 26.93	1.63 41.40	.69 17.53	— —	— —	.150 3.81		70.0	A4 or A6 B2, C1, D6
N24	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.32 8.13	.75 19.05	1.18 29.97	.31 7.88	.56 14.23	.81 20.58	.150 3.81		45.0	A4 or A6 B2, D6
N27	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.42 10.67	1.13 28.70	1.84 46.74	.38 9.65	.69 17.53	1.00 25.40	.150 3.81		92.0	A4 or A6 B2, D7
P25	2.25 57.15	1.38 35.05	1.21 30.74	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.78 19.81	1.47 37.34	— —	.38 9.65	1.00 25.40	— —	.150 3.81		86.0	A4 or A6 B2, D7
P26	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.57	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.50 12.70	1.00 25.40	— —	.31 7.88	.81 20.58	— —	.150 3.81		42.5	A4 or A6 B2, D6
Q28	40.6 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.81 20.58	.06 1.53				300.0	A5, D8

*tolerance x ± .1   xx ± .03   xxx ± .015

oz. = grams x .0353

*NOTES:

MATERIAL & FINISH

A1. Header material CRS; Pin material; #52 alloy. Finish: electro tin hot-oil flowed. Cover material: cupro-nickel.

A4. Case material aluminum. Finish: iridite.

A5. Case material CRS. Finish: baked grey enamel over hot-tin dip.

A6. Case material aluminum. Finish: blue baked enamel over phosphoric etch per MIL-C-15328.

MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

B2. Mounting bracket available on request. Add suffix B to part number. Add $1.50 to unit cost.

MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

CONNECTORS

D1. Connectors: SMA Standard. BNC on request (no charge). Male SMA on request (add $5.00 to unit cost).

D2. Connectors: please specify, unless otherwise noted; BNC is standard, TNC no charge, SMA and Type N add $5.00 per unit. (ZAPD only, Dash – 4 units not available with BNC).

D3. For Type N or TNC connectors this dimension, "C*", changes from 0.75 to 0.94 inches.

D4. Isolated BNC connectors are standard, FTB models only.

D5. Connectors: BNC standard, TNC on request (no charge).

D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

D7. Connectors: BNC only.

D8. Connectors: BNC standard, TNC on request (add $10.00 to unit cost), Female SMA on request (add $15.00 to unit cost).

D9. Male BNC, Male N available: (add $2.00 to unit price. Specify ports for Male connectors).

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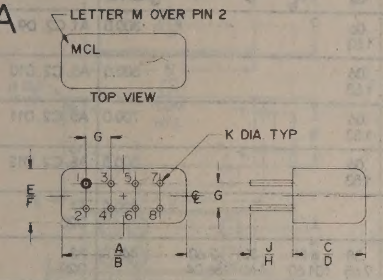
& outline drawings

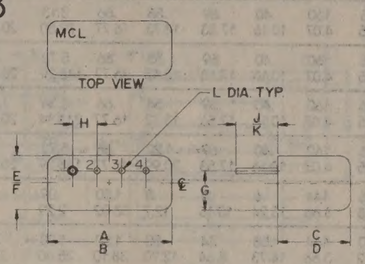
Mini-Circuits

A


LETTER M OVER PIN 2
MCL
TOP VIEW
G
K DIA. TYP.
E
F
G
A
B
J
H
C
D

NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

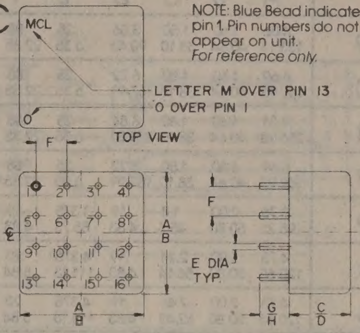
B


MCL
TOP VIEW
L DIA. TYP.
H
J
K
E
F
G
A
B
C
D

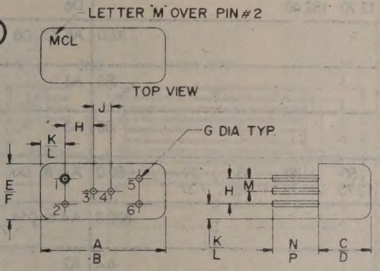
NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

C

NOTE: Blue Bead indicates pin 1. Pin numbers do not appear on unit.
For reference only.

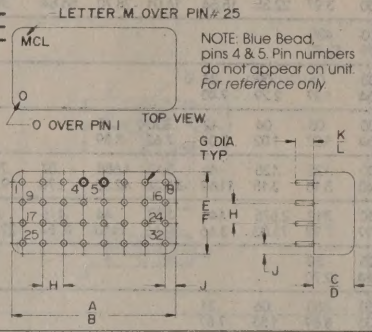

MCL
LETTER M OVER PIN 13
O OVER PIN 1
TOP VIEW
F
A
B
E DIA. TYP.
G
H
C
D

D


LETTER M OVER PIN # 2
MCL
TOP VIEW
J
H
K
L
G DIA. TYP.
E
F
M
H
A
B
K
L
N
P
C
D

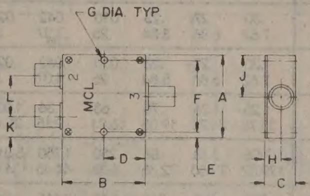
NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

E

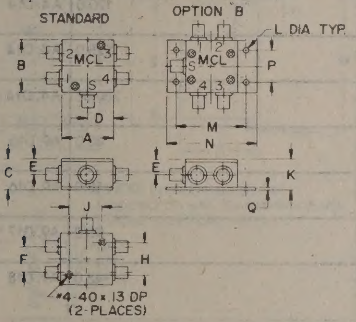

LETTER M OVER PIN # 25
MCL
O OVER PIN 1
TOP VIEW
G DIA. TYP.
K
L
E
F
H
J
C
D
A
B

NOTE: Blue Bead, pins 4 & 5. Pin numbers do not appear on unit.
For reference only.

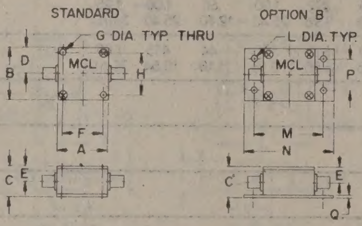
F


G DIA. TYP.
MCL
L
K
F
A
J
D
B
E
H
C

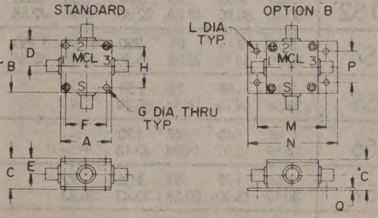
G


STANDARD
OPTION "B"
L DIA. TYP.
B
MCL
D
A
P
M
N
C
E
K
Q
J
F
H
#4-40 x .13 DP (2-PLACES)

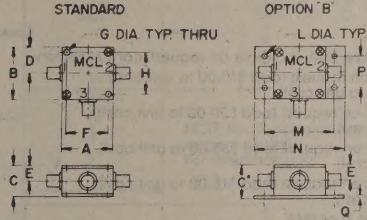
H


STANDARD
OPTION "B"
G DIA. TYP. THRU
L DIA. TYP.
MCL
D
B
H
F
A
P
M
N
C
E
Q

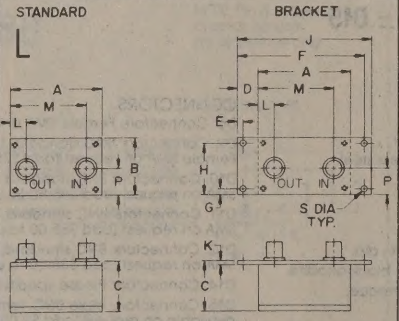
J


STANDARD
OPTION "B"
L DIA. TYP.
D
B
MCL
H
G DIA. THRU TYP.
F
A
P
M
N
C
E
Q

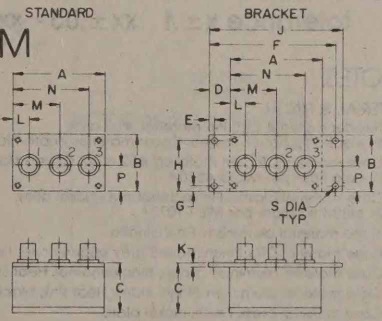
K


STANDARD
OPTION "B"
G DIA. TYP. THRU
L DIA. TYP.
D
B
MCL
H
F
A
P
M
N
C
E
Q

L


STANDARD
BRACKET
A
M
L
OUT
IN
B
P
J
F
A
D
M
L
E
H
G
S DIA. TYP.
K
C

M


STANDARD
BRACKET
A
N
M
L
B
P
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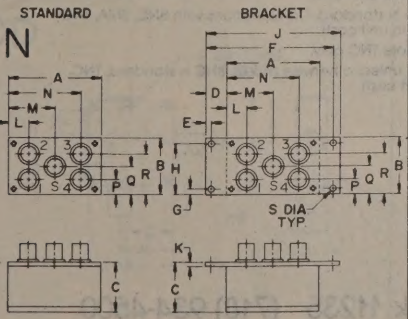
G
S DIA. TYP.
K
C

N


STANDARD
BRACKET
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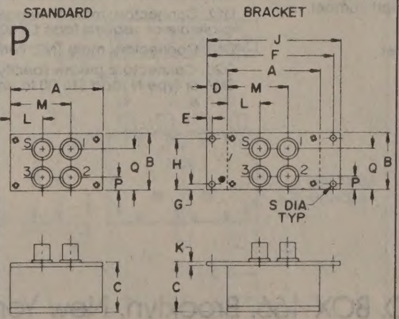
STANDARD
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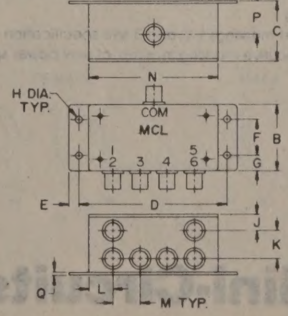
A
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H DIA. TYP.
COM
MCL
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Q
L
M TYP.

For More Information. Circle No. 415

case style outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
R 29	4.06 103.13	1.60 40.64	1.50 38.10	3.56 90.43	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.58 14.73	.66 16.77	3.13 79.50	.81 20.58	.06 1.53				300.0	A1, C2, D9
R 30	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.55 13.97	.66 16.77	5.72 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D10
R 31	9.31 236.98	1.60 40.64	1.50 38.10	8.84 224.54	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	.54 13.72	.66 16.77	8.34 211.84	.81 20.58	.06 1.53				700.0	A5, C2, D11
R 67	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.25 6.35	.88 22.35	.36 9.15	.160 4.07	.40 10.16	.69 17.53	1.22 30.99	.66 16.77	5.72 145.29	.81 20.58	.06 1.53				500.0	A5, C2, D12
S 32	3.75 95.25	2.00 50.80	1.8 45.7	.19 4.83	3.375 85.73	.19 4.83	1.625 41.28	.144 3.66	.6 15.24	.4 10.16	.5 12.7	1.30 33.02	.09 2.29						220.0	A7 D20
T 34	4.75 120.65	2.00 50.80	2.21 56.14	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.09 2.29	.38 9.65	4.00 101.60	30 7.62	2 60 66.04	440.0	A8 D20
T 35	4.75 120.65	2.00 50.80	2.46 62.49	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.09 2.29	.38 9.65	4.00 101.60	1.50 38.10	5.00 127.00	700.0	A8 D20
U 36	7.00 177.80	3.25 82.55	2.13 54.10	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.97	.88 22.35	.73 18.54	.63 16.01	1.13 28.70	2.23 56.64	.125 3.18	.50 12.70	6.00 152.40			900.0	A8 D6
V 37	.80 20.32	.80 20.32	.75 19.05	.40 10.16	.38 9.65	.485 12.32	.110 2.79	.485 12.32											33.0	A5, C1, D6
W 38	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.09 2.29	.37 9.40									.50	A3
X 65	.30 7.62	.27 6.86	.23 5.84	.010 .25	.042 1.07	.020 .51	.100 2.54	.05 1.27	.04 1.02	.12 3.05	.300 7.62	.35 8.89							.50	A3
Y 39	1.25 31.75	1.25 31.75	.75 19.05	.63 16.01	.36 9.15	1.000 25.40	1.000 25.40	.125 3.18	.125 3.18	.46 11.69	2.18 55.38	1.688 42.88	.07 1.78	.750 19.05	.50 12.70	.80 20.32	.45 11.43	.29 7.37	50.0	A4, B1, D6
Z 40	7.06 179.32	3.13 79.50	.88 22.35	.250 6.35	1.750 44.45	5.310 134.87	6.810 172.97	.312 7.92	2.875 73.03	.144 3.66	3.53 89.66	.44 11.18	.415 10.54	.89 22.61					800.0	A4 or D14
AA 46	.830 21.08	.580 14.73	.265 6.73	.13 3.30	.415 10.54	.340 8.64	.025 .64	.50 12.70											6.4	A2
BB 48	.50 12.70	.39 9.91	.225 5.72	.025 .64	.07 1.79	.100 2.54	.250 6.35	.350 8.89	.06 1.53	.31 7.87									3.0	A1
CC 51	2.00 50.80	2.00 50.80	.75 19.05	.938 23.83	.13 3.30	1.750 44.45	.125 3.18	.375 9.53	1.00 25.40	1.25 31.75									120.0	A4, D14
DD 52	2.00 50.80	2.00 50.80	.75 19.05	.900 22.86	.156 3.96	1.688 42.88	.125 3.18	.392 9.96	1.00 25.40	.50 12.70	1.00 25.40	1.25 31.75							225.0	A4, D14
EE 54	3.50 88.90	2.13 54.10	.88 22.35	.250 6.35	1.750 44.45	3.250 82.55	.250 6.35	1.813 46.05	.125 3.18	.44 11.18	.415 10.54	.89 22.61							250.00	A4, D14
FF 55	1.40 35.56	.58 14.73	.73 18.54	2.59 65.79	— —														40.0	A9, D15
FF 56	.98 24.89	.43 10.92	.47 11.94	1.70 43.18	— —														18.0	A9, D16
FF 57	1.54 39.12	.72 18.92	.81 20.58	3.05 77.47	.82 20.83														90.0	A9, D17
FF 58	1.40 35.56	.58 14.73	.61 15.50	2.59 65.79	.64 16.26														45.0	A9, D18

tolerance x ± .1 xx ± .03 xxx ± .015

oz. = grams x .0353

*NOTES:

MATERIAL & FINISH

A1. Header material CRS; Pin material; #52 alloy. Finish: electro tin hot-oil flowed, Cover material; cupro-nickel.

A2. Case material CRS; Pin material; #52 alloy; Covers stainless steel. Finish; gold flash per MIL-G-45204.

A3. Case material plastic. Pin material; iron-nickel alloy. Finish; bright tin-plate per MIL-T-10727.

A4. Case material aluminum. Finish; iridite.

A5. Case material CRS. Finish; baked grey enamel over hot-tin dip.

A7. Case material aluminum. Finish; black enamel. Heat Sink; black anodize.

A8. Case material aluminum. Finish; iridite. Heat sink; black anodize.

A9. Case material brass. Finish; nickel plate.

MOUNTING

B1. Mounting bracket available on request. Add suffix B to part number.

MARKING

C1. For port markings 1, 2, and 3 see specification data sheet.

C2. Consecutive marking, n = no. of way power splitter.

CONNECTORS

D6. Connectors: Female SMA only. Male SMA available on request, consult factory.

D9. Connectors: BNC standard, TNC on request (add $10.00 to unit cost), Female SMA on request (add $25.00 to unit cost).

D10. Connectors: BNC standard, TNC on request (add $20.00 to unit cost), SMA on request (add $45.00 to unit cost).

D11. Connectors: BNC standard, TNC on request (add $35.00 to unit cost), SMA on request (add $65.00 to unit cost).

D12. Connectors: BNC standard, TNC on request (add $15.00 to unit cost), SMA on request (add $35.00 to unit cost).

D14. Connectors: Please specify: Type N or SMA

D15. Connectors: male BNC, female BNC standard. Other combinations with SMA available on request (add $2.00 to unit cost).

D16. Connectors: male SMA, Female SMA only.

D17. Connectors: male N, female N standard. Combinations with BNC, SMA, TNC available on request (add $3.00 to unit cost).

D18. Connectors: male TNC, Female TNC only.

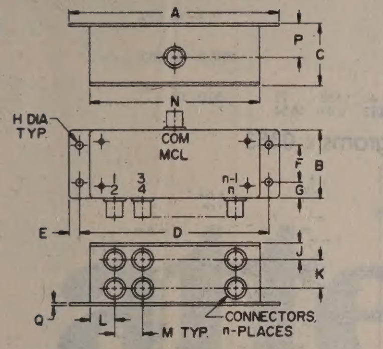
D20. Connectors: please specify, unless otherwise noted. BNC is standard, TNC, SMA or Type N (add $10.00 to unit cost).

Mini-Circuits P.O. BOX 166, Brooklyn, New York 11235 (718) 934-4500

& outline drawings

Mini-Circuits

R


A
P
C
N
H DIA TYP.
COM
MCL
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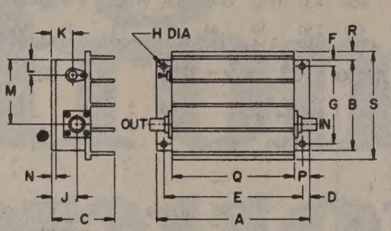
n-1 n
E
D
J
K
Q
L
M TYP.
CONNECTORS, n-PLACES

S


K
H DIA
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OUT
IN
N
J
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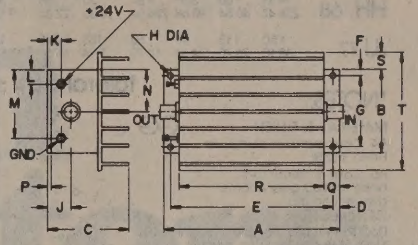
A

T


+24V
K
H DIA
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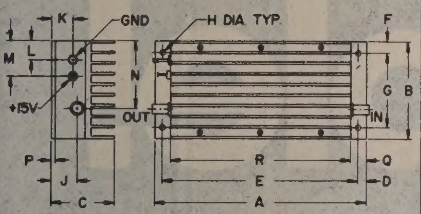
A

U


K
GND
H DIA. TYP.
F
L
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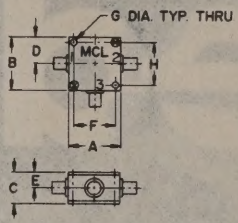
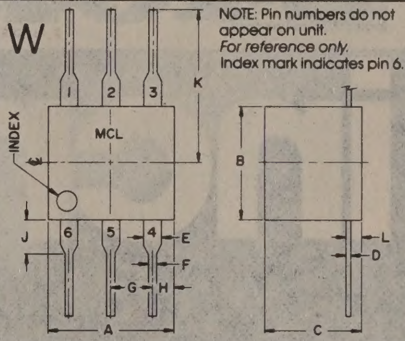
G
B
+15V
OUT
IN
P
J
C
R
Q
E
D
A

V

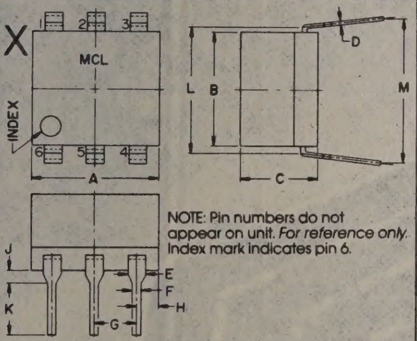

G DIA. TYP. THRU
D
B
MCL
1
2
3
H
F
A
C
E

W


1
2
3
K
INDEX
MCL
B
J
6
5
4
E
F
G
H
A
L
D
C

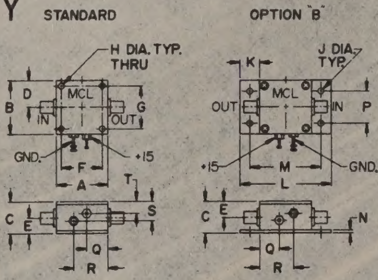
NOTE: Pin numbers do not appear on unit.
For reference only.
Index mark indicates pin 6.

X

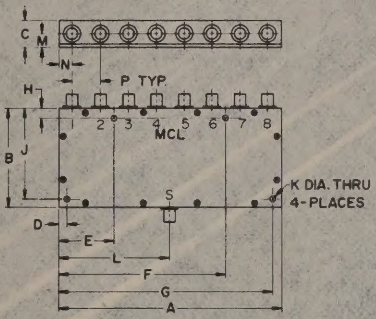

1
2
3
MCL
INDEX
6
5
4
A
L
B
D
M
C
J
E
F
K
G
H

NOTE: Pin numbers do not appear on unit. *For reference only.* Index mark indicates pin 6.

Y


STANDARD
OPTION "B"
H DIA. TYP. THRU
D
B
MCL
IN
OUT
G
GND.
+15
F
A
T
C
E
S
Q
R
J DIA. TYP.
K
OUT
IN
P
+15
M
GND.
L
C
E
N
Q
R

Z


C
M
N
P TYP.
H
1 2 3 4 5 6 7 8
MCL
B
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S
K DIA. THRU 4-PLACES
D
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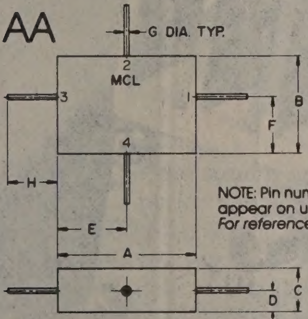
F
G
A

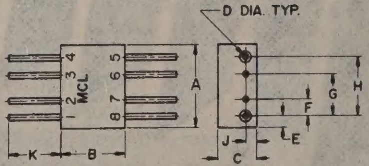
AA


G DIA. TYP.
2
MCL
3
1
B
F
4
H
E
A
C
D

NOTE: Pin numbers do not appear on unit.
For reference only.

BB

NOTE: Pin numbers do not appear on unit.
For reference only.


D DIA. TYP.
4 3 2 1
MCL
5 6 7 8
A
K
B
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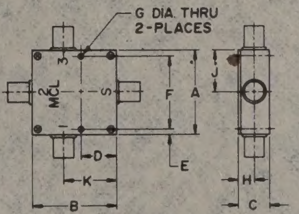
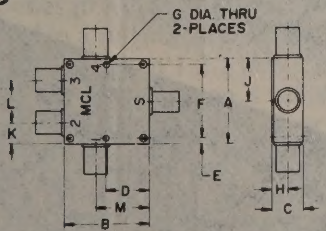
J
C
E

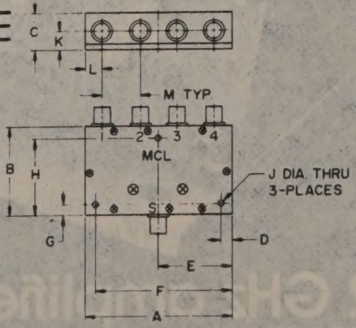
CC


G DIA. THRU 2-PLACES
3
MCL
2
S
F
A
J
D
K
E
B
H
C

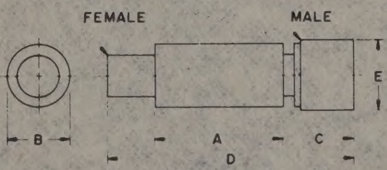
DD


G DIA. THRU 2-PLACES
4
3
MCL
2
S
L
K
F
A
J
E
D
M
B
H
C

EE


C
K
L
M TYP.
1 2 3 4
MCL
B
H
J DIA. THRU 3-PLACES
S
G
D
E
F
A

FF


FEMALE
MALE
E
B
A
C
D

case style outline dimensions (inch/mm) & drawings

Mini-Circuits

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
GG 60	2 31 58 68	1 20 30 48	60 15 24	125 3 18	2 062 52 38	30 7 62	53 13 46	63 16 00											75 0	A4, D19
HH 68	9 31 236 47	1.60 40 64	3 57 90 68	9 84 224 54	25 6 35	88 22 35	36 9 14	160 4 06	34 8 37	69 17 53	54 13 72	66 16 76	8 34 211 84	33 8 38	06 1 52				1090 0	A5, D13
JJ 77	1 50 38.10	1 13 28 70	97 24 64	50 12 70	155 3.94	2 345 59 57	14 3 55	850 21 60	2 50 63 50	10 2 54	44 11 17	75 19 05	63 16 00	37 9 39	54 13 71	43 10 92	150 3 81	73 18 54	50 0	D6

tolerance x ± .1 xx ± .03 xxx ± .015 oz. = grams x .0353

*NOTES:

MATERIAL & FINISH

A4 Case material aluminum
Finish, iridite

A5 Case material CRS
Finish, baked grey enamel
over hot-tin dip

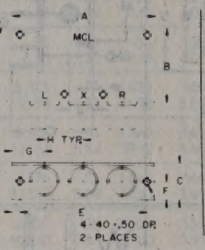
CONNECTORS

D6 Connectors Female SMA only
Male SMA available on request

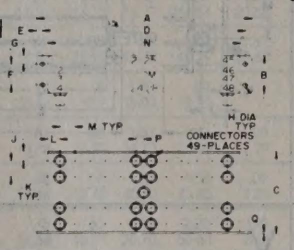
D13 Connectors BNC standard,
SMA on request
(add $130 00 to unit cost)

D19 Connectors BNC standard,
SMA on request
(add $15 00 to unit cost)

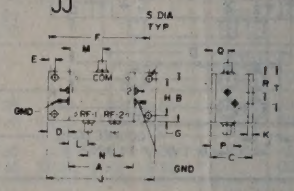
GG


A
MCL
B
L X R
H TYP
G
C
F
D
E
4-40 x .50 DP.
2 PLACES

HH


E
G
F
A
D
N
M
46
47
48
B
H DIA
TYP
M TYP
J
L
P
CONNECTORS
49-PLACES
K
TYP
C
Q

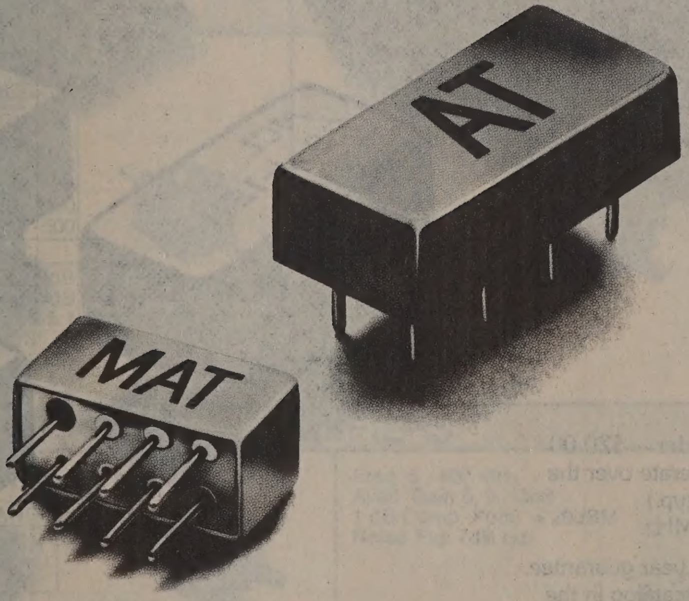
JJ


S DIA
TYP
F
M
E
COM
GND
RF-1
RF-2
H
B
G
D
L
N
A
J
GND
Q
R
T
K
P
C

incredible!
GND
+15V
OUTPUT
Mini-Circuits
1 watt 0.7 to 4.2 GHz amplifiers...only $895

For More Information, Circle No. 415

gain from attenuators?



AT Series	MAT Series	Attenuation (dB)
AT-1	MAT-1	1
AT-3	MAT-3	3
AT-6	MAT-6	6
—	MAT-9	9
AT-10	MAT-10	10
—	MAT-12	12
—	MAT-15	15
AT-20	MAT-20	20
AT-30	MAT-30	30
AT-40*	MAT-40*	40

AT Series $3.95 (10-49)
MAT Series $4.95 (10-49)

Frequency Range DC-1500 MHz
power (max.) MAT = 0.5W, AT = 1W
*Frequency Range DC-500 MHz

YES Gain system reliability and improved performance using Mini-Circuits' low-cost, DC to 1500 MHz attenuators. Minimize interaction between subsystems (for example, mixer and amplifier) and eliminate spurious signals and oscillation by proper input/output matching. And only $1.95 (AT-Series, 1000 qty.)

Choose from over a dozen models (1 to 40 dB) in the compact AT-Series (0.8 X 0.21 X 0.2 in.) or tiny MAT-Series (0.5 X 0.21 X 0.25 in.) housed in a rugged, hermetically-sealed metal case meeting MIL-STD-202. VSWR is less than 1.2:1 (typ.), frequency response is flat ±0.3 dB (typ.), and nominal attenuation is within ±0.3 dB (typ.). Exceptional repeatability is achieved by laser trimming internal resistors.

No waiting, immediate delivery. One-year guarantee. Call or write for 64-page catalog or see our catalog in the Gold Book.

DESIGNERS KIT AVAILABLE:

KAT-1 . . . 4 of each AT (3,6,10,20 dB), only $39.95

KMAT-1 . . . 2 of each MAT (3,6,9,10,12,15,20 dB), only $39.95

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RF switches

MCL
ZMSW
MCL
PSW-1111
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PSW-1211
MCL
PSW-121

10 to 2500 MHz from $19^95 PSW 1211 (500 qty.)

Now, for your wideband systems design, under —$20.00 SPST and SPDT pin diode switches that operate over the 10 to 2500 MHz range with less than 1 dB (typ.) insertion loss at 1000 MHz, 1.5 dB at 2500 MHz.

No waiting, immediate delivery . . . with one year guarantee. Call or write for 64-page, catalog or see our catalog in the Gold Book,

SPECIFICATIONS for
PSW 1111 (SPST) **and PSW 1211** (SPDT)

FREQUENCY RANGE	10-2500 MHz
INSERTION LOSS	
10-2000 MHz	1.7 dB max.
2000-2500 MHz	2.7 dB max.
ISOLATION	
10-500 MHz	40 dB min.
500-1000 MHz	30 dB min.
1000-2000 MHz	25 dB min.
2000-2500 MHz	20 dB min.
SWR	1.5 max. ("on" state)
SWITCHING SPEED	1 μsec. (max.)
MAXIMUM RF INPUT	+20 dBm
CONTROL	+5 V (5 mA max.)
OPERATING TEMPERATURE	−54°C to +100°C
STORAGE TEMPERATURE	−54°C to +100°C
PRICE (6-24)	
PSW 1111	$29.95
PSW 1211	$29.95

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computer-automated performance data

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setting higher standards

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P.O. Box 166, Brooklyn, New York 11235 (718) 934-4500
Domestic and International Telex 125460 International Telex 620156

C80 REV. ORIG.

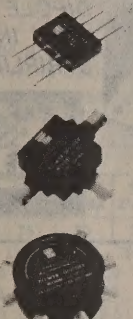
TECHNICAL RESEARCH and MANUFACTURING, INC.
Grenier Field RFD. #10, Manchester, N.H. 03103
Tel. 603-627-6000 Cable: TRAM Manchester, N.H., USA
TWX 710-220-6765

MICROWAVE COMPONENTS 1.8KHz to 26GHz

POWER DIVIDER/COMBINER

FERRITE

DL SERIES
2,3,4,6,8 & 12 Ways



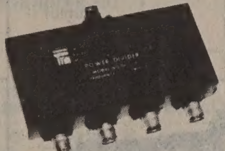
FREQ. BANDS
.02 - 20 MHz
0.1 - 100
20 - 200
100 - 400
0.2 - 200
5.0 - 500
10 - 1,000

TYP. SPEC.	
Loss	0.5dB
Isolation	30dB
VSWR	1.3:1
Input Power	2.5W

Impedance
Avail. 50 or 75Ω

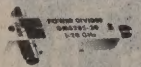
COAXIAL

DM SERIES
2,3,4,6 & 8 Ways
F Center 100 to 1,500 MHz
Bandwidths = ±20%, ±30%
INPUT POWER
DM = 60w CW
1 Kw Peak



TYP. SPEC.	
Loss	0.3dB
Isol.	30dB
VSWR	1.3:1

DMS 285 (2 way)
Freq. 1-20 GHz



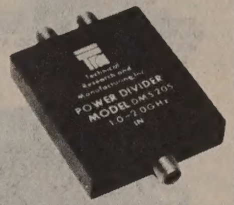
	Low end	High end
Loss(TYP.)	0.2dB	0.6dB
Iso. (TYP.)	25dB	19dB

STRIPLINE

DMS SERIES
2,4 & 8 Ways

FREQ. BANDS
OCTAVE .125 - 12.4 GHz
MULTI-OCTAVE 1.0 - 12.4 GHz 7 - 18 GHz 2 - 18 GHz

TYP. SPEC.	
Loss	0.5dB
Isolation	20dB
VSWR	1.3:1
Phase	0°



INPUT POWER
50 watts CW
1 K watt Peak

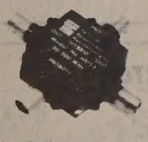
BROADBAND 0, 90, 180° HYBRIDS OCTAVE; MULTI-OCTAVE 0, 90, 180°

FERRITE

HS 150 SERIES 0/180°

MODEL	FREQ. (MHz)
HS 151	.02 - 20
HS 152	0.1 - 100
HS 153	20 - 200
HS 154	100 - 400
HS 155	.2 - 200
HS 156	5 - 500

TYP. SPEC.	
Loss	1.0dB
Isolation	30dB
VSWR	1.5:1
Phase Bal.	3°
Amp. Bal.	0.3dB
Input Power	2.5w

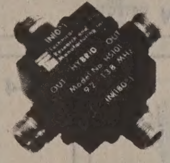


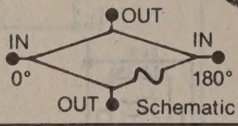
IMPEDANCE
Avail. 50 or 75Ω

COAXIAL

HS 100 SERIES 0/180°
Center Frequency 100 - 1,500 MHz
Bandwidth ± 10,20,30%

TYP. SPEC.	
Loss	.3dB
Isolation	30dB
VSWR	1.3:1
Phase Bal.	2°
Amp. Bal.	.2dB
In Power	60 w

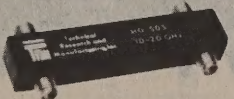




Schematic

STRIPLINE

HQ 500 SERIES 90°	HS 500 SERIES 180°
FREQ. BAND	
.125 - 18 GHz OCTAVE	.5 - 12 GHz
TYP. SPEC.	
Loss 0.2dB Isolation 20dB VSWR 1.2:1 Phase Bal. 1.5°	Loss 0.5dB Isolation 20dB VWSR 1.5:1 Phase Bal. 5.0°



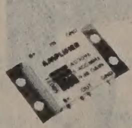
AMPLIFIERS

AD SERIES HIGH DYNAMIC RANGE

FREQ. BANDS
0.5 - 100 MHz
1 - 100
10 - 300

Avail. Gain 10, 20, 30dB
1dB Comp. Point +20dBM
Noise Fig. 5dB Typical

Freq. 5 - 400 MHz
Avail. Gain 6, 9, 13dB
1 dB Comp. Point +20dBM
Noise Fig. 7dB typ.



POWER SUPPLIES

For AD Series Amplifiers
Input 115 or 220 VAC
Ripple & Noise 20 mv P-P

MIXERS

DOUBLE BALANCED-SINGLE BALANCED
MD SERIES

FREQ. BANDS	TYP. SPEC.
.2 - 200 5 - 500 10 - 1,000	Conv. Loss 7dB Isolations 25dB

COUPLERS

STRIPLINE

WIDE BAND DIRECTIONAL
BI-DIRECTIONAL - DIRECTIONAL
AVAILABLE COUPLING
6, 10, 20, 30dB

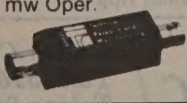
	TYP. SPEC.	
MULTI-OCTAVE & OCTAVE BANDS .125 - 18 GHz	Loss	0.25dB
	Directivity	25dB
	VSWR	1.3:1

FERRITE

DB Series
Coupling
20.5 ± 0.5dB
Freq. 1-2000MHz
VSWR 1.2 Max.
Input 1.5 watts max.

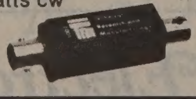
FREQUENCY DOUBLERS

Freq. 0.1 - 2100 MHz
Input power 10 to 20 mw Oper.
1 w max.
Impedance 50 ohms



TRANSFORMERS

Freq. 0.02 - 1000 MHz
Input Power 2.5 watts cw
VSWR 1.3 max.



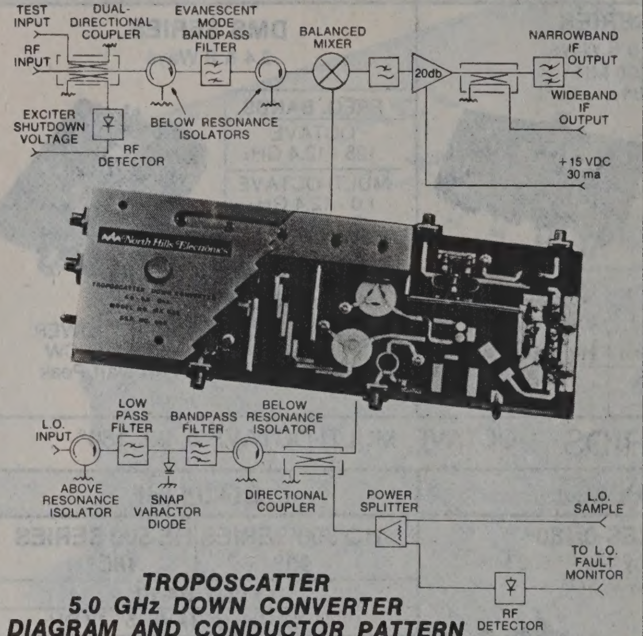
All TRM products are designed to meet the applicable specifications of:
MIL-E-16400 Class 1
MIL-E- 5400 Class 3
MIL-C-15370
MIL-C-39012
and manufactured in accordance with:
MIL-I- 45208 and MIL-C-45662

MICROWAVE INTEGRATED SUBASSEMBLIES

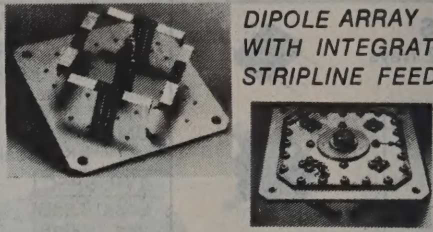
by

North Hills Electronics, INC.

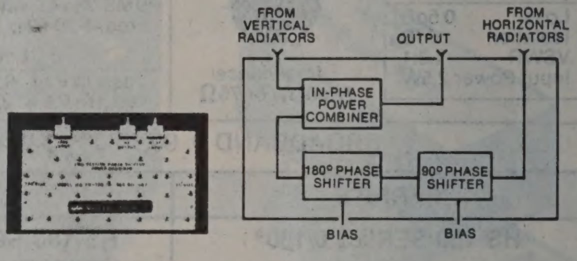
SPECIALISTS IN INTEGRATED MICROWAVE NETWORKS


TEST INPUT
DUAL-DIRECTIONAL COUPLER
EVANESCENT MODE BANDPASS FILTER
BALANCED MIXER
NARROWBAND IF OUTPUT
RF INPUT
20db
WIDEBAND IF OUTPUT
EXCITER SHUTDOWN VOLTAGE
BELOW RESONANCE ISOLATORS
RF DETECTOR
+15 VDC 30 ma
North Hills Electronics
LOW PASS FILTER
BANDPASS FILTER
BELOW RESONANCE ISOLATOR
L.O. INPUT
ABOVE RESONANCE ISOLATOR
SNAP VARACTOR DIODE
DIRECTIONAL COUPLER
POWER SPLITTER
L.O. SAMPLE
TO L.O. FAULT MONITOR
RF DETECTOR

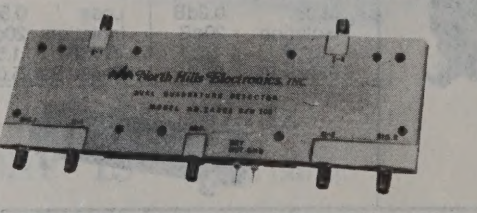
TROPOSCATTER 5.0 GHz DOWN CONVERTER DIAGRAM AND CONDUCTOR PATTERN



DIPOLE ARRAY WITH INTEGRATED STRIPLINE FEED CIRCUITRY


FROM VERTICAL RADIATORS
OUTPUT
FROM HORIZONTAL RADIATORS
IN-PHASE POWER COMBINER
180° PHASE SHIFTER
90° PHASE SHIFTER
BIAS
BIAS

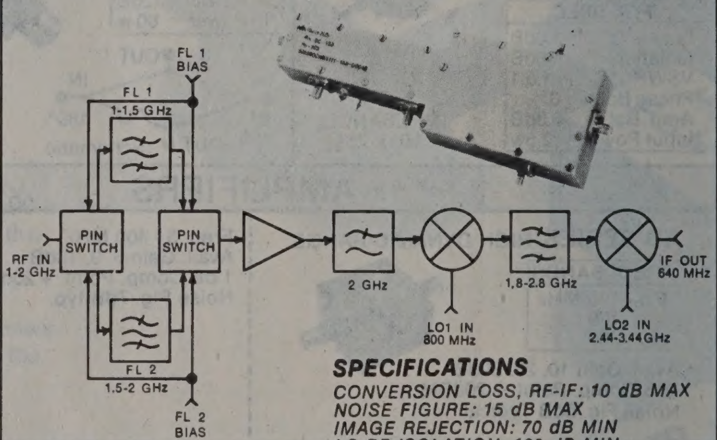
TWO SECTION PIN DIODE PHASE SHIFTER AND POWER COMBINER ASSEMBLY


North Hills Electronics, INC.
DUAL QUADRATURE DETECTOR

DUAL QUADRATURE PHASE DETECTOR

36-WAY RECEIVER MULTICOUPLER WITH PRESELECTION AND GAIN

2-4 GHz DOWN CONVERTER


FL 1 BIAS
FL 1
1-1.5 GHz
PIN SWITCH
PIN SWITCH
RF IN 1-2 GHz
2 GHz
1.8-2.8 GHz
IF OUT 640 MHz
LO1 IN 800 MHz
LO2 IN 2.44-3.44 GHz
FL 2
1.5-2 GHz
FL 2 BIAS

SPECIFICATIONS

CONVERSION LOSS, RF-IF: 10 dB MAX
NOISE FIGURE: 15 dB MAX
IMAGE REJECTION: 70 dB MIN
LO-RF ISOLATION: 100 dB MIN
RF INPUT VSWR: 1.9:1 MAX
IF OUTPUT AT 1 dB COMPRESSION: −20 dBm MIN

ADVANTAGES OF INTEGRATED MICROWAVE CONSTRUCTION

Integrated Microwave circuit techniques are the optimum approach when superior electrical performance, smaller size, and greater reliability are required in microwave and RF systems and subassemblies. Advantages realized include:

- Greater reliability
- Shorter MTTR
- Lower cost
- Smaller size
- Elimination of interconnecting cables resulting in:
  - lower losses
  - elimination of discontinuities
  - low amplitude and group delay ripple

North Hills Electronics, INC.

GLEN COVE, N.Y. 11542
Tel.: 516-671-5700
Telex: 64-0476

For More Information. Circle No. 417

WIDEBAND POWER DIVIDERS/COMBINERS, HYBRID TRANSFORMERS, & TERMINATIONS

North Hills

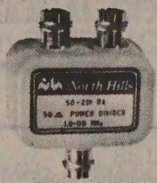
POWER DIVIDERS/COMBINERS

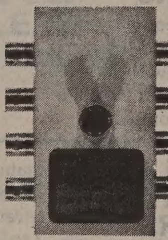
0.2 - 110 and 30 - 225 MHz
2, 4, and 8-way
50 and 75 ohms

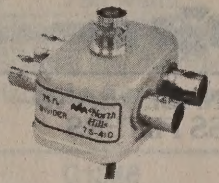
Series 01 and 10 Power Dividers are designed for low power applications in the 0.2 to 110 and 30 to 225 MHz frequency ranges.

Hybrid Junction Techniques are employed to assure superior isolation and minimal insertion loss. VSWR is optimized at all ports.

50 and 75 ohm impedances are standard. Other impedances available on special order.



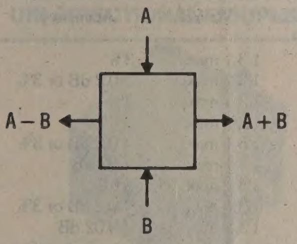




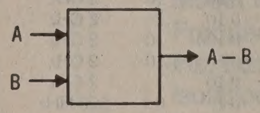
	2-WAY				4-WAY				8-WAY			
Model	50-201RA	75-201RA	50-210RA	75-210RA	50-401RB	75-401RB	50-410RB	75-410RB	50-801SA	75-801SA	50-810SA	75-810SA
Impedance (Ω)	50	75	50	75	50	75	50	75	50	75	50	75
Frequency Range (MHz)	0.2 - 110		30 - 225		0.2 - 110		30 - 225		0.2 - 110		30 - 225	
Insertion Loss (dB)	0.5		1.0		0.5		1.0		1.0		1.5	
Isolation (dB min)	30		30		30		30		30		30	
Amplitude Balance (± dB)	0.5		0.5		0.5		0.5		1.0		0.5	
Phase Balance (± °)	0.5		2.0		1.0		2.0		0.5		2.0	
Input VSWR	1.1		1.25		1.1		1.25		1.1		1.25	
Input Power (watts)	5		3		5		3		5		3	
Case Style	RA		RA		RB		RB		SA		SA	
Weight (gm)	50		50		65		65		160		160	

HYBRID TRANSFORMERS

SUM & DIFFERENCE (4-port)



DIFFERENCE DIVIDER (3-port)



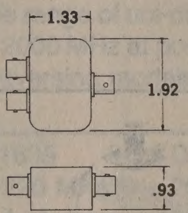
Port Impedance Type	50Ω 50-212RE	75Ω 75-212RE
Frequency Range	0.2 - 110 MHz	
Insertion Loss	1 dB max	
Isolation	30 dB min	
Amplitude Balance	±.3 dB	
Phase Balance	1° max	
VSWR	1.20 max	
Power	0.5 watt max	

Port Impedance Type	50Ω 50-221RA	75Ω 75-221RA
Frequency Range	.2 - 110 MHz	
Insertion Loss	1 dB max	
Isolation	30 dB min	
Null	40 dB min	
VSWR	1.20 max	
Power	0.5 watt max	

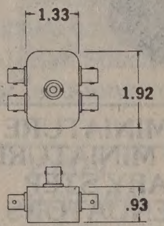
TERMINATIONS

Model	Impedance	Frequency Range	VSWR	Connector
R50-101	50 Ω	DC - 1 GHz	1.06 max.	BNC Male
R75-101	75 Ω	DC - 1 GHz	1.06 max.	BNC Male

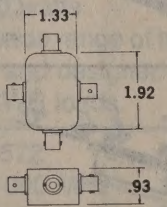
CASE STYLES



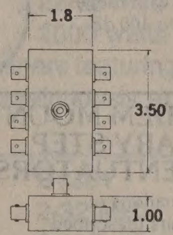
RA



RB



RE



SA

BNC Connectors are standard. Other connectors available on special order. Stud mounting standard.

Different case styles, including printed circuit types with solder terminals, available on special order.

SPECIAL UNITS — 10 Hz to 1 GHz

In addition to our standard lines, North Hills custom designs to specific requirements. Examples of these include:

- Active unity - or high-gain power splitters, adders and combiners.
- High power dividers.
- Resistive dividers from dc to 500 MHz
- Power dividers for video applications with response down to 1 kHz.
- Non-standard impedances.

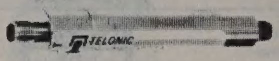
North Hills Electronics, INC.
GLEN COVE, N.Y. 11542 • 516-671-5700

Microwave Filters and RF Attenuators

TUBULAR LOWPASS FILTERS

Cutoff frequency range: 30 to 2,750 MHz. Available with 2 thru 12 sections and virtually any RF connector.

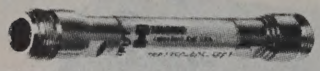
SERIES TLP	SERIES TLA	SERIES TLC	SERIES TLR	SERIES TLS
100 to 2,750 MHz	50 to 1,500 MHz	30 to 1,000 MHz	1,000 to 2,750 MHz	750 to 1,500 MHz
½" diam.	¾" diam.	1¼" diam.	Resonant line	Resonant line
low cost	intermediate loss	low loss	½" diam.	¾" diam.
small size	size power	highest power	for high production	for high production



TUBULAR BANDPASS FILTERS

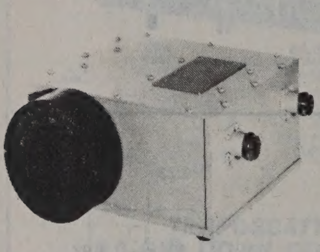
Featuring 0.1 dB Chebyschev design, these cover 30 to 2,400 MHz, 2 to 30% bandwidth, 2 to 12 sections.

SERIES TBS	SERIES TBP	SERIES TBA	SERIES TBC
400 to 2,300 MHz	100 to 2,400 MHz	50 to 1,000 MHz	30 to 900 MHz
¼" inch diam.	½" inch diam.	¾" inch diam.	1¼" inch diam.
smallest tubular	lowest cost	medium loss	lowest loss
lightest weight	most popular	and power	highest power

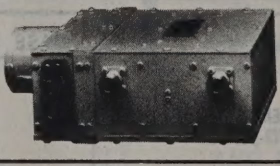


TUNABLE BAND-PASS FILTERS

MANUAL VERSION
Iris-coupled, 0.05 dB Chebyschev design. Frequency-Reading Dials, Full Octave Coverage 48 MHz to 4 GHz Range. Individually Calibrated, Vernier Tuning, 3 or 5 sections.



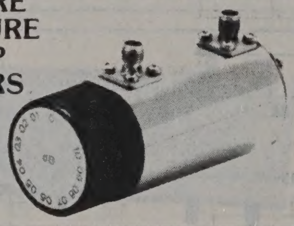
SPECIFICATIONS	TTA 3% & 5 % SERIES	TTF 5% SERIES
VSWR	1.5:1 Maximum	1.5:1 Maximum
Impedance	50 Ohms	50 Ohms
Maximum Input Power	20 Watts	50 Watts
Dial Accuracy —	± 1%	± 1%



COMPUTER-CONTROLLED VERSION
New, digitally-addressable tunable rf filters also available. Consult factory.

SUBMINIATURE AND MINIATURE ROTARY STEP ATTENUATORS

Available in nine models with ranges from 1 to 100 dB

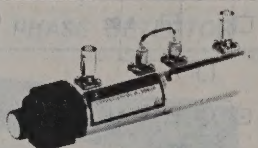


*Accuracy to 0.5% available in custom units.

Model No.	dB Range	dB Steps	Frequency Range	Impedance (ohms)	VSWR	Accuracy*
8051	0-60	10	2 GHz	50	1.3:1 max.	3%
8052	0-10	1	2 GHz	50	1.3:1 max.	±0.2 dB or 3%
8120	0-100	10	2 GHz	50	1.3:1 max.	3%
8121	0-60	10	2 GHz	50	1.3:1 max.	3%
8122	0-10	1	2 GHz	50	1.3:1 max.	±0.2 dB or 3%
8123	0-1	0.1	500 MHz	50	1.3:1 max.	±02 dB
8131	0-70	10	1 GHz	75	1.3:1 max.	3%
8132	0-10	1	1 GHz	75	1.3:1 max.	±0.2 dB or 3%
8133	0-1	0.1	500 MHz	75	1.3:1 max.	±0.02 dB

TANDEM MOUNTED ROTARY STEP ATTENTUATORS

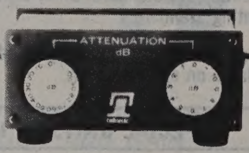
Combinations of step units (described above) in one assembly



Model No.	dB Range	dB Steps	Frequency Range	Impedance (ohms)	VSWR	Accuracy
8107	0-69	1	2 GHz	50	1.3:1 to 1 GHz	±0.2 dB or 3%
8140	0-109	1	2 GHz	50	1.4:1 to 2 GHz	±0.2 dB or 3%
8142	0-69	1	2 GHz	50		±0.2 dB or 3%
8149	0-10.9	0.1	500 MHz	50	dc to 500 MHz 1.3:1 max.	±0.2 dB or 3%

BENCH TYPE ROTARY STEP ATTENUATORS

Discrete instruments for electonics lab, production, testing, or quality assurance



Model No.	dB Range	dB Steps	Frequency Range	Impedance (ohms)	VSWR	Accuracy
8128	0-100	10	2 GHz	50		3%
8129	0-10	1	2 GHz	50	1.3:1 to 1 GHz	±0.2 dB or 3%
8143	0-110	1	2 GHz	50	1.4:1 to 2 GHz	±0.2 dB or 3%
8145	0-80	1	1 GHz	75	1.4:1 max.	±0.2 dB or 3%
8148	0-11	0.1	500 MHz	50	1.3:1 max.	

Since 1960, Telonic has been a leading name in precision electronic components. Telonic's approach is to offer an *exceptionally wide* choice of standard filter types that can be delivered promptly—and which meet your specification requirements. Electrical test design data accompanies each order on request—and is your guarantee of quality assurance.

In the early 1960's when Telonic needed a precision step attenuator for one of their newly designed sweep generators, they had to revert to the ultimate supplier—themselves—to get the performance and dependability the instrument engineer demanded. Today, the product line has expanded into a complete series of rotary step, toggle, fixed, programmable, and custom units.

■ Technical assistance ■ Custom designs ■ Competitive prices ■ Outstanding product quality—backed by full warranty ■ Prompt delivery of stock items.

Call toll free for specs, prices and delivery on standard or special orders.

®TELONIC BERKELEY INC.
A SUBSIDIARY OF BERKELEY INDUSTRIES

2825 Laguna Canyon Road, P.O. Box 277,
Laguna Beach, CA 92652
Tel 800/854-2436, (714/494-9401 in CA),
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WERLATONE INC.
P.O. BOX 47
BREWSTER, NEW YORK 10509

BROADBAND
DIRECTIONAL COUPLERS
POWER DIVIDERS/COMBINERS

DUAL DIRECTIONAL COUPLERS

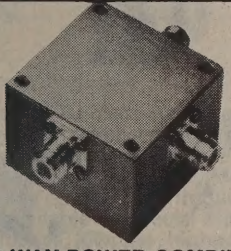
Model No.	C1460	C1487	C1373
Frequency	0.01-250 MHz	100-500 MHz	1.5-80 MHz
Coupling	50 db	40 db	30 db
Directivity	20 db min.	20 db min.	25 db min.
Power	2000 watts	1000 watts	750 watts

Werlatone dual couplers are available in wide range of coupling values: 7 to 70db at power levels to 10Kw. Special low distortion, linear phase and amplitude models are available for feed-forward systems.

UNI-DIRECTIONAL COUPLERS

Model No.	C1651	C1346	C1346
Frequency	0.5-1000 MHz	1.5-80 MHz	2-32 MHz
Coupling	40 db	30 db	10 db
Directivity	20 db min.	25 db min.	20 db min.
Power	100 watts	750 watts	200 watts

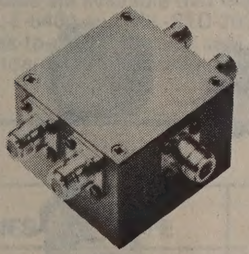
Choose from a wide range of uni-directional couplers covering the range of 10KHz to 2000 MHz at power levels to 10Kw. Special low distortion, phase reversing models available for feed-forward systems.



TWO WAY POWER COMBINERS

Model No.	D1635	D1316	D1379
Frequency	2-220 MHz	20-80 MHz	2-32 MHz
Ins. Loss	0.4 db max.	0.1 db max.	0.2 db max.
Isolation	20 db min.	22 db min.	22 db min.
Power	200 watts	500 watts	2000 watts

Werlatone offers a wide range of two way combiners featuring low loss, high isolation and designed to operate continuously at full power into high VSWR loads.



FOUR WAY POWER COMBINERS

Model No.	D1572	D1624	D1301
Frequency	1-1000 MHz	1-500 MHz	2-32 MHz
Ins. Loss	1.0 db max.	0.8 db max.	0.1 db max.
Isolation	20 db min.	25 db min.	23 db min.
Power	40 watts	100 watts	1000 watts

Four way dividers/combiners are available covering the range of 1 MHz to 2000 MHz at high power levels. Internal isolating terminations are capable of dissipating any combination of unbalanced power.

HYBRID JUNCTIONS

LOW DISTORTION		HIGH POWER
180°		90°
H1484	Model Number	QH1531
2-32 MHz	Freq. Range	2-32 MHz
0.15 db	Ins. Loss max.	0.3 db
25 db	Isolation min.	20 db
500 w	Power Watts	200 w

WERLATONE, INC. BREWSTER, NEW YORK 914-279-6187

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- World's Smallest Design
- Ideal for OEM Systems Applications
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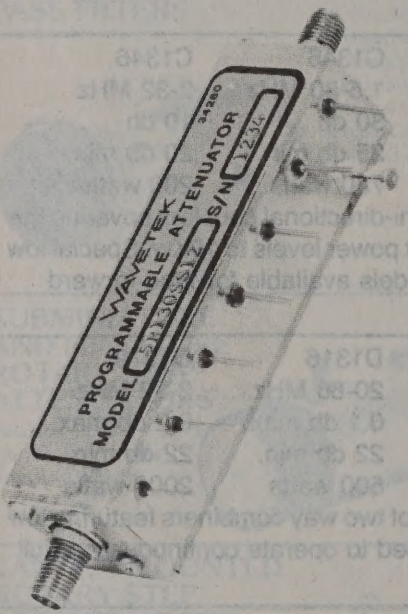
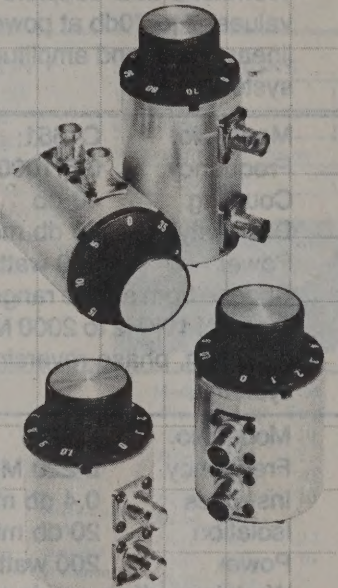


MODEL	ATTENUATION	FREQUENCY
5P70	0 to 70 dB	DC to 2000 MHz
5P127	0 to 127 dB	DC to 1500 MHz
5P130	0 to 130 dB	DC to 1500 MHz

TURRET ATTENUATORS

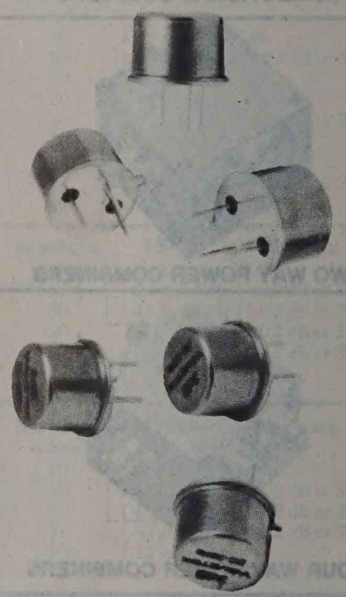
- Broadband Operation
- Low VSWR
- High Repeatable Accuracy
- Ideal for OEM Applications



MODEL	ATTENUATION
5001	1 to 2 dB in 0.1 dB steps
5010	0 to 10 dB in 1 dB steps
5035	0 to 35 dB in 5 dB steps
5070	0 to 70 dB in 10 dB steps
5080	0 to 80 dB in 1 dB steps

MICROPAD SERIES MA5 STRIPLINE/ MICROSTRIP FIXED ATTENUATORS

- DC to 3 GHz
- ±0.2 dB Accuracy to 1 GHz
- 5 Standard Attenuation Values
- Ultraminiature Packaging
- Hermetically Sealed
- Custom Values Available



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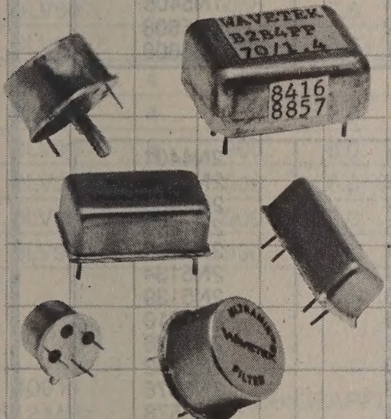
WAVETEK

RF AND MICROWAVE COMPONENTS

ULTRAMIN® MINIATURE FILTERS

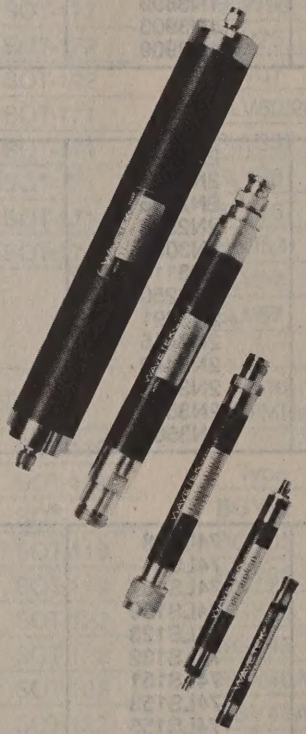
- 10 to 2000 MHz
- Miniature Packages
- Meet Military Specifications



Filters in TO-5 size packages are only 0.36 inches in diameter and weigh less than 0.046 oz. Standard models cover 10 to 2000 MHz frequency range. Other frequencies are available on special order. Bandpass, lowpass, highpass and bandstop filters are available. Models are available that meet MIL-E-5400 and MIL-STD-202. A glass-to-glass hermetic seal is standard on "T" packages.

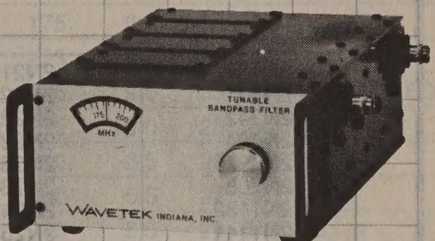
TUBULAR AND LC FILTERS

- 2 MHz to 10 GHz
- Computer Designed (CAD)
- Nine Series
- Meet Military Specifications



TUNABLE BANDPASS FILTERS

- 30 to 2000 MHz
- Octave Frequency Bands
- 2.2 Typical Form Factor
- ±1% Accuracy and Resetability
- Gear Drive



MODEL	FREQUENCY RANGE
5201	31 to 62 MHz
5202	62 to 125 MHz
5203	125 to 250 MHz
5204	250 to 500 MHz
5205	500 to 1000 MHz
5206	1 to 2 GHz

SERIES	TYPE	FREQUENCY RANGE (MHz)	NUMBER OF SECTIONS	SIZE (INCH)	AVERAGE POWER (W)
25	Tubular	500 to 10,000	3 to 6	1/4 dia.	1
38	Tubular	100 to 5000	2 to 8	3/8 dia.	5
50	Tubular	50 to 4000	2 to 12	1/2 dia.	25
75	Tubular	25 to 1500	2 to 12	3/4 dia.	60
125	Tubular	10 to 900	2 to 12	1 1/4 dia.	200
A	LC	2 to 500	2 to 12	3/4 x 3/4 x 2 3/16	10
A2	LC	2 to 500	2 to 12	3/8 x 3/4	10
B	LC	5 to 500	2 to 6	3/4 x 3/4 x 1	10
B2	LC	5 to 500	2 to 6	3/8 x 3/4 x 1	10

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1N283
1N643A
1N914
1N1183A
1N1194A
1N1200

1N1201
1N1202
1N1203
1N1204
1N1205
1N1301
1N1306
1N2021
1N2025
1N2250
1N2282
1N2285
1N2446

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TRANSISTORS

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2N1141
2N1305
2N1309
2N1595
2N1711
2N2060

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ICS

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900 MHz — MOBILE APPLICATIONS

Type	Power (W)	Freq. (MHz)	Gain (db) min.	VCC (V)	Package
BLU98	0.5	900	9.0	12.5	SOT-103/E1
BLV90	1	900	7.5	12.5	SOT-172
BLV91	2	900	6.5	12.5	SOT-172
BLU99	4	900	7.3	12.5	SOT-122
BLV92	4	900	8.0	12.5	SOT-171
BLV93	8	900	6.0	12.5	SOT-171
BLV94	15	900	6.0	12.5	SOT-171
BLV95	25	900	6.0	12.5	SOT-171
BLV96	40	900	5.5	12.5	SOT-171

400 to 512 MHz — MOBILE APPLICATIONS

BLU60/12	60	470	4.8	12.5	SOT-119
BLU45/12	45	470	5.1	12.5	SOT-119
BLU30/12	30	470	6.0	12.5	SOT-119
BLU20/12	20	470	6.5	12.5	SOT-119
BLW82	30	470	5.0	12.5	SOT-119
BLW81	10	470	6.0	12.5	SOT-122
BLU99	5	470	10.5	12.5	SOT-122
BLW80	4	470	8.0	12.5	SOT-122
BLW79	2	470	9.0	12.5	SOT-122
BLX65	2	470	6.0	12.5	TO-39
BLX65E	2	470	8.0	12.5	TO-39E

175 MHz — MOBILE APPLICATIONS

BLV75/12	75	175	7.0	12.5	SOT-119
BLV45/12	45	175	6.5	12.5	SOT-119
BLV30/12	30	175	8.2	12.5	SOT-119
BLW60C	45	175	5.0	12.5	SOT-120
BLW31	28	175	9.5	12.5	SOT-120
BLY89C	25	175	6.0	12.5	SOT-120
BFQ43	4	175	12.0	12.5	TO-39E
BFQ42	2	175	10.5	12.5	TO-39

30 to 900 MHz — BASE STATIONS

Type	Power (W)	Freq. (MHz)	Gain (db) min.	VCC (V)	Package
BLW96	200	30	13.5	50	SOT-121
BLV25	175	108	10.5	28	SOT-119
BLV37	250	108	10.0	35	MAX-BALANCED
BLV80/28	80	175	6.5	28	SOT-119
BLV33F	85	225	10.5	28	SOT-119
BLV38	250	225	9.0	35	MAX-BALANCED
BLV36	120	225	10.0	28	SOT-161
BLU53	100	400	6.5	28	SOT-161
BLV97	30	860	6.5	24	SOT-171
BLV57	38	860	6.5	25	SOT-161

66 to 870 MHz — AMPLIFIER MODULES FOR LAND MOBILE

Type	Freq. (MHz)	P In (MW)	P Out (W)	VCC	Package
BGY32	68-88	100	20	12.5	SOT-132
BGY33	80-108	100	20	12.5	SOT-132
BGY35	132-156	150	20	12.5	SOT-132
BGY36	148-174	150	20	12.5	SOT-132
BGY43	148-174	150	13	12.5	SOT-132B
BGY40A	400-440	100	7.5	12.5	SOT-132C
BGY41A	400-440	150	13	12.5	SOT-132C
BGY40B	440-470	100	7.5	12.5	SOT-132C
BGY41B	440-470	150	13	12.5	SOT-132C
BGY40A	470-512	100	7.5	12.5	SOT-132C
BGY41C	470-512	150	13	12.5	SOT-132C
BGY45A	68-88	150	30	12.5	SOT-301-A-03
BGY45B	144-175	150	30	12.5	SOT-301-A-03
BGY46A	400-440	30	1.5	9.6	SOT-26NC
BGY47A	400-440	45	2.2	9.6	SOT-26NC
BGY47B	430-470	45	2.2	9.6	SOT-26NC
BGY47C	460-512	45	2.2	9.6	SOT-26NC
BGY22	380-512	50	2.9	12.5	SOT-75A
BGY23	380-480	2.5 WATTS	7	12.5	SOT-75A
BGY93A	66-88	35	2.0	9.6	SOT-26NC
BGY93B	136-156	35	2.0	9.6	SOT-26NC
BGY93C	148-174	35	2.0	9.6	SOT-26NC

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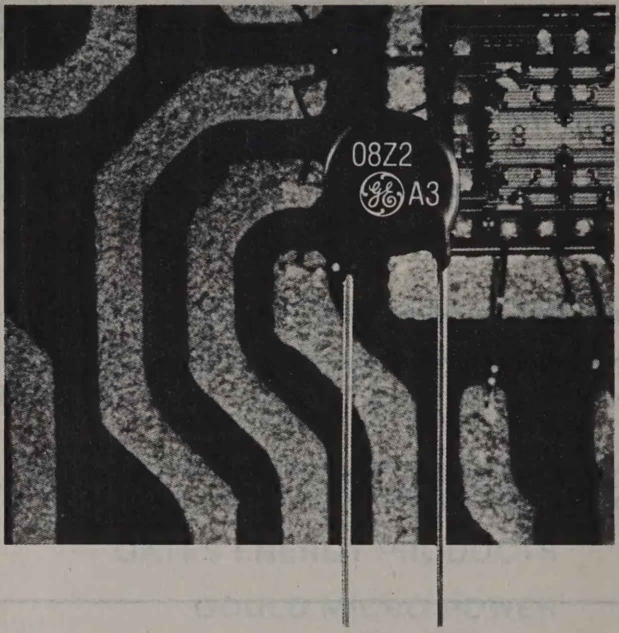

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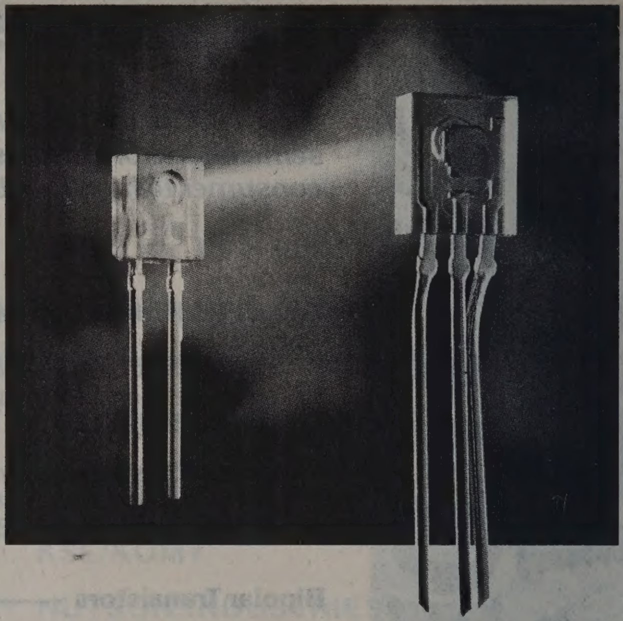

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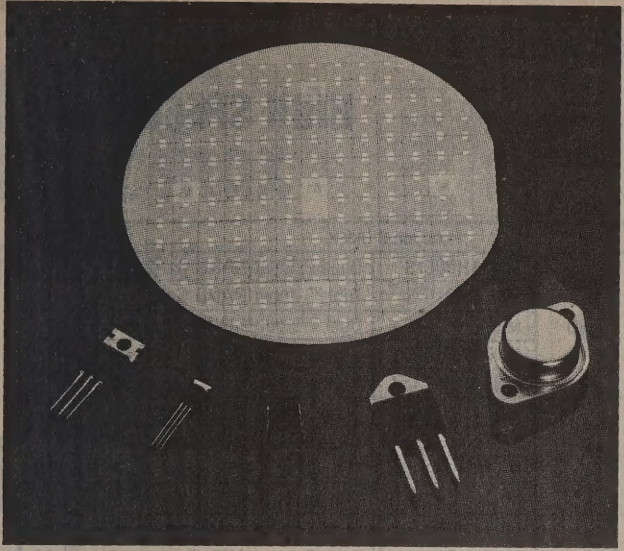

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MN74HC133/S	13-Input NAND Gate	16
MN74HC138/S	3-to-8 Line Decoder	16
MN74HC139/S	Dual 2-to-4 Line Decoders	16
MN74HC157/S	Quad 2-Input Multiplexers	16
MN74HC158/S	Quad 2-Input Multiplexers (Inverted Output)	16
MN74HC160/S	Synchronous Decade Counter with Asynchronous Clear	16
MN74HC161/S	Synchronous Binary Counter with Asynchronous Clear	16
MN74HC174/S	Hex D-Type Flip-Flops with Clear	16
MN74HC175/S	Quad D-Type Flip-Flops with Clear	16
MN74HC240/S	Inverting Octal TRI-STATE Buffers	20
MN74HC241/S	Octal TRI-STATE Buffers	20
MN74HC242/S	Inverting Quad TRI-STATE Transceivers	14
MN74HC243/S	Quad TRI-STATE Transceivers	14
MN74HC244/S	Octal TRI-STATE Buffers	20
MN74HC245/S	Octal TRI-STATE Transceivers	20
MN74HC273/S	Octal D-Type Flip-Flops with Clear	20
MN74HC365/S	Hex TRI-STATE Buffers	16
MN74HC366/S	Inverting Hex TRI-STATE Buffers	16
MN74HC367/S	Hex TRI-STATE Buffers	16
MN74HC368/S	Inverting Hex TRI-STATE Buffers	16
MN74HC373/S	Octal TRI-STATE D-Type Latches	20
MN74HC374/S	Octal TRI-STATE D-Type Flip-Flops	20
MN74HC390/S	Dual 4-Bit Decade Counters	16
MN74HC393/S	Dual 4-Bit Binary Counters	14
MN74HC4002/S	Dual 4-Input NOR Gates	14
MN74HC4049/S	Hex Inverting Logic Level Down Converters	16
MN74HC4050/S	Hex Logic Level Down Converters	16
MN74HC4075/S	Triple 3-Input OR Gates	14
MN74HC4078/S	8-Input NOR Gate	14

Functional Index				Pin
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		MN74HC10/S	Triple 3-Input NAND Gates	14
		MN74HC20/S	Dual 4-Input NAND Gates	14
		MN74HC30/S	8-Input NAND Gate	14
		MN74HC133/S	13-Input NAND Gate	16
	NOR	MN74HC02/S	Quad 2-Input NOR Gates	14
		MN74HC27/S	Triple 3-Input NOR Gates	14
		MN74HC4002/S	Dual 4-Input NOR Gates	14
		MN74HC4078/S	8-Input NOR Gate	14
	AND	MN74HC08/S	Quad 2-Input AND Gates	14
		MN74HC11/S	Triple 3-Input AND Gates	14
		MN74HC21/S	Dual 4-Input AND Gates	14
	OR	MN74HC32/S	Quad 2-Input OR Gates	14
		MN74HC4075/S	Triple 3-Input OR Gates	14
	Buffer	MN74HC241/S	Octal TRI-STATE Buffers	20
		MN74HC244/S	Octal TRI-STATE Buffers	20
		MN74HC365/S	Hex TRI-STATE Buffers	16
		MN74HC367/S	Hex TRI-STATE Buffers	16
		MN74HC4050/S	Hex Logic Level Down Converters	16
	Inverter	MN74HC04/S	Hex Inverters	14
		MN74HC240/S	Inverting Octal TRI-STATE Buffers	20
		MN74HC366/S	Inverting Hex TRI-STATE Buffers	16
		MN74HC368/S	Inverting Hex TRI-STATE Buffers	16
		MN74HC4049/S	Hex Inverting Logic Level Down Converters	16
	Complex Gate	MN74HC51/S	Dual AND-OR-Invert Gates	14
	Schmitt Trigger	MN74HC14/S	Hex Inverting Schmitt Triggers	14
Flip-Flops		MN74HC74/S	Dual D-Type Flip-Flops with Preset and Clear	14
		MN74HC107/S	Dual J-K Flip-Flops with Clear	14
		MN74HC174/S	Hex D-Type Flip-Flops with Clear	16
		MN74HC175/S	Quad D-Type Flip-Flops with Clear	16
		MN74HC273/S	Octal D-Type Flip-Flops with Clear	20
		MN74HC374/S	Octal TRI-STATE D-Type Flip-Flops	20
Latch		MN74HC373/S	Octal TRI-STATE D-Type Latches	20
Decoders		MN74HC138/S	3-to-8 Line Decoder	16
		MN74HC139/S	Dual 2-to-4 Line Decoders	16
Counters	Binary	MN74HC161/S	Synchronous Binary Counter	16
		MN74HC393/S	Dual 4-Bit Binary Counters	14
	Decade	MN74HC160/S	Synchronous Decade Counter	16
		MN74HC390/S	Dual 4-Bit Decade Counters	16
Multiplexers (Digital)		MN74HC157/S	Quad 2-Input Multiplexers	16
		MN74HC158/S	Quad 2-Input Multiplexers (Inverted Output)	16
Transceivers		MN74HC242/S	Inverting Quad TRI-STATE Transceivers	14
		MN74HC243/S	Quad TRI-STATE Transceivers	14
		MN74HC245/S	Octal TRI-STATE Transceivers	20

Panasonic Industrial Company • Electronic Components Division
One Panasonic Way, Secaucus, N.J. 07094 (201) 392-4496

PEC
PROMAX

FACTORY STOCK RECTIFIERS

PEC
PROMAX

**PROMAX ELECTRONICS
CORPORATION U. S. A.**
10556 Bechler River Ave.
Fountain Valley, CA 92708
714-964-0609
TELEX 4994648 KENOA
1-800-22DIODE

LOW/MEDIUM RECTIFIER

TYPE	Package	VRRM (V)	Io (A)	IFSM (A)	VF (V)
IN4001	DO–41	50	1.0	50	1.1@1A
IN4002	DO–41	100	1.0	50	1.1
IN4003	DO–41	200	1.0	50	1.1
IN4004	DO–41	400	1.0	50	1.1
IN4005	DO–41	600	1.0	50	1.1
IN4006	DO–41	800	1.0	50	1.1
IN4007	DO–41	1000	1.0	50	1.1
PG4001	DO–41	50	1.0	50	1.1@1A
PG4002	DO–41	100	1.0	50	1.1
PG4003	DO–41	200	1.0	50	1.1
PG4004	DO–41	400	1.0	50	1.1
PG4005	DO–41	600	1.0	50	1.1
PG4006	DO–41	800	1.0	50	1.1
PG4007	DO–41	1000	1.0	50	1.1
PS150	DO–15	50	1.5	50	1.1 @1.5 A
PS151	DO–15	100	1.5	50	1.1
PS152	DO–15	200	1.5	50	1.1
PS154	DO–15	400	1.5	50	1.1
PS156	DO–15	600	1.5	50	1.1
PS158	DO–15	800	1.5	50	1.1
PS1510	DO–15	1000	1.5	50	1.1
IN5400	D0201AD	50	3.0	200	1.2 @3A
IN5401	D0201AD	100	3.0	200	1.2
IN5402	D0201AD	200	3.0	200	1.2
IN5403	D0201AD	300	3.0	200	1.2
IN5404	D0201AD	400	3.0	200	1.2
IN5405	D0201AD	500	3.0	200	1.2
IN5406	D0201AD	600	3.0	200	1.2
IN5407	D0201AD	800	3.0	200	1.2
IN5408	D0201AD	1000	3.0	200	1.2
PG5400	D0201AD	50	3.0	200	1.1@3A
PG5401	D0201AD	100	3.0	200	1.1
PG5402	D0201AD	200	3.0	200	1.1
PG5404	D0201AD	400	3.0	200	1.1
PG5406	D0201AD	600	3.0	200	1.1
PG5407	D0201AD	800	3.0	200	1.1
PG5408	D0201AD	1000	3.0	200	1.1

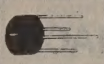
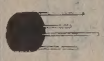
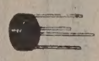
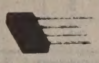
FAST RECOVERY RECTIFIER

TYPE	Package	VRRM (V)	Io (A)	IFSM (A)	VF (V)	Trr (NS)
PS100R	DO–41	50	1.0	50	1.3@1A	150
PS101R	DO–41	100	1.0	50	1.3	150
PS102R	DO–41	200	1.0	50	1.3	150
PS104R	DO–41	400	1.0	50	1.3	150
PS106R	DO–41	600	1.0	50	1.3	250
PS108R	DO–41	800	1.0	50	1.3	500
PS1010R	DO–41	1000	1.0	50	1.3	500
PG100R	DO–41	50	1.0	50	1.3@1A	150
PG101R	DO–41	100	1.0	50	1.3	150
PG102R	DO–41	200	1.0	50	1.3	150
PG104R	DO–41	400	1.0	50	1.3	150
PG106R	DO–41	600	1.0	50	1.3	250
PG108R	DO–41	800	1.0	50	1.3	500
PG1010R	DO–41	1000	1.0	50	1.3	500
PS150R	DO–15	50	1.5	50	1.3@1.5 A	150
PS151R	DO–15	100	1.5	50	1.3	150
PS152R	DO–15	200	1.5	50	1.3	150
PS154R	DO–15	400	1.5	50	1.3	150
PS156R	DO–15	600	1.5	50	1.3	250
PS158R	DO–15	800	1.5	50	1.3	500
PS1510R	DO–15	1000	1.5	50	1.3	500
PS300R	D0201AD	50	3.0	200	1.3@3A	150
PS301R	D0201AD	100	3.0	200	1.3	150
PS302R	D0201AD	200	3.0	200	1.3	150
PS304R	D0201AD	400	3.0	200	1.3	150
PS306R	D0201AD	600	3.0	200	1.3	250
PS308R	D0201AD	800	3.0	200	1.3	500
PS3010R	D0201AD	1000	3.0	200	1.3	500
PG300R	D0201AD	50	3.0	200	1.3@3A	150
PG301R	D0201AD	100	3.0	200	1.3	150
PG302R	D0201AD	200	3.0	200	1.3	150
PG304R	D0201AD	400	3.0	200	1.3	150
PG306R	D0201AD	600	3.0	200	1.3	250
PG308R	D0201AD	800	3.0	200	1.3	500
PG3010R	D0201AD	1000	3.0	200	1.3	500

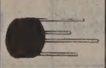
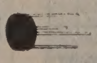
SUPER FAST RECOVERY RECTIFIER

TYPE	Package	VRRM (V)	Io (A)	IFSM (A)	VF (V)	Trr (NS)
ER 100	DO–41	50	1.0	30	.95@1A	35
ER 101	DO–41	100	1.0	30	.95	35
ER 101A	DO–41	150	1.0	30	.95	35
ER 102	DO–41	200	1.0	30	.95	35
ER 103	DO–41	300	1.0	30	.95	35
ER 200	DO–41	50	2.0	50	.95@2A	35
ER 201	DO–41	100	2.0	50	.95	35
ER 201A	DO–41	150	2.0	50	.95	35
ER 202	DO–41	200	2.0	50	.95	35
ER 203	DO–41	300	2.0	50	.95	35
ER 300	D0201AD	50	3.0	125	.95@3A	35
ER 301	D0201AD	100	3.0	125	.95	35
ER 301A	D0201AD	150	3.0	125	.95	35
ER 302	D0201AD	200	3.0	125	.95	35
ER 303	D0201AD	300	3.0	125	.95	35
ER 500	D0201AD	50	5.0	175	.95@5A	35
ER 501	D0201AD	100	5.0	175	.95	35
ER 501A	D0201AD	150	5.0	175	.95	35
ER 502	D0201AD	200	5.0	175	.95	35
ER 503	D0201AD	300	5.0	175	.95	35
ER 600	TO–220	50	6.0	200	.95 @3A	35
ER 601	TO–220	100	6.0	200	.95	35
ER 601A	TO–220	150	6.0	200	.95	35
ER 602	TO–220	200	6.0	200	.95	35
ER 603	TO–220	300	6.0	200	1.0	50
ER 800	TO–220	50	8.0	250	.95@4A	35
ER 801	TO–220	100	8.0	250	.95	35
ER 801A	TO–220	150	8.0	250	.95	35
ER 802	TO–220	200	8.0	250	.95	35
ER 803	TO–220	300	8.0	250	1.0	50
ER 1600	TO–220	50	16	250	.95@8A	35
ER 1601	TO–220	100	16	250	.95	35
ER 1601A	TO–220	150	16	250	.95	35
ER 1602	TO–220	200	16	250	.95	35
ER 1603	TO–220	300	16	250	1.0	50

BRIDGE RECTIFIER

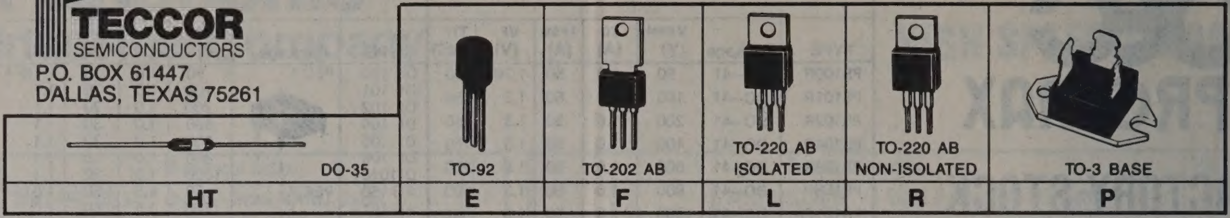
TYPE	Package	VRRM (V)	Io (A)	IFSM (A)	VF (V)
DI 100	PEC 1. 	50	1.0	30	1.1@1A
DI 101		100	1.0	30	1.1
DI 102		200	1.0	30	1.1
DI 104		400	1.0	30	1.1
DI 106		600	1.0	30	1.1
DI 108		800	1.0	30	1.1
DI1010		1000	1.0	30	1.1
AG 150	PEC 2. 	50	1.5	50	1.0 @1A
AG 151		100	1.5	50	1.0
AG 152		200	1.5	50	1.0
AG 154		400	1.5	50	1.0
AG 156		600	1.5	50	1.0
AG 158		800	1.5	50	1.0
AG 1510		1000	1.5	50	1.0
AG200	PEC 2. 	50	2.0	50	1.0 @2A
AG201		100	2.0	50	1.0
AG202		200	2.0	50	1.0
AG204		400	2.0	50	1.0
AG206		600	2.0	50	1.0
AG208		800	2.0	50	1.0
AG 2010		1000	2.0	50	1.0
AM100	PEC 3. 	50	1.0	50	1.0 @1A
AM101		100	1.0	50	1.0
AM102		200	1.0	50	1.0
AM104		400	1.0	50	1.0
AM106		600	1.0	50	1.0
AM108		800	1.0	50	1.0
AM1010		1000	1.0	50	1.0
FI 150	PEC 4. 	50	1.5	50	1.0 @1A
FI 151		100	1.5	50	1.0
FI 152		200	1.5	50	1.0
FI 154		400	1.5	50	1.0
FI 156		600	1.5	50	1.0
FI 158		800	1.5	50	1.0
FI 1510		1000	1.5	50	1.0
FI 200	PEC 4. 	50	2.0	50	1.0 @1A
FI 201		100	2.0	50	1.0
FI 202		200	2.0	50	1.0
FI 204		400	2.0	50	1.0
FI 206		600	2.0	50	1.0
FI 208		800	2.0	50	1.0
FI 2010		1000	2.0	50	1.0
3N 246	PEC 4. 	50	1.0	30	1.3 @3.14
3N 247		100	1.0	30	1.3
3N 248		200	1.0	30	1.3
3N 249		400	1.0	30	1.3
3N 250		600	1.0	30	1.3
3N 251		800	1.0	30	1.3
3N 252		1000	1.0	30	1.3
CP 600	PEC 5. 	50	6.0	125	1.1@3A
CP 601		100	6.0	125	1.1
CP 602		200	6.0	125	1.1
CP 604		400	6.0	125	1.1
CP 606		600	6.0	125	1.1
CP 608		800	6.0	125	1.1
CP 6010		1000	6.0	125	1.1
CM1000	PEC 6. 	50	10	200	1.2 @5A
CM 1001		100	10	200	1.2
CM 1002		200	10	200	1.2
CM 1004		400	10	200	1.2
CM 1006		600	10	200	1.2
CM 1008		800	10	200	1.2
CM 10010		1000	10	200	1.2
CM 2500	PEC 6. 	50	25	300	1.2@12.5A
CM 2501		100	25	300	1.2
CM 2502		200	25	300	1.2
CM 2504		400	25	300	1.2
CM 2506		600	25	300	1.2
CM 2508		800	25	300	1.2
CM 25010		1000	25	300	1.2
CM3500	PEC 6. 	50	35	300	1.2@12.5A
CM3501		100	35	300	1.2
CM3502		200	35	300	1.2
CM3504		400	35	300	1.2
CM3506		600	35	300	1.2
CM3508		800	35	300	1.2
CM35010		1000	35	300	1.2

FAST RECOVERY BRIDGE RECTIFIER

TYPE	Package	VRRM (V)	Io (A)	IFSM (A)	VF (V)	Trr (NS)
AG100R	PEC 2 	50	1.0	50	1.3@1A	200
AG 101R		100	1.0	50	1.3	200
AG 102R		200	1.0	50	1.3	200
AG 104R		400	1.0	50	1.3	200
AG 106R		600	1.0	50	1.3	200
AM100R	PEC 3 	50	1.0	50	1.3@1A	200
AM 101R		100	1.0	50	1.3	200
AM 102R		200	1.0	50	1.3	200
AM 104R		400	1.0	50	1.3	200
AM 106R		600	1.0	50	1.3	200

TECCOR
SEMICONDUCTORS
P.O. BOX 61447
DALLAS, TEXAS 75261

TRIACS, SCRs, DIACS, SIDACS



LOGIC TRIACS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}*(mA)	PKG. TYPE
1 AMP	L201E3	200	3	E
	L201E5	200	5	
	L201E7	200	10	
	L201E9	200	25	
	L401E3	400	3	
	L401E5	400	5	
	L401E7	400	10	
	L401E9	400	25	
1.6 AMPS	L2001L3	200	3	L
	L2001L5	200	5	
	L2001L7	200	10	
	L2001L9	200	25	
	L4001L3	400	3	
	L4001L5	400	5	
	L4001L7	400	10	
	L4001L9	400	25	
4 AMPS	L2004L3	200	3	
	L2004L5	200	5	
	L2004L7	200	10	
	L2004L9	200	25	
	L4004L3	400	3	
	L4004L5	400	5	
	L4004L7	400	10	
	L4004L9	400	25	
	L2004F31	200	3	F
	L2004F51	200	5	
	L2004F71	200	10	
	L2004F91	200	25	
	L4004F31	400	3	
	L4004F51	400	5	
	L4004F71	400	10	
	L4004F91	400	25	

*I_{GT} *in Quadrants I, II, III, & IV*

QUADRACS

(Internal Diac Trigger)

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	VOLTS	PKG. TYPE
1.6 AMPS	Q2001LT	200	30–40	L
	Q4001LT	400		
3 AMPS	Q2003LT	200		
	Q4003LT	400		
4 AMPS	Q2004FT1	200	30–40	F
	Q4004FT1	400		
	Q5004FT1	500		
	Q6004FT1	600		
	Q2004LT	200	30–40	L
	Q4004LT	400		
	Q5004LT	500		
	Q6004LT	600		
6 AMPS	Q2006FT1	200	30–40	F
	Q4006FT1	400		
	Q5006FT1	500		
	Q6006FT1	600		
	Q2006LT	200	30–40	L
	Q4006LT	400		
	Q5006LT	500		
	Q6006LT	600		
8 AMPS	Q2008FT1	200	30–40	F
	Q4008FT1	400		
	Q5008FT1	500		
	Q6008FT1	600		
	Q2008LT	200	30–40	L
	Q4008LT	400		
	Q5008LT	500		
	Q6008LT	600		
10 AMPS	Q2010FT1	200	30–40	F
	Q4010FT1	400		
	Q5010FT1	500		
	Q6010FT1	600		
	Q2010LT	200	30–40	L
	Q4010LT	400		
	Q5010LT	500		
	Q6010LT	600		
15 AMPS	Q2015LT	200	30–40	
	Q4015LT	400		
	Q5015LT	500		
	Q6015LT	600		

SIDACS

PART NUMBER	VOLTS	PKG. TYPE
K1050E	105	E
K1100E	110	
K1200E	120	
K1300E	130	
K2000F1	200	F
K2200F1	220	
K2400F1	240	

DIACS

PART NUMBER	V_{BO}	PKG. TYPE
HT-5760	28	HT
HT-32	32	
HT-5761	32	
HT-5761A	32	
HT-5762	36	
HT-35	40	
HT-40	45	
HT-50	58	
HT-60	60	
HT-105	113	
HT-110	118	
HT-120	125	
HT-130	138	
HT-200	200	
HT-220	230	
HT-240	250	

TRIACS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	$I_{GT(mA)}$	PKG. TYPE
1 AMP	Q201E3	200	10	E
	Q201E4	200	25	
	Q401E3	400	10	
	Q401E4	400	25	
	Q2001L3	200	10	L
	Q2001L4	200	25	
	Q4001L3	400	10	
	Q4001L4	400	25	
3 AMPS	Q2003L3	200	10	
	Q2003L4	200	25	
	Q4003L3	400	10	
	Q4003L4	400	25	
4 AMPS	Q2004F31	200	10	F
	Q2004F41	200	25	
	Q4004F31	400	10	
	Q4004F41	400	25	
	Q5004F41	500	25	
	Q6004F41	600	25	
	Q2004L3	200	10	L
	Q2004L4	200	25	
	Q4004L3	400	10	
	Q4004L4	400	25	
	Q5004L3	500	10	
	Q5004L4	500	25	
	Q6004L4	600	25	
	Q8004L4	800	25	
	Q2004R4	200	25	R
	Q4004R4	400	25	
	Q5004R4	500	25	
	Q6004R5	600	50	
6 AMPS	Q2006F41	200	25	F
	Q4006F41	400	25	
	Q5006F41	500	25	
	Q6006F51	600	50	
	Q2006L4	200	25	L
	Q2006L5	200	50	
	Q4006L4	400	25	
	Q4006L5	400	50	
	Q5006L4	500	25	
	Q5006L5	500	50	
	Q6006L5	600	50	

TRIACS (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	$I_{GT(mA)}$	PKG. TYPE
6 AMPS	Q2006R4	200	25	R
	Q4006R4	400	25	
	Q5006R4	500	25	
	Q6006R5	600	50	
8 AMPS	Q2008F41	200	25	F
	Q4008F41	400	25	
	Q5008F41	500	25	
	Q6008F51	600	50	
	Q2008L4	200	25	L
	Q2008L5	200	50	
	Q4008L4	400	25	
	Q4008L5	400	50	
	Q5008L4	500	25	
	Q5008L5	500	50	
	Q6008L5	600	50	
	Q2008R4	200	25	R
	Q4008R4	400	25	
	Q5008R4	500	25	
	Q6008R5	600	50	
10 AMPS	Q2010F41	200	25	F
	Q4010F41	400	25	
	Q5010F41	500	25	
	Q6010F51	600	50	
	Q2010L4	200	25	L
	Q2010L5	200	50	
	Q4010L4	400	25	
	Q4010L5	400	50	
	Q5010L4	500	25	
	Q5010L5	500	50	
	Q6010L5	600	50	
	Q8010L5	800	50	
	Q2010R4	200	25	R
	Q4010R4	400	25	
	Q5010R4	500	25	
	Q6010R5	600	50	
	Q8010R5	800	50	
12 AMPS	Q2012L5	200	50	L
	Q4012L5	400	50	
	Q5012L5	500	50	
	Q6012L5	600	50	
	Q8012L5	800	50	
	Q2012R5	200	50	R
	Q4012R5	400	50	
	Q5012R5	500	50	
	Q6012R5	600	50	
	Q8012R5	800	50	
15 AMPS	Q2015L5	200	50	L
	Q4015L5	400	50	
	Q5015L5	500	50	
	Q6015L5	600	50	
	Q8015L5	800	50	
	Q2015R5	200	50	R
	Q4015R5	400	50	
	Q5015R5	500	50	
	Q6015R5	600	50	
	Q8015R5	800	50	
25 AMPS	Q2025L5	200	50	L
	Q4025L5	400	50	
	Q5025L5	500	50	
	Q6025L5	600	50	
	Q2025R5	200	50	R
	Q4025R5	400	50	
	Q5025R5	500	50	
	Q6025R5	600	50	
	Q2025P	200	80	P
	Q4025P	400	80	
	Q5025P	500	80	
	Q6025P	600	80	
40 AMPS	Q2040P	200	100	
	Q4040P	400	100	
	Q5040P	500	100	
	Q6040P	600	100	

TECCOR
SEMICONDUCTORS

TRIACS, SCRs, DIACS, SIDACS

THYRISTOR SPECIALIST

214/252-7651

SENSITIVE SCR's

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(\mu A)}$	PKG. TYPE
.8 AMPS	EC103Y	30	200	E
	EC103Y1	30	10	
	EC103Y2	30	50	
	EC103Y3	30	500	
	EC103A	100	200	
	EC103A1	100	10	
	EC103A2	100	50	
	EC103A3	100	500	
	EC103B	200	200	
	EC103B1	200	10	
	EC103B2	200	50	
	EC103B3	200	500	
	EC103C	300	200	
	EC103C1	300	10	
	EC103C2	300	50	
	EC103C3	300	500	
	EC103D	400	200	
	EC103D1	400	10	
	EC103D2	400	50	
	EC103D3	400	500	
	EC103E	500	200	
	EC103E1	500	10	
	EC103E2	500	50	
	EC103E3	500	500	
	EC103M	600	200	
	EC103M1	600	10	
	EC103M2	600	50	
	EC103M3	600	500	
	2N5060	30	200	
	2N5061	60	200	
	2N5062	100	200	
	2N5063	150	200	
	2N5064	200	200	
1.6 AMPS	S0301LS1	30	100	L
	S0301LS2	30	200	
	S0301LS3	30	500	
	S0501LS1	50	100	
	S0501LS2	50	200	
	S0501LS3	50	500	
	S1001LS1	100	100	
	S1001LS2	100	200	
	S1001LS3	100	500	
	S2001LS1	200	100	
	S2001LS2	200	200	
	S2001LS3	200	500	
	S4001LS1	400	100	
	S4001LS2	400	200	
	S4001LS3	400	500	
3 AMPS	S0303LS1	30	100	
	S0303LS2	30	200	
	S0303LS3	30	500	
	S0503LS1	50	100	
	S0503LS2	50	200	
	S0503LS3	50	500	
	S1003LS1	100	100	
	S1003LS2	100	200	
	S1003LS3	100	500	
	S2003LS1	200	100	
	S2003LS2	200	200	
	S2003LS3	200	500	
	S4003LS1	400	100	
	S4003LS2	400	200	
	S4003LS3	400	500	
4 AMPS	T106Q1	15	200	F
	T107Q1	15	500	
	T106Y1	30	200	
	T107Y1	30	500	
	T106F1	50	200	
	T107F1	50	500	
	T106A1	100	200	
	T107A1	100	500	
	T106B1	200	200	
	T107B1	200	500	
	T106C1	300	200	
	T107C1	300	500	
	T106D1	400	200	
	T107D1	400	500	
	T106E1	500	200	
	T107E1	500	500	
	T106M1	600	200	
	T107M1	600	500	
6 AMPS	S0306FS21	30	200	
	S0306FS31	30	500	
	S0506FS21	50	200	
	S0506FS31	50	500	
	S1006FS21	100	200	
	S1006FS31	100	500	
	S2006FS21	200	200	
	S2006FS31	200	500	
	S4006FS21	400	200	
	S4006FS31	400	500	
	S0306LS2	30	200	L
	S0306LS3	30	500	
	S0506LS2	50	200	
	S0506LS3	50	500	
	S1006LS2	100	200	
	S1006LS3	100	500	
	S2006LS2	200	200	
	S2006LS3	200	500	
	S4006LS2	400	200	
	S4006LS3	400	500	

SEN. SCR's (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(\mu A)}$	PKG. TYPE
8 AMPS	S0308FS21	30	200	F
	S0308FS31	30	500	
	S0508FS21	50	200	
	S0508FS31	50	500	
	S1008FS21	100	200	
	S1008FS31	100	500	
	S2008FS21	200	200	
	S2008FS31	200	500	
	S4008FS21	400	200	
	S4008FS31	400	500	
	S0308LS2	30	200	L
	S0308LS3	30	500	
	S0508LS2	50	200	
	S0508LS3	50	500	
	S1008LS2	100	200	
	S1008LS3	100	500	
	S2008LS2	200	200	
	S2008LS3	200	500	
	S4008LS2	400	200	
	S4008LS3	400	500	
10 AMPS	S0310FS21	30	200	F
	S0310FS31	30	500	
	S0510FS21	50	200	
	S0510FS31	50	500	
	S1010FS21	100	200	
	S1010FS31	100	500	
	S2010FS21	200	200	
	S2010FS31	200	500	
	S4010FS21	400	200	
	S4010FS31	400	500	
	S0310LS2	30	200	L
	S0310LS3	30	500	
	S0510LS2	50	200	
	S0510LS3	50	500	
	S1010LS2	100	200	
	S1010LS3	100	500	
	S2010LS2	200	200	
	S2010LS3	200	500	
	S4010LS2	400	200	
	S4010LS3	400	500	

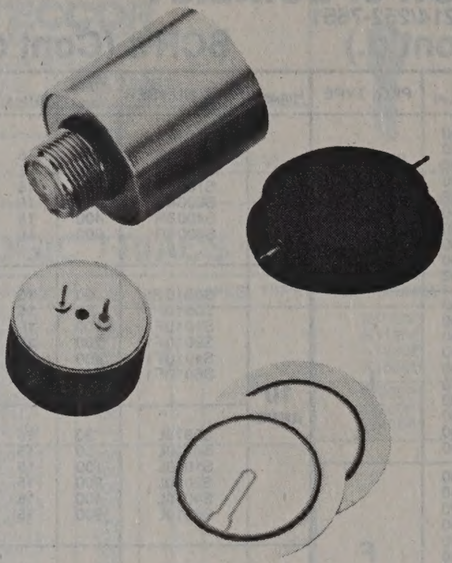
SCR's

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(mA)}$	PKG. TYPE
1 AMPS	S031E	30	10	E
	S051E	50	10	
	S101E	100	10	
	S201E	200	10	
	S401E	400	10	
	S601E	600	10	
1.6 AMPS	S0301L	30	10	L
	S0501L	50	10	
	S1001L	100	10	
	S2001L	200	10	
	S4001L	400	10	
	S6001L	600	10	
3 AMPS	S0303L	30	10	
	S0503L	50	10	
	S1003L	100	10	
	S2003L	200	10	
	S4003L	400	10	
	S6003L	600	10	
4 AMPS	S0304F1	30	10	F
	S0504F1	50	10	
	S1004F1	100	10	
	S2004F1	200	10	
	S4004F1	400	10	
	S6004F1	600	10	
6 AMPS	S0306F1	30	15	
	S0506F1	50	15	
	S1006F1	100	15	
	S2006F1	200	15	
	S4006F1	400	15	
	S6006F1	600	15	
	S0306L	30	15	L
	S0506L	50	15	
	S1006L	100	15	
	S2006L	200	15	
	S4006L	400	15	
	S6006L	600	15	
8 AMPS	S0308F1	30	15	F
	S0508F1	50	15	
	S1008F1	100	15	
	S2008F1	200	15	
	S4008F1	400	15	
	S6008F1	600	15	
	S0308L	30	15	L
	S0508L	50	15	
	S1008L	100	15	
	S2008L	200	15	
	S4008L	400	15	
	S6008L	600	15	

SCR's (Cont'd.)

$I_{T(RMS)}$	PART NUMBER	V_{DRM} V_{RRM}	$I_{GT(mA)}$	PKG. TYPE
8 AMPS	S0308R	30	15	R
	S0508R	50	15	
	S1008R	100	15	
	S2008R	200	15	
	S4008R	400	15	
	S6008R	600	15	
10 AMPS	S0310F1	30	15	F
	S0510F1	50	15	
	S1010F1	100	15	
	S2010F1	200	15	
	S4010F1	400	15	
	S6010F1	600	15	
	S0310L	30	15	L
	S0510L	50	15	
	S1010L	100	15	
	S2010L	200	15	
	S4010L	400	15	
	S6010L	600	15	
12 AMPS	S0312L	30	20	
	S0512L	50	15	
	S1012L	100	20	
	S2012L	200	20	
	S4012L	400	20	
	S6012L	600	20	
	S0312R	30	15	R
	S0512R	50	15	
	S1012R	100	20	
	S2012R	200	20	
	S4012R	400	20	
	S6012R	600	20	
15 AMPS	S0315L	30	30	L
	S0515L	50	15	
	S1015L	100	30	
	S2015L	200	30	
	S4015L	400	30	
	S6015L	600	30	
	S8015L	800	50	
16 AMPS	S0316R	30	30	R
	S0516R	50	15	
	S1016R	100	30	
	S2016R	200	30	
	S4016R	400	30	
	S6016R	600	30	
	S8016R	800	50	
20 AMPS	S0320L	30	30	L
	S0520L	50	30	
	S1020L	100	30	
	S2020L	200	30	
	S4020L	400	30	
	S6020L	600	30	
	S8020L	800	50	
25 AMPS	S0325L	30	30	
	S0525L	50	30	
	S1025L	100	30	
	S2025L	200	30	
	S4025L	400	30	
	S6025L	600	30	
	S8025L	800	50	
	S0325R	30	30	R
	S0525R	50	30	
	S1025R	100	30	
	S2025R	200	30	
	S4025R	400	30	
	S6025R	600	30	
	S8025R	800	50	
65 AMPS	S0365P	30	50	P
	S0565P	50	50	
	S1065P	100	50	
	S2065P	200	50	
	S4065P	400	50	
	S6065P	600	50	

For More Information. Circle No. 427



BLATEK ULTRASONIC TRANSDUCERS

Blatek Industries, Inc. offers ultrasonic transducers in several frequencies providing for a wide range of applications.

The 9000 series of transducers are high frequency, but low cost transducers designed for use in industrial controls and level sensing. Available in OEM quantities or custom designs.

The 9350 (pictured above, top center) is a 1Mhz unit designed for use in various liquid media including hydrocarbons. It is in a brass housing with a UHF connector. Minimum order is one piece.

The 8010 and 8020 model transducers, available in either 25 or 40KHz, are ideal for a variety of applications where a low to medium power ultrasonic transducer is required. Operating distance on these units is a minimum of six feet to a maximum of twenty feet.

Both have painted aluminum housings. The 8010 is available with either PC pins or a phono plug; the 8020 with either PC pins or wire lead attachments. Minimum order is five pieces. Available in OEM quantities.

BLATEK SPECIAL PRODUCTS

Blatek provides specific customer design assistance and/or assembles special products for companies that do not have in-house capability.

Some other special product lines include:

- — MEDICAL TRANSDUCERS AND SUBASSEMBLIES
- — SMALL MILITARY PARTS
- — PIEZO CERAMIC BIMORPHS
- — CUSTOM DESIGN AND SUB-ASSEMBLY WORK OF YOUR COMPANY'S PRODUCT OR SYSTEM

For an estimate on a specific design or project, submit a complete set of prints, drawings, or tentative application of product.

Confidentiality of proprietary project guaranteed. Customer references furnished upon request.

BLATEK INDUSTRIES, INC.
P.O. Box 574
Pine Street & Mill Road
Bellefonte, PA 16823

814-355-4910

BLATEK AUDIO TRANSDUCERS

Blatek piezo ceramic audio transducers are available in three standard sizes, with or without feedback tab. All units can be provided with soldered-on lead wires at additional charge. Units requiring a stud mount or other special treatment will be quoted upon request.

MODEL	O.D.	RES FREQ. (KHz)
6010 (6013)*	1.062"	4.8 ± 500
6020 (6023)	1.250"	3.5 ± 600
6030 (6033)	1.375"	3.0 ± 600

*Units in parenthesis designates feedback pattern. Special electrode patterns and frequency requirements quoted upon request. Small quantities from stock. Minimum order 30 pieces.

MODEL/FREQ.	*DIMENSIONS*	*BANDWIDTH*	*POWER RATING*	*IMPEDANCE*	*MAX. DRIVING VOLTAGE*
9350-1MHz	1.0"x1.250"	±10%	20 watts	300 ohms	200 (p-p)
8010-25KHz	1.0"x .562"	.4 KHz	.2 watts	325 ohms	35 (p-p)
8010-40KHz	1.0"x .562"	.4 KHz	.2 watts	750 ohms	60 (p-p)
8020-25KHz	1.5"x .375"	.8 KHz	2 watts	1150 ohms	100 (p-p)
8020-40KHz	1.5"x .375"	1.0 KHz	2 watts	525 ohms	100 (p-p)

REV C4-84

WHEN THE QUESTION IS MOTION CONTROL, THE ANSWER IS BEI

Call the division that matches your application.

H-25
L-25
Extra heavy duty H-40
New economy E-25

Our INDUSTRIAL ENCODER DIVISION guarantees 30-day delivery on standard model encoders with over 125 resolutions in stock from 1 to 50,000 CPT *incremental:* a wide choice of mechanical and electrical options.

Designed for the abusive machine tool environment. Rugged cast housing, heavy duty shaft and bearings. Available sealed against liquid entry and for shaft loads up to 200 lbs. and 200G shocks.

TYPICAL APPLICATIONS: Incremental machine tool, process control, instrumentation, incremental motion computer peripheral.

FOR FAST, LOW OEM PRICE QUOTES CALL OUR APPLICATIONS ENGINEERS.

INDUSTRIAL ENCODER DIVISION
7230 Hollister Ave.
Goleta, CA 93117
805-968-0782

Ultra-Loc®
690
1190
New Series 143

Our DIGITAL PRODUCTS DIVISION offers a wide choice of high accuracy optical rotary, *absolute, incremental* and *tachometer* encoders. Standard resolutions to 1,048,576 bits-per-turn. Special resolutions to 16,777,216 (2^{24}) bits per turn.

Also Ultra-Loc® direct drive programmable rate and position digital control servo system.

TYPICAL APPLICATIONS: Space rated, military high reliability, precision servo systems, pointing and tracking.

FOR ASSISTANCE WITH CUSTOM MILITARY, AEROSPACE AND SPECIAL APPLICATIONS, CONTACT:

DIGITAL PRODUCTS DIVISION
P. O. Box 3838
Little Rock, AR 72203
501-851-4000

New economy T-25
M-25 Two versions

Our POSITION CONTROLS DIVISION offers fast 30-day delivery on optical *absolute* encoders using the latest aerospace technologies in the range of 512 to 65,536 bits per turn in a convenient size 25 package.

Features include single light source, heavy duty shaft, housings and bearing assemblies, wide range of output driver options and mounting configurations.

TYPICAL APPLICATIONS: Robotic measurement, drive system components, process control, absolute machine tool, absolute pointing and tracking.

FOR LOW INDUSTRIAL PRICES CONTACT:

POSITION CONTROLS DIVISION
819 Reddick Ave.
Santa Barbara, CA 93103
805-966-1538

M-15
E-15
Self-contained, self-aligning

Our COMPUTER PRODUCTS DIVISION offers small, high quality optical encoders for high volume computer peripheral, medical and robotics markets.

Our modular M-15 can be customer installed in 60 seconds. Not a kit! Totally self contained. Needs no alignment. The E-15 is also self-contained, with shaft and bearings. Both models are 1.5″ diam. TTL outputs with resolutions up to 1024 CPT in quadrature with zero reference. Dual inch/metric outputs available.

FAST DELIVERY for standard shaft sizes.

TYPICAL APPLICATIONS: Computer Peripheral, Medical Electronics, Robotics, General applications requiring small size encoder.

COMPUTER PRODUCTS DIVISION
1755B La Costa Meadows Dr.
San Marcos, CA 92069
619-471-2600

BEI Motion Systems Co.

BEI

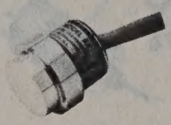
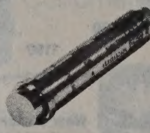
Specialists in Motion Control

For More Information. Circle No. 429

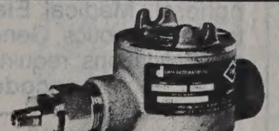
DATA INSTRUMENTS' PRESSURE TRANSDUCERS

Features
- Pressure ranges: 0–5 to 20,000 PSI
- Output: voltage, frequency, or current
- A unique design that puts stainless steel in contact with your pressure media
- 2x rated pressure without damage. 10x rated pressure without bursting
- Full calibration and temperature compensation
- Unit-to-unit interchangeability: ± 1%
- Rated intrinsically safe

Options
Optional features can be obtained at additional costs:
1. Absolute pressure version.
2. Improved zero and span temperature compensation to 1%/100°F (55°C) and improved accuracy (combined non-linearity, hysteresis and repeatability) from 1% to 0.5%.
3. Barbed fitting for attaching protective hose around cable.
4. Install longer cable by splicing to existing 3 ft. cable.
5. Install longer continuous cable.
7. Extended operating temperature range to 300°F (148.9°C) 6 and 15 PSI excluded. Includes Bendix PTIH-10-6P electrical connector with an extended case.

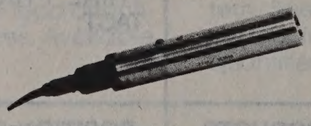
	Model AB PSIG, PSIA	**Model AR** PSIG, PSIA	**Model BF** PSIG, PSIA	**Model BL** PSIG, PSIA	**Models EA and EAF** PSIG	**Model SA** PSIA, PSIS
						
	General Purpose	High Performance	Amplified Output	Two-Wire Transmitter	Rugged OEM Style	Sealed/Absolute
Pressure Range	0–6, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 15,000, 20,000	0–5, 10, 20, 50, 100, 500, 1000, 5000	0–5, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 20,000	0–5, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 20,000	0–6, 15, 25, 50, 100, 200, 300, 500, 1000, 2000, 5000	0–15, 25, 50 PSIA; 0–100, 200, 500, 1000, 3000, 5000 PSIS
Accuracy	Within 0.5% FSO best fit, including non-linearity, repeatability and hysteresis	Within 0.25% FSO best fit, including non-linearity, repeatability and hysteresis	Within 0.5% FSO best fit, including non-linearity, repeatability and hysteresis 0.25% available	Within 0.5% FSO best fit, including non-linearity, repeatability and hysteresis 0.25% available	Within 0.5% FSO best fit, including non-linearity, repeatability and hysteresis	Within 0.5% FSO best fit, including non-linearity, repeatability and hysteresis
Sensitivity	20 mV/V	20 mV/V				
Signal Output	0 to 100 mV	0 to 100 mV	0 to 5 Vdc	4 to 20 mA	1 to 6 Vdc 1 to 6 kHz	1 to 6 Vdc
Excitation Voltage	5 Vdc or ac; 6 V maximum	5 Vdc or ac; 10 V maximum	12 to 20 Vdc or 20 to 32 Vdc	14 to 50 Vdc	8 to 20 Vdc 10 to 20 Vdc	9 to 20 Vdc
Operating Temperature Range	−65°F to 200°F	−65°F to 200°F	−50°F to 200°F	0°F to 200°F	−67°F to 257°F −40°F to 185°F	−67°F to 257°F
Compensated Temperature Range	30°F to 130°F	30°F to 130°F	30°F to 130°F	30°F to 130°F	32°F to 185°F	32°F to 185°F
Thermal Effect on Zero	< 1% of full scale over compensated range	< ± 2% of full scale over compensated range	< 1% of full scale over compensated range	< 1% of full scale over compensated range	< ± 0.02% FSO/°C maximum over compensated range	< ± 0.02% FSO/°C maximum over compensated range
Thermal Effect on Sensitivity	< 1% of reading over compensated range	< ± 2% of reading over compensated range	< 1% of reading over compensated range	< 1% of reading over compensated range	< ± 0.02% RDG/°C maximum over compensated range	< ± 0.02% RDG/°C maximum over compensated range
Options	1, 2, 3, 4, 5, 7	1, 3, 4, 5,	1, 2	1, 2		

Series E Explosion-Proof Housing



Series E may contain Models AB, BF, or BL. Consult above chart for specifications.

Model DS Depth Sensor



- Two-wire • 4–20 mA output
- Watertight connector
- Waterproof housing withstands 10,000 PSI

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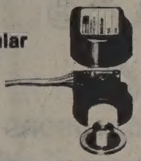
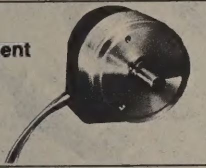
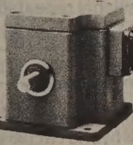
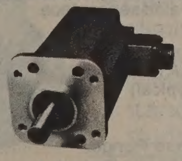
OPTICAL SHAFT ENCODERS

INCREMENTAL ENCODERS

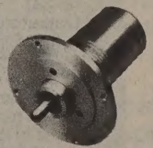
	Pulses Per Revolution	Input Voltage (VDC)	Output Formats	Frequency Range (KHz)	Shaft Diameter (Inches)	Outline Dimension (Inches)
K15 Modular 	50 to 1000	5 or 12	Square Wave	0 to 50	N/A	1 1/2 Dia. x 3/4 L
	Ultra low cost, very small modular encoder for easy installation on servo or stepper motor. Hybrid circuitry minimizes solder connections and improves reliability.					
K3 Modular	50 to 1200	5	Square Wave, Sine Wave	0 to 50	N/A	2 Dia. x 3/4 L
	Low cost modular encoder designed to be integrally mounted on servo or stepper motor having shaft diameter of up to 1/2 inch. Square wave or amplified sine wave output.					
LC-15 Instrument Grade 	50 to 1000	5 or 12	Square Wave	0 to 50	1/4	1 1/2 Dia. x 1 1/2 L
	Very low cost shaft encoder for applications where space is at a premium. Unit features a single LED light source, a monolithic sensor array and hybrid circuitry for maximum reliability.					
LC-23 Instrument Grade	30 to 2500	5 or 12	Square Wave, Sine Wave, Line Driver	0 to 50	1/4	2 1/4 dia. x 1 7/8L
	Low cost shaft encoder which offers many of the optional features of far more expensive units. Face or servo mount, choice of output formats, cable or terminal connections.					
Tru-Mite Heavy Duty	100 to 5000	5 to 15	Square Wave, Sine Wave, Line Driver	0 to 100	3/8	2 1/2 Dia. x 2 1/2 L
	High performance, industrial duty encoder with 3/8" diameter shaft and sealed bearings. Cast aluminum housing with flange or servo mount. LED light source 100 KHz frequency range and up to 5000 PPR resolution.					
Tru-Tac Heavy Duty 	10 to 1200	5 to 24	Square Wave, Sine Wave, Line Driver	0 to 30	3/8	3L x 3 1/4 W x 3 1/8 H
	Very rugged encoder with double-ended 3/8" diameter shaft and sealed bearings. Cast aluminum housing with foot or face mounting. Built-in voltage regulator permits use over a wide supply voltage range.					

OPTIONAL ENCLOSURES



L Series

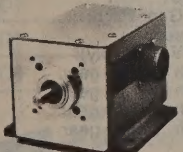
The L Series consists of a heavy duty sealed, NEMA 4 enclosure within which an encoder is mounted. A flexible coupling connects the encoder shaft to the enclosure's shaft, thus isolating the encoder's bearings from shaft loading effects. Two Datametrics encoder models can be mounted in the L Series — LC-23 and Tru-Mite.



EX Series

The EX Series consists of an explosion-proof enclosure which is FACTORY MUTUAL LISTED for Class I, Divisions 1 and 2, Groups C and D; and Class II, Division 1, Groups E, F and G indoor and outdoor (NEMA 4) hazardous locations. Two Datametrics encoder models can be mounted in the EX Series — LC-23 and Tru-Mite.

ABSOLUTE ENCODERS

	Resolution (Counts)	Input Voltage (VDC)	Output Codes	Output Format	Frequency Range (KHz)	Shaft Diameter (Inches)	Outline Dimensions (Inches)
LR Absolute 	360 or 512	5 to 24	BCD, Gray Natural Binary, Gray	Square Wave	0 to 50	3/8 or 5/8	5 L x 3 1/2 W x 3 5/8 H
	Industrial duty, absolute encoder with BCD, natural binary or Gray code output. 360 or 512 counts per revolutions, 5 to 24 VDC input voltage range, open collector or passive pull-up output.						

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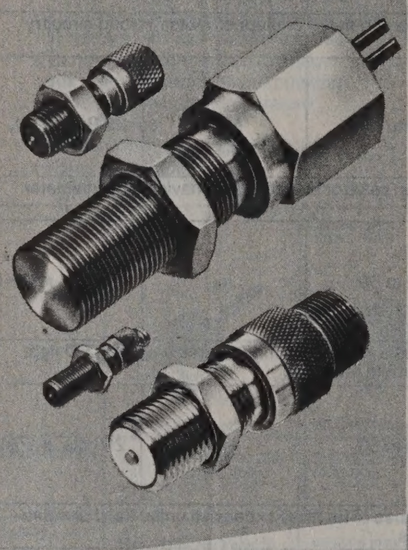

Electro's MAXI-MAG® Magnetic Sensors are non-contact transducers that convert mechanical motion into electrical control signals. The motion may be of any nature i.e., rotating, sliding, or oscillating. The actuator must be ferro-magnetic material. Commonly used actuators include gears, slotted discs, shafts with keyways, or other moving machine parts with a discontinuity.

Magnetic sensors have a unique set of characteristics that make them valuable in a wide range of applications. These characteristics include:

- Self-powered operation.
- Error-free conversion of actuator speed to output frequency.
- Simple installation.
- No moving parts, thus providing long life and high reliability.
- Usable over essentially an unlimited speed range.
- No mechanical contact with actuator, thus eliminating wear.
- Adaptability to a wide variety of shape and size configurations.

The versatility of MAXI-MAG® Sensors is unexcelled in their ability to function:

- Without a power supply.
- At repetition rates greater than one megahertz.
- At temperatures from −300°F to +450°F (Special designs can accommodate much higher temperatures. Consult the factory). Reliability under severe environmental conditions of thermal and mechanical shock, vibration, humidity, immersion in water or oil, salt spray, sand or dust, radiation and pressure.
- In hazardous locations.
- With readily available actuators (gears).
- With superior synchronization accuracy.

Custom design and low-cost molded sensors are also available. Consult the factory.

DI-MAG®
DIGITAL MAGNETIC SENSORS

Electro's DI-MAG® Digital Output Magnetic Sensors combine the features of a passive sensor with a self-contained switching circuit. The circuit changes the pulses generated by the sensor coil into a digital (on-off) square-wave output with the passing of a ferro-magnetic material, such as a gear, in front of the sensor pole-piece. The use of this built-in amplifier powered from your control circuit or instrumentation provides the following advantages:

- Constant amplitude, logic-level output.
- Improved signal-to-noise ratio.
- Usable signal at low RPM.
- Larger air gap between sensor and actuator.

FEATURES:

- Constant output amplitude independent of speed, gap and runout (within sensing range).
- Output signal of integrated circuit suitable for direct use in digital equipment.
- Interface circuitry eliminated reducing installation and maintenance costs.
- Digital output discriminates signal from noise in low-signal applications.
- Excellent sensitivity insures full output. Stable operating rate from −40°F to +176°F.

Since 1941, ELECTRO Corporation has pioneered in the development and production of non-contact, variable-reluctance transducers.

DI-MAG® ZERO
DIGITAL MAGNETIC SENSORS

DI-MAG® ZERO Digital Magnetic Sensors generate one pulse-per-pass of a ferro-magnetic discontinuity in front of the sensor's face. They operate completely independent of speed and do not contact the actuator being detected. They do not load or otherwise interfere with the actuator and have no wearing parts or exhaustible elements. All models have identical electrical specifications and characteristics.

FEATURES:

- Respond to ferro-magnetic discontinuity position—independent of speed.
- Provide excellent positional repeatability of switchpoint.
- Outputs compatible with CMOS, TTL, HTL, DTL and RTL logic families.
- Operate over wide range of supply voltages.
- Excellent electrical noise immunity.
- Utilize state-of-the-art hybrid circuitry.
- Full output signal from zero Hz through 50K Hz.
- Rugged stainless steel construction—with completely sealed sensor face.

SPECIFICATIONS:

Power Requirements:
4.5 to 15V dc, 30mA max.
(12mA @ 12V dc typical).
Sensed Frequency:
0 to 50K Hz.
Operating Temperature Range:
0°F to +170°F.
Output:
Square-wave, Logic O: 0.25V max. at 50mA sink current.
Square-wave, Logic 1: $\frac{\text{R Load} \times \text{V Supply}}{\text{R Load} + 2{,}200}$
Recommended Gear Pitch:
48 D.P. or coarser.
Air Gap (At + 12V dc supply):
0 to 0.005″ with 48 pitch gear.
0 to 0.060″ with 20 pitch gear.
0 to 0.080″ with 12 pitch gear.
0 to 0.100″ with 8 pitch gear.

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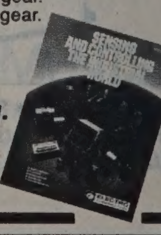

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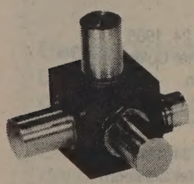
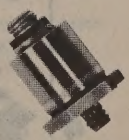
Model Number	Sensitivity	Frequency Response ±5%	Operating Dynamic Range	Dimensions	Weight
CE 501 M101	10 mV/g	7 Hz to 20 kHz	485 g	0.31″ Dia. x 0.42″H.	1.8 grams
CE 501 M201	2 mV/g	1.5 Hz to 25 kHz	2300 g	0.31″ Dia. x 0.42″H.	1.8 grams
CE 501 M701	0.7 mV/g	1.5 Hz to 25 kHz	6900 g	0.31″ Dia. x 0.42″H.	1.8 grams
CE 505 M101	10 mV/g	7 Hz to 12 kHz	485 g	.84″H. x .84″W. x .84″L.	10 grams
CE 506 M101	10 mV/g	7 Hz to 20 kHz	485 g	0.31″ Dia. x 0.42″H.	2 grams
CE 507 M101	100 mV/g	6 Hz to 7 kHz	48 g	0.75″ Hex. x 1.27″H.	40 grams
CE 507 M301	200 mV/g	0.6 Hz to 7 kHz	48 g	0.75″ Hex. x 1.27″H.	40 grams
CE 507 M501	10 mV/g	0.6 Hz to 7 kHz	485 g	0.75″ Hex. x 1.27″H.	40 grams
CE 508 M101	10 mV/g	6 Hz to 15 kHz	485 g	0.5″ Hex. x 0.92″H.	12 grams
CE 508 M401	0.12 mV/g	9 Hz to 12 kHz	23,000 g	0.5″ Hex. x 0.92″H.	12 grams
CE 510 M101	8 V/g	0.1 Hz to .25 kHz	0.57 g	2.00″ Dia. x 2.17″H.	485 grams
CE 510 M201	2 V/g	0.1 Hz to .25 kHz	2.3 g	2.00″ Dia. x 2.17″H.	485 grams
CE 524 M301	100 mV/g	0.6 Hz to 5 kHz	21 g	1.0″ Hex. x 2.1″H.	100 grams
CE 525 M201	25 mV/g	5 Hz to 8 kHz	190 g	0.75″ Hex. x 1.5″H.	40 grams
CE 528 M101	500 mV/g	200 Hz to 2 kHz	9 g	1.0″ Hex. x 2.8″H.	150 grams
CE 529 M101	10 mV/g	3 Hz to 8 kHz	485 g	0.394″ Hex. x 0.65″H.	6 grams
CE 557 M101	10 mV/g	1 Hz to 3 kHz	485 g	1.5″ Dia. x 1.6″H.	75 grams

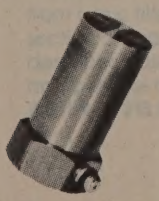


Piezoelectric accelerometers with built in electronics. CE 500 Series.

- operating temperature range: –65°F to +250°F (54C to 121C)
- eliminate cable length limitations: allow varying cable lengths between sensor and power supply with no degradation in sensitivity or performance
- eliminate cable motion effects
- standard accessories available: extension cables, magnetic mounts, isolation studs, constant current single and multi channel power supplies
- other operational characteristics and mechanical configurations are available

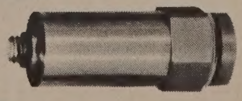


Model Number	Sensitivity	Frequency Response ±5%	Operating Dynamic Range	Dimensions	Weight
CA 424 M201	100 pC/g	2 Hz to 6 kHz	25 g	1.0″ Hex. x 2.2″H.	100 grams
CA 426 M101	10 pC/g	1 Hz to 12 kHz	100 g	0.5″ Hex. x 1.45″H.	15 grams
CA 431 M201	70 pC/g	1 Hz to 2 kHz	200 g	1.0″ Hex. x 1.65″H.	180 grams



Charge coupled accelerometers. CE 400 Series.

- operating temperatures in excess of 700°F (375C)
- highly stable to temperature changes
- integral cabling available
- hermetically sealed
- other operational and mechanical configurations available



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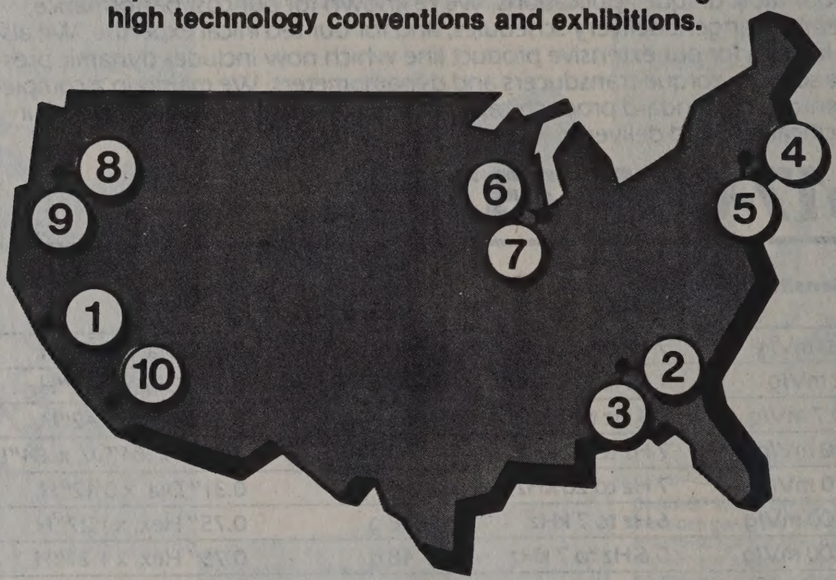

1 **Mini/Micro West**
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Anaheim, California

2 **Southcon**
March 5, 6, 7, 1985
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4 **Electro**
April 23, 24, 25, 1985
New York Coliseum
New York

5 **Mini/Micro Northeast**
April 23, 24, 25, 1985
Albert Hall
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6 **Midcon**
September 10, 11, 12, 1985
Rosemont Exposition Center
Chicago, Illinois

7 **Mini/Micro Midwest**
September 10, 11, 12, 1985
Rosemont Exposition Center
Chicago, Illinois

8 **Northcon**
October 22, 23, 24, 1985
Portland Memorial Coliseum
Portland, Oregon

9 **Mini/Micro Northwest**
October 22, 23, 24, 1985
Portland Memorial Coliseum
Portland, Oregon

10 **Wescon**
November 19, 20, 21, 22, 1985
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At Entran, we've solved most of the problems you might encounter with pressure transducers by making them tiny. And nowadays, tiny is the state-of-the-art.

Being tiny means you don't interfere with the integrity of the system being measured.

Being tiny means less measuring surface to bear loads, and a more compact solid state density with no moving parts.

Being tiny means being insensitive to acceleration, vibration and shock, so you get flat pressure readings, both static and dynamic.

And, being tiny means greater handling ease in hard-to-get-at places. Which adds up to more applications flexibility.

Entran pressure tranducers can usually be interfaced directly with scopes, recorders and milliammeters.

Our transducers come complete and ready to use. All you need supply is the excitation voltage on two leads and read output on the other two leads.

All units give you direct linear output in millivolts/psi and read both static and dynamic pressures. There's no need for charge or voltage amplifiers. Calibrations are traceable to The National Bureau of Standards.

Write Entran Devices, Inc., 10 Washington Ave., Fairfield, N.J. 07006 (201) 227-1002, Telex 130-361.

$\$360^{00}$

Must not be used in water or corrosive medium.

Only 0.080 in diameter (that's tiny), EPI-080.

This solid-state pressure transducer is 0.080" in diameter, 0.25" in length and occupies a volume of only 0.0013 cubic inches. Yet it gives accurate static and dynamic pressure readings like the big ones do. Its atomically bonded, diffused diaphragm with leads attached to the non-active area make this device virtually insensitive to acceleration, vibration and shock.

Typical ranges	25 psi	50 psi	100 psi	250 psi	500 psi
Sensitivity nom.	3 mV/psi	1.8 mV/psi	1.0 mV/psi	0.4 mV/psi	0.2 mV/psi
Useful frequency nom.	25 KHz	30 KHz	40 KHz	60 KHz	80 KHz

Excitation: 5V. Output impedance: 750 Ω nom. Repeatability: 0.5%.
Non-linear and hyst: ± ¾%. Resolution: infinite.

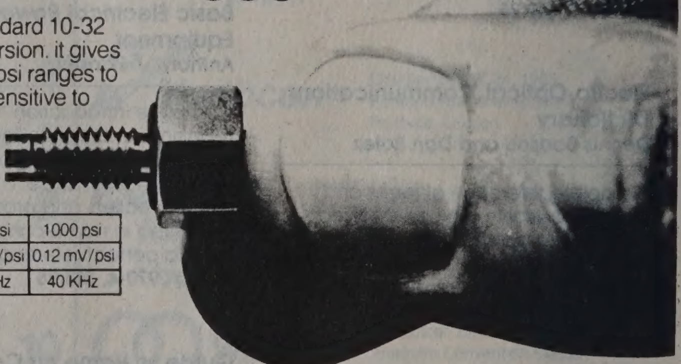
Tiny but easy to handle, EPX-10

This easy to install pressure transducer is built with standard 10-32 UNF thread and is available in an optional M5 metric version. it gives flat pressure readings static and dynamic, in 5 to 5,000 psi ranges to as high as 90KHz. Has infinite resolution and is also insensitive to acceleration, vibration and shock. Made of stainless steel, and with its built-in "O" ring seal can be screwed in just about anywhere. However, for corrosive or water usage, order our "welded" version.

Typical ranges	5 psi	50 psi	100 psi	250 psi	1000 psi
Sensitivity nom.	3 mV/psi	1.5mV/psi	1.2 mV/psi	0.5 mV/psi	0.12 mV/psi
Useful frequency nom.	9 KHz	15 KHz	15 KHz	20 KHz	40 KHz

Combined non-linear and hyst: ± 1% below 100psi, ½% above 100 psi.
Excitation: 10V. Output impedance: 350 Ω nom.
Repeatability: 0.25%. Thread length: 7/16".

$\$385^{00}$



Entran® Pressure Transducers.

(Today, miniature makes sense.)

Call (201) 227-1002

For More Information. Circle No. 435

The advantages of being tiny.

At Entran we build a line of accelerometers that can best be described as tiny.

Being tiny means you don't interfere with the integrity of the system being measured.

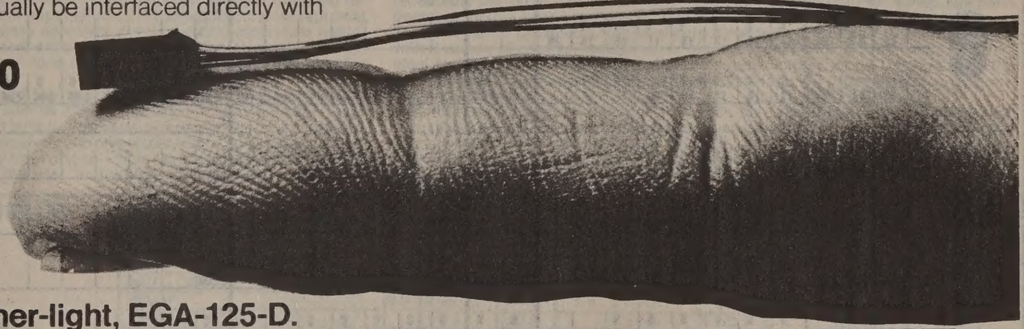
Being tiny gives you greater handling ease in hard-to-get-at places, which adds up to more applications flexibility. And, being tiny means less mass to distort your test scale, more room for other instruments. All at no sacrifice in test data.

Entran accelerometers give you high output, low impedance readings, both static and dynamic. As a result they can usually be interfaced directly with scopes, recorders and milliammeters.

Entran accelerometers come complete and ready to use. All you supply is the excitation voltage on two leads and read output in millivolts on the other two leads.

All units give you direct linear output in millivolts/g and read both static and dynamic acceleration. There's no need for charge or voltage amplifiers. Calibrations are traceable to The National Bureau of Standards.

Write Entran Devices, Inc., 10 Washington Ave., Fairfield, NJ 07006 Phone 201/227-1002, Telex 130-361.



$329.00

Tiny and feather-light, EGA-125-D.

This accelerometer weighs only one half a gram. Is less than 0.006 cu. inches in volume. Yet gives you static & dynamic readings of acceleration, vibration and shock. And comes with .7 critical damping to eliminate resonance. ("D" is for "damped.")

Typical ranges	± 5g	± 10g	± 50g	± 100g	± 500g
Sensitivity nom.	15 mV/g	12 mV/g	4 mV/g	2.5 mV/g	0.5 mV/g
Useful frequency nom.	150 Hz	200 Hz	500 Hz	600 Hz	1200 Hz

Excitation: 15V, Weight: ½ gram without leads, Linearity: ± 1%,
5 other mounting styles available at no extra charge.

$389.00

Tiny but tough, EGC-500DS.

Guaranteed overrange of 1000%. And only a half inch cube to boot.

Static & dynamic measurements of acceleration, vibration and shock in ranges from 5 to 1,000 g. Fully damped to eliminate resonance and fitted with mechanical stops to impede overload response.

Typical ranges	± 5g	± 10g	± 50g	± 100g	± 500g
Sensitivity nom.	25 mV/g	20 mV/g	4 mV/g	2 mV/g	0.5 mV/g
Useful frequency	150 Hz	200 Hz	600 Hz	1000 Hz	1500 Hz

Excitation: 15V, Damping: 0.7 cr. nom., Linearity: ± 1%
Output impedance: 450 Ω nom., Input impedance: 1000 nom.
Size: 0.5" x 0.5" 0.6" width, 10-32UNF tapped hole

Entran Accelerometers.

(Today, miniature makes sense.)

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μS_/16	1.6	.25	12	13	14	15	—	6.4K
μS_/23	2.3	.25	13	14	15	16	17	

Features: Small Size • High Accuracy • Direct Digital Transducer • Absolute Whole Word Output • MIL Environments—Gun, Ship, Aircraft, Spacecraft (Vibration 20g, Shock 1000g, 0.8ms) • LED Illuminators • High Reliability.

Digisec® Encoders—RA series — RI series

Rotary Absolute Encoders

	Model	SIZE (Inches) O.D.	Shaft Diam.	Resolution (Quanta/Rev.) Binary (2^{xx})								BCD	
SOLID SHAFT	15	1.5	.187										
	23	2.3	.25	C 11	C 12	C 13	T 16	T 17	T 18	T 19	T 20		
	35	3.5	.375	C 12	C 13	C, S 14	C, S 15	C, S 16	C, S 17	S 18		S 3.6K	S 36K
THRU-HOLE		O.D.	I.D.										
	55	5.5	.75	S 16	S 17	S 18	S 19	S 20					
	60	6.0	2.25	S 16	S 17	S 18	S 19	S 20					
	100	10.0	2.75	S 16	S 17	S 18	S 19	S 20	S 21			S 36K	S 360K
	106	10.0	6.0	S 16	S 17	S 18	S 19	S 20	S 21			S 36K	S 360K
	117	11.0	7.0	S 19	S 20	S 21							
	158	15.0	8.0	S 20	S 21	S 22							

Rotary Incremental Encoders

	Model	Resolution (Quanta/Rev.) Binary (2^{xx})							Decimal														
SOLID SHAFT	15	C 8	C 9	C 10	C 11	C 12	C 13		C 0.5K	C 1.0K	C 1.8K	C 2.0K	C 3.6K	C 4.0K	C 5.0K	C 6.4K	C 8.0K						
	23																						
	35	C 13	C 14	C 15	C 16	C 17	C 18	C 19	C 20K	C 32K	C 36K	C 40K	C 50K	C 64K	C 72K	C 100K	C 128K	C 180K	C 200K	C 320K	C 360K	C 640K
THRU-HOLE	55	C 16	C 17	C 18	C 19	S 20																	
	60																						
	100	C 17	C 18	C 19	C 20	S 21			C 360K														
	106	C 17	C 18	C 19	C 20	S 21			C 360K														
	117																						
	158	C 20	C 21	S 22																			

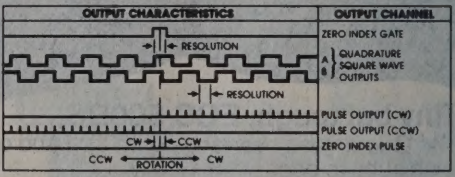
OD—Outside Diameter **ID**—Inside Diameter **C**—Self-contained Electronics **S**—Separate electronic enclosure **T**—2 speed geared paired configurations

Features: • Parallel whole word unambiguous output • T TL/DTL compatible • Resolution to 0.31 arc-seconds (22 bits) • Highest accuracies available anywhere • Operating temperature −40° to +71°C • Military Specification rated • Instant on-the-fly readout • LED light sources • Separate Electronics—no electronics in optical unit (thru-hole systems)

Available Options: • Serial readout • Line driver output • Redundancy • Chrome slit and disc (standard on size 23 and size 158) • Binary lamp display • Subtractor card for electronic zeroing

Features: • Quadrature square wave or pulse output, zero index • T TL/DTL compatible • Resolution to 0.31 arc-seconds (22 bits) • Self-contained electronics • Operating temperature −40° to +71°C • Military Specification rated • LED light sources

Available Options: • Line driver output • Pigtail cable • Square wave or pulse output



Environmental Ratings. All DIGISEC® encoders are designed to meet rigid military specifications. The following environmental specifications are typical. Temperature: −40° to +71°C Vibration: 10-20g Humidity: 0 to 98% Shock: 50g, 11 milliseconds (higher on solid shaft models)

Spacecraft Encoders: Absolute & Incremental

Model	Type	Diam. (Inches)	Resolution (Quanta/Rev.)	Accuracy	Weight (lbs.)	Power (watts)	Features
RA21/1510	Absolute	15.0	2^{21}	2.6 sec	20.0	3.0	10 Inch Thru-hole Electrical Redundancy.
RA18/60	Absolute	6.0	2^{18}	10.0 sec	8.5	3.0	Elect. & Mech. Redundancy.
RI13/35	Incremental	3.5	2^{13}	2.6 min	3.0	2.0	Commutator Outputs.
RI20/63	Incremental	6.3	2^{20}	1.5 sec	1.7	0.5	Unhoused. Commutator Outputs.
RI36K/40	Incremental	4.0	36,000	2.5 sec	3.0	0.3	Electrical Redundancy.
RI14.4K/23	Incremental	2.3	14,000	1.5 min	.75	0.4	Commutator Outputs.

Features: LED Illuminators • Resolution to 0.31 Arc Seconds (22 Bits) • Highest Accuracy Available Anywhere. Available with bearings (housed) or without (unhoused).

Specifications subject to change without notice.

Litton
ITEK MEASUREMENT SYSTEMS
27 Christina Street, Newton, Massachusetts 02161
Telephone: 617-969-7300 TWX: 710-335-6783

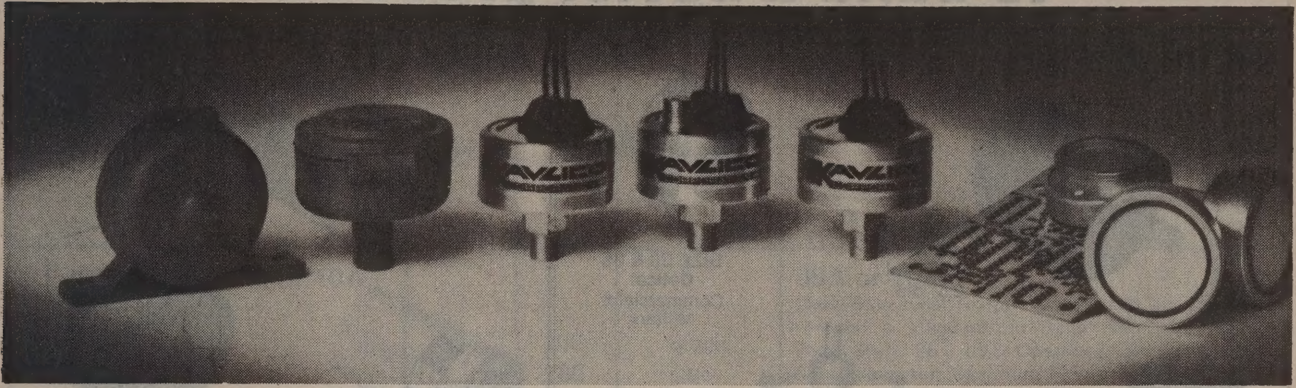
Write or call Dept. G

For More Information. Circle No. 436

KAVLICO CORPORATION

PRESSURE TRANSDUCERS

20869 PLUMMER ST. CHATSWORTH 91311 **818 882-2400**
FAX 818 998-2050



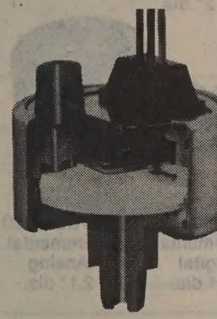
Providing excellent performance at minimum cost, the P600 Series is intended for custom, OEM pressure measurement applications. This series features exceptional repeatability, low hystreresis, accurate operation over a broad temperature range, and the ability to perform without zero shift when subjected to high overpressures. These characteristics, combined with long term stability, make the series ideal for microprocessor-based applications.

Key to the uniform performance and low cost features of this series is Kavlico's patented ceramic sensing element with its integral signal conditioning that employs a reliable solid state, custom hybrid circuit. Temperature compensation and calibration is provided through use of computer-controlled laser trimming of hybrid circuit components. As a result, uniformity from unit-to-unit is assured and there is no need for adjustment or recalibration by the user. In addition, the P600 Series maintains repeatable performances even after extraordinary overpressures, which has been demonstrated in over five years of automotive service.

The P600 Series provides a high level output voltage, permitting it to interface easily with a variety of circuits, indicators, or alarms. In addition, its ratiometric output is ideal for digital monitoring. By using the supply voltage as the reference for the conversion circuit, measurement accuracy is maintained regardless of supply voltage variations.

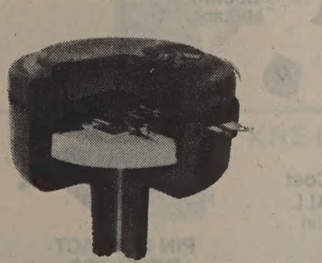
The P600 series provides a choice of rugged die cast aluminum or high dielectric strength Valox housing. Seal materials are available to meet a variety of applications. In electrically noisy environments, reliability and performance are assured with protection against electromagnetic interference (EMI) and line voltage transients as a standard feature on most models.

DIE CAST ALUMINUM



⅛ NPT, ¼ NPT AND TUBE FITTING AVAILABLE

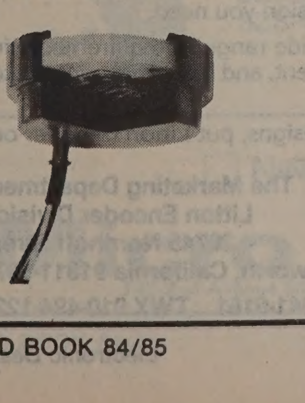
@STANDARD, V$_S$ = 9VDC	P655			P656, P657			P657			
PARAMETER	0-5 THRU 0-500 PSI			±10" H_2O THRU ±15 PSID			0-.5, 0-1 PSI6			
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
FULL SCALE OUTPUT	5.92	5.96-6.04	6.08	5.9	5.95-6.05	6.1	5.9	5.95-6.05	6.1	VDC
NULL OFFSET	1.92	1.96-2.04	2.08	3.9	3.95-4.05	4.1	1.9	1.95-2.05	2.1	VDC
SPAN*	3.84	3.96-2.04	4.16	1.8	1.9-2.1	2.2	3.8	3.9: -4/	4.2	VDC
LINEARITY (BEST FIT)		±0.3	±0.5		±0.3	±0.3		%SPAN		
HYSTERESIS		±0.003	±0.01		±0.003	±0.01		±0.003	± .01	%SPAN
REPEATABILITY		±0.005	±0.05		±0.005	±0.05		±0.005	± .05	%SPAN
TEMPERATURE										%SPAN
NULL −30° to +100°C		±1.6	±3.0							
SPAN −30° to +100°C		±1.0	±1.5							
NULL −10° to +80°C					±1.6	±3.0		±1.6	±3.0	
SPAN −10° to +80°C					±1.0	±1.5		±1.0	±1.5	
STABILITY (1 YEAR)		±1.0			±1.0					%SPAN
SUPPLY VOLTAGE (V$_S$)**	7.5		15	7.5		15	7.5	8	15	VDC
SUPPLY CURRENT (QUIESCENT) 10K Load		8	15		8	15			15	MA
EMI-STANDARD ALL MODELS CHANGE IN OUTPUT DUE TO RF FIELD OF 200V/M 10KHz TO1GHz		±0.2	±1.0		±0.2	±1.0		±.2	±1.0	VDC



¼ NPT AND TUBE FITTING AVAILABLE

@STANDARD, V$_S$ = 9VDC	P650 - P652			P651 - P652			P651			
PARAMETER	0-.5 THRU 0-150 PSI			±10" H_2O THRU ±15 PSID			0-5 THRU 0-15 PSI0			
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
FULL SCALE OUTPUT	5.9	5.94-6.06	6.1	5.9	5.92-6.08	6.1	5.9	5.92-6.08	6.1	VDC
NULL OFFSET	1.9	1.94-2.06	2.1	3.9	3.92-4.08	4.1	2.35	2.4-2.5	2.7	VDC
SPAN*	3.8	3.94-4.06	4.2	1.8	1.84-2.16	2.2	3.3	3.32-3.68	3.75	VDC
LINEARITY (BEST FIT)		±0.3	±0.5		±0.3	±0.5		±0.3	±0.5	%SPAN
HYSTERESIS		±0.003	±0.01		±0.003	±0.01		±0.003	±0.01	%SPAN
REPEATABILITY		±0.005	±0.05		±0.005	±0.05		±0.005	±0.05	%SPAN
TEMPERATURE										%SPAN
NULL −30° to +100°C } P650		±1.6	±3.0		±1.6	±0.3		±1.6	±0.3	
SPAN −30° to +100°C		±1.0	±1.6		±1.0	±1.5		±1.0	±1.5	
NULL −10° to +60°C } P652		±1.6	±3.0		±1.6	±3.0				
SPAN −10° to +60°C		±1.0	±1.5		±1.0	±1.5				
STABILITY (1 year)		±1.0			±1.0			±1.0		%SPAN
SUPPLY VOLTAGE (V$_S$)**	7.5		15	7.5		15	7.5		15	VDC
SUPPLY CURRENT (QUIESCENT) 10K Load		8	15		8	15		8	15	MA

OEM MODULE



@STANDARD V$_S$ = 9VDC	PRESSURE RANGE (Custom Ranges Available)									
PARAMETER	±1. ±5 PSID			0-1. 5. 0-15 PSID			0-1 PSIG. 0-5 0-15			
	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
FULL SCALE OUTPUT (POS PRESS.)	5.9	5.92-6.08	6.1	5.9	5.92-6.08	6.1	5.9	5.92-6.08	6.1	VDC
NULL OFFSET	3.9	3.92-4.08	4.1	2.35	2.4-2.6	2.7	1.9	1.92-2.08	2.1	VDC
SPAN*	1.8	1.84-2.16	2.2	3.2	3.32-3.68	3.75	3.8	3.84-4.16	4.2	VDC
LINEARITY (BEST FIT)		±0.3	±0.5		±0.3	±0.5		0.3	±0.5	%SPAN
HYSTERESIS		±0.003	±0.01		±0.003	±0.01		±0.003	±0.01	%SPAN
REPEATABILTITY		±0.005	±0.05		±0.005	±0.05		±0.005	±0.05	
TEMPERATURE ERROR										
NULL −30° to +100°C		±1.6	±3.0		±1.6	±3.0		±1.6	±3.0	%SPAN
SPAN −30° to +100°C		±1.0	±1.5		±1.0	±1.5		±1.0	±1.5	%SPAN
STABILITY (1 year)		±1.0			±1.0			±1.0		%SPAN
SUPPLY VOLTAGE (V$_S$)**	7.5		15	7.5		15	7.5		15	VDC
SUPPLY CURRENT (QUIESCENT) 10K Load		8	15		8	15		8	15	MA

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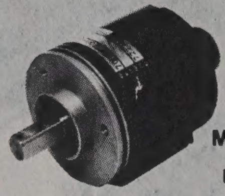
From robotics, computers, and machine tools to aerospace . . .

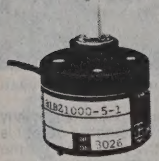
Use the Litton Encoder lineup to build a better product.

INCREMENTAL

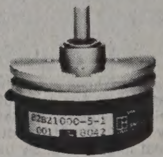


MODEL 70
Optical
Industrial
2.5″ dia.

SIZE 23 & 35
Optical
Commercial &
Military

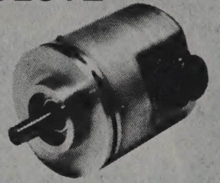


MODEL 81
Low Cost
1.5″ dia.



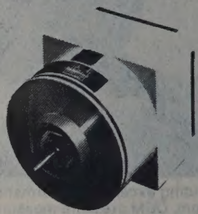
MODEL 82
Low Cost
2.2″ dia.

ABSOLUTE



MODEL 76
Low Cost Optical
2.5″ dia.

SIZE 23 & 35
Optical
Commercial &
Military



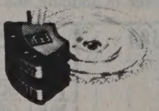
Multi-Turn
Heavy Duty
4.3″ dia.

ABSOLUTE / INCREMENTAL

SIZE 60
6″ dia.

SIZE 11
Pin Contact

MODULAR



Absolute
Optical
2″ dia.

MODEL 715
Incremental
Optical
1.5″ dia.

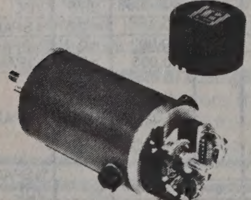
MODEL 720
Incremental
Optical
2″ dia.

New!

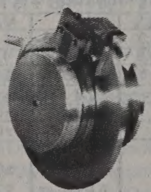
MODEL 820
Incremental
Digital
2.1″ dia.

MODEL 920
Incremental
Analog
2.1″ dia.

MOTOR/ ENCODER PACKAGE



SPECIALS / CUSTOM DESIGN



Aerospace

TRACKBALL
Commercial &
Military
4″ sq.

Absolute
Military

New Low Cost
TRACKBALL
Commercial
3″ sq.
RS232 Interface
Option

PIN CONTACT
DETENTED
SWITCH

The Litton Encoder team leads the way with encoders and special products that help you build more reliable, higher quality, cost-effective products with the precision you need.

Our product lineup is the broadest in the industry and meets a wide range of requirements in applications from robotics, computer peripherals, medical equipment, and industrial controls to specialized, high-reliability designs for aerospace and defense.

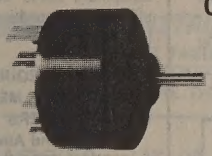
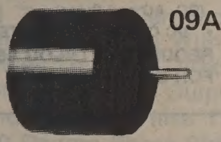
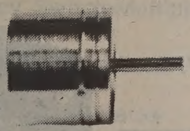
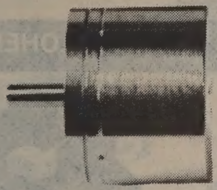
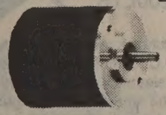
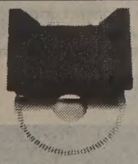
For anything from simple modular kits to sophisticated custom designs, put Litton Encoder on *your* design team. For complete data and specifications, contact —

The Marketing Department
Litton Encoder Division
20745 Nordhoff Street
Chatsworth, California 91311-5979
Telephone (818) 341-6161 TWX 910-494-1229

Litton
ENCODER DIVISION

For More Information. Circle No. 438

OPTICAL SHAFT ENCODERS

	Diameter (mm)	Resolutions (Cycles/Rev.)	Output Channels	FEATURES
01A 	22	15	Dual	**01A** High Precision. LED Operating Current: 5-20mA. Phototransistor Maximum Power Dissipation: 50 mW. Maximum Frequency approx.: 10 KHz (40,000 RPM). Signal Phase Shift: 120°. Output Wave Shape: Incremental Quasi-Sinusoidal. Available fitted to our Faulhaber Motors.
09A or 10A 	22	100 180	Single Dual	**09A or 10A** Quasi-Sinusoidal Output Signals can be interfaced through a standardized 6-pin connector. Signal Phase Shift: 90°. LED Operating Current: 50 mA. Phototransistor Maximum Power Dissipation: 100 mW. Available fitted to our Faulhaber Motors.
012H 	12	50 90 125	Dual	**012H** Our smallest, custom and thru-shaft versions available. Factory equipped leads and double-shielded dual ball bearing construction standard. Compact P.C. Board mountable, weighs 0.26 oz. Optional Squaring Circuit available. Speeds up to 8,000 RPM. Signal Phase Shift: 90°. Standard Output Wave Shape: Incremental Quasi-Sinusoidal. LED Operating Current: 40 mA. Max. Phototransistor Maximum Power Dissipation: 75 mW.
018H 	18	100 200 300 360	Dual with Indexing	**018H** Rugged construction. Custom and thru-shaft versions available. Same as our 012H. Optional Built-in Squaring Circuit TTL compatible. Speeds up to 8,000 RPM. Signal Phase Shift: 90°. Output Wave Shape: Incremental Quasi-Sinusoidal. LED Operating Current: 40 mA. Max. Phototransistor Maximum Power Dissipation: 75 mW.
E-3030 	30	100 200	Dual with Indexing	**E-3030** Encoder with Standard Square-Wave Output. Amplifier built-in, with Standard 7½" flexible cable. Power Supply Voltage: 5VDC ± 5% at 80 mA. Max. Supply Current. Signal Phase Shift: 90°. Maximum Operating Frequency: 20 kHz.
KRE-01 	NA	100	Dual with Indexing	**KRE-01** Easy installation. Modular Unit consists of Encoded Disk and separate Sensor Module. Output Wave Shape: Quasi-Sinusoidal. Signal Phase Shift: 90°. Operating Frequency: 20 kHz. Power Dissipation: 60 mA. Max.
SZS-1 **SZS-3** **SZS-4**	20 50 70	100 to 4000	Dual with Indexing	**SZS-1-3-4** General purpose high resolution. Signal Phase Shift: 90°. Operating Current to 100 mA. Max. Speeds up to 5,000 RPM. TTL, Square Wave Output. Channel Output Options: a/Clockwise, B/CCW or A, B, C/Direction.

☐ New Item - Rotary Hall Effect Encoders Available.

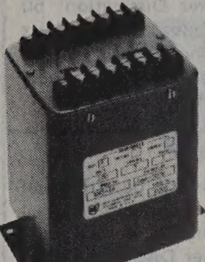
Micro Mo ELECTRONICS INC.
742-2nd Avenue South / St. Petersburg, Florida 33701 / Phone: 813/822-2529 / Telex: 807-982

TRANSDUCERS, WATT, CURRENT, VOLTAGE

A.C. WATT TRANSDUCERS (102 STANDARD 60 Hz MODELS AVAILABLE)

OSI Watt Transducers provide an isolated D.C. output proportional to the true power (E1 × Cos θ) consumed in single or three phase circuits. Their fast response makes them very useful on non-sinusoidal as well as sinusoidal waveforms.

Outputs of millivolts, milliamperes or volts are available, offering flexibility to the designer in interfacing to control or metering systems.



MODEL	NOMINAL VOLTAGE	NOMINAL CURRENT	NO. OF PHASES	NO. OF WIRES	F.S. POWER	F.S. OUTPUT	ACCURACY ±%
PC5-1B	120V	5A	1	2	500W	1mA	0.5
PC5-29B	240V	50A	1	2	10KW	1mA	0.5
PC5-48B	480V	2KA	1	2	800KW	1mA	0.5
PC5-4B	120V	5A	3	3	1KW	1mA	0.5
PC5-15B	480V	10A	3	3	8KW	1mA	0.5
PC5-7B	120A	5A	3	4	1.5KW	1mA	0.5

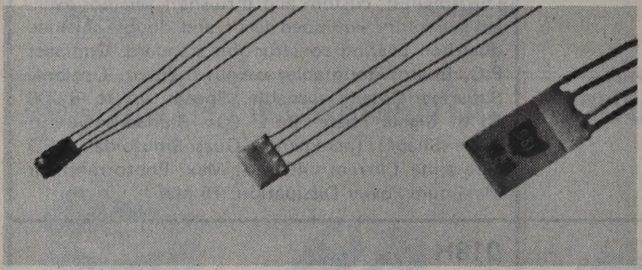
RELATED EQUIPMENT

Equipment items are available utilizing the transducers listed on this page.

- **Q.A. TEST EQUIPMENT**
- **WATT-HOUR METERS**
- **WATT METERS (DC, AC and Audio)**
- **MOTOR TEST PANELS**
- **POWER MONITORS (DC, AC and Pulse)**
- **DC CLAMP ON AMMETERS**

REQUEST CATALOG 983 FOR SPECIFICATIONS

HALLTRON MAGNETIC FIELD SENSORS



OSI offers a wide variety of standard Hall Effect probes for magnetic sensing of measuring applications. The high linearity, low noise, excellent stability and ruggedness permit optimum use in your most critical applications. Reliability has been proved by years of continuous operation in industrial and military systems. Large quantity production enables OSI to offer high quality units at attractive prices.

MODEL	SENSITIVITY V/A Kg (Nominal)	CONTROL CURRENT mA (Nominal)	TEMPERATURE COEFFICIENT OF OUTPUT %°C (Avg.)	DIMENSIONS IN INCHES (L x W x T)
HP325	0.8	25	−0.2	.187 × .075 × .020
HR36	0.1	350	−0.1	.500 × .375 × .025
HR66	0.4	200	−0.15	.200 × .250 × .028
HR70	0.17	200	−0.12	.200 × .250 × .028
HR72	0.7	100	−0.2	.200 × .200 × .028

VOLTAGE AND CURRENT TRANSDUCERS

CURRENT TRANSDUCER

OSI Voltage and Current Transducers provide an isolated d.c. output for 50 to 500 Hertz inputs. Models with other voltage and current inputs are available. Output signal of up to 10 Volts (1 mA × 10 K Ohms) is ideal for metering and control circuitry.

TRUE RMS UNITS ARE AVAILABLE

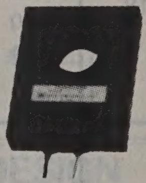
MODEL	F.S. INPUT	F.S. OUTPUT	ACCURACY
VT120	150V	1mA	0.5% F.S.
CT5-1	5A	1mA	0.5% F.S.
CT10-1E	10A	4 to 20mA	0.5% F.S.

D.C. WATT TRANSDUCER

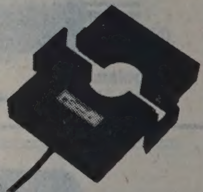
OSI d.c. watt transducers provide a d.c. output proportional to power delivered to a load by d.c. low frequency a.c. chopped waveform a.c., or non-symmetrical a.c. inputs.

MODEL	NOMINAL VOLTAGE	NOMINAL CURRENT	F.S. POWER	F.S. OUTPUT
PC8-3-01	120V	100A	10KW	0-1mA
PC8-4-06	220	1000A	100KW	0-1mA

CURRENT TRANSDUCERS D.C. TO KILOHERTZ



MODEL CT200L



MODEL CT200LTS

These current transducers provide flat d.c. to Kilohertz response which allows accurate waveform monitoring and measurements of D.C., sinusoidal or distorted waveform currents with high accuracy. Since no physical or electrical connection is necessary to the circuti being monitored, they are especially useful where high voltages are present by providing an output which is electrically isolated from the current source.

Models with better than 1% linearity and temperature effects less than 1% are stock items in current ranges to 8000 Amps. Special units for higher currents or split-core configurations can be supplied for specific requirements Auxiliary amplifier-power supply units are available to provide 10 Volt output when desired instead of 50 millivolt output of transducer alone.

CT-L SERIES SPECIFICATIONS FOR STANDARD MODELS

MODEL	ENCLOSED CURRENT AMPS	EXCITATION CURRENT ma (nom)	OUTPUT mV. (typ.)	TEMP. LINEARITY %f.s.	TEMP. EFFECT ON OUTPUT	RANGE °C
CT50LT	50rms	100	20	0.5	±1%	−40 +65
CT100LTT	100rms	100	50	0.5	±1%	0 +40
CT100LT	100rms	100	50	0.5	±1%	−40 +65
CT200LT	100rms	100	50	0.5	±1%	−40 +65
CT600LT	600rms	100	50	0.5	±1%	−40 +65
CT2KLTT	2000rms	200	100	0.5	±1%	0 +40
CT8KLTT	8000 Peak	200	75	1	±1%	0 +40

OHIO SEMITRONICS, INC.

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Phone 614/486-9561
Columbus, Ohio 43212
TWX 810/482-1630

CURSOR CONTROLS
For Interactive Man-Machine Displays Military or Commercial Models

ORBIT INSTRUMENT CORP.

CORPORATE FACILITIES:
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6431 GLOBAL DRIVE, CYPRESS, CA 90630, TELEPHONE: (714) 527-0561

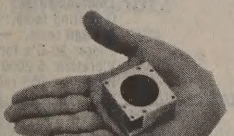
BALL TRACKERS — 1″, 2″, 2.5″, 3″ SIZES

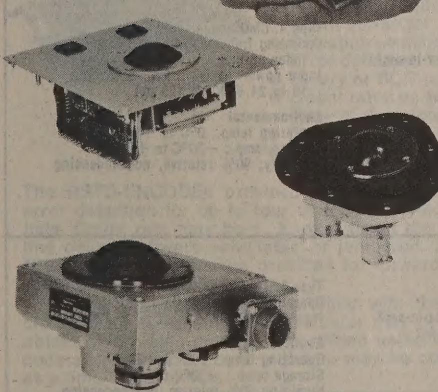
Ball Trackers Can Include Output Interfacing Cards With . . .

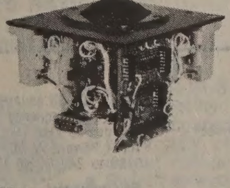
- Pulse Train and Direction Outputs
- Binary Counter Outputs
- Independent Pulse Train Outputs
- 90 Degree Phase Shifted Outputs
- Differential Line Drivers
- Anti Dither and Hystersis Networks
- Frequency Switch-Multiplier Networks

RS-232-C Interface Micro Boards Featuring

- Selectable Baud Rates
- Custom Protocals Can Be Furnished







BALL TRACKER SYSTEMS
ORBIT

CALL OR WRITE FOR OUR 20 PAGE CATALOG

BALL TRACKER SYSTEMS

Orbit Part No.	Approx. Dimensions			Unit Connector	Nature of Pulses	Pulses/ Revolution	Push Button	General Remarks
	L	W	D					
BALL TRACKERS — 2-INCH DIAMETER BALL								
OPTICAL ENCODER — LAMPS								
55713**	3.00	3.80	4.90	Direct to Board	Square	120 ±10%	–	
55749*°†	6.94	6.31	3.31	348-40E14-37P1	Square	256-275	5 P.B.	Single Ended Line Driver
55751‡	3.95	3.61	3.00	MM-11-22PGDSLB	4 Ind. Pulse Trains	480 ±10%	–	Pulses Approximately 40 µs Wide +, −Dir. "X", +, −Dir. "Y"
55782*°†	6.50	6.50	2.70	MRAC-34P-G7	Square	256-275	2 P.B.	With 10 Bit Up-Down Counter
55784*°†	4.30	3.80	3.00	MS18174-1	Square	64	–	
55795*°†	4.12	6.12	2.30	DAMM-15P	Square	256-275	2 P.B.	
55800*°	5.00	4.80	3.12	Direct Wire	Square	200 ±20	–	Single Axis
55829*°†	4.12	5.60	2.30	65692-007	Square	256-275	2 P.B.	Single Ended Line Driver
OPTICAL ENCODER — L.E.D.								
55815*°†	4.30	3.86	3.00	MS18174-1	Square	64	–	
55832†	3.50	3.50	2.06	MS24308/8-1	4 Ind. Pulse Trains	267 ±10%	–	+, −Direct Pulse Lines Per Axis/Pulse 40 µs
55847**†‡	3.59	3.61	2.31	WTB-20PCSY	Square	384 ±10%	2 P.B.	
BRUSH ENCODER								
57147	3.80	3.80	5.50	MS3116E 22-55P	Square	1 Rev. of Ball = 2 Revs. Comp.	2 P.B.	12-Bit V-Scan Binary
POTENTIOMETER								
55752	5.00	4.88	2.70	Direct to Pot	Linear	1 Rev. of Ball = 1.5 Revs. of Pot	–	10 Turn, 5000 Ohm
BALL TRACKERS — 2½-INCH DIAMETER BALL								
OPTICAL ENCODER — LAMPS								
55731**	4.50	5.25	2.90	Screw Term.	Square	2048 ±10%	–	4 Revolutions of Encoder
BRUSH ENCODER								
55728	5.75	5.75	3.25	DAMM-15P	4 Phase	100 NOM	3 P.B.	1 Rev. of Ball = 1.87 Rev. Component Size 23 Encoder
55831	6.40	5.60	2.70	88023-1	4 Phase 4 Pulse	115 ±15P	4 P.B.	Each Track Has 32 "On" Segments In 360°
55841	4.50	4.00	2.70	MS3112E14-19PX	4 Phase	115 ±15P	–	86-128 Pulses/Channel
57400	4.50	4.50	2.87	MS3112E14-19PX	4 Phase 4 Pulse	115 ±15P	–	1 Rev. of Ball = 1.76 Revs. of Component
POTENTIOMETER Tracking Ratio Ball to Pot = 1:2; 1.5 Rev. of Ball = 1 Rev. of Pot								
55753	4.50	4.50	3.00	Direct to Pot	Linear		–	Single Turn of Pot = 2000 Ohms ±5%
55760	4.50	4.50	4.25	Direct to Pot	Linear		–	Pot, Clutch Spring Center
MAGNETIC ENCODER								
55720	5.75	5.75	2.90	MS3112E14-19PV	4 Phase	100 NOM	3 P.B.	1 Rev. Ball = 1.87 Rev. Component ±10%, Size 23 Encoder
57025	4.50	4.50	2.90	Dir. to Encoder	4 Phase	240	–	3 Revolutions of Encoder
BALL TRACKERS — 3-INCH DIAMETER BALL								
OPTICAL ENCODER — LAMPS								
55743**	6.30	6.30	3.20	MRAC-14PG7	Square	512-580	1 P.B.	With or Without Adjustment Pots
55778**†	5.00	5.00	3.19	M28748/3-C00F 2A	Square	512-580	–	Differential Line Drives
55817*°†‡	6.19	9.00	3.50	M28748/3-D00F 2A	Square	512-580	2 or 4 P.B.	100,000 MTFB MIL-STD-810B
55826**	4.91	4.29	3.65	P.C. Board Terms	Square	512-580	–	Pot Adjustable 75,000 Hour MTBF
55845**	6.20	7.20	3.53		Square	512-580	2 P.B.	With or Without Swivel Caster Ball Support
OPTICAL ENCODER — L.E.D.								
55848**†‡	4.29	4.91	3.09	MS18268-2	Square	288 ±25P	–	Differential Line Driver Airborne Qualified
BRUSH ENCODER								
55712	7.60	7.40	3.30	MRAC-20-PGV	4 Phase	262 ±5%	2 P.B.	4 Brushes Common Output
55714	7.90	7.90	3.20	Terminal Block	4 Phase	6-7 Revs. = 2048P	–	4 Brushes Common Output
55719	6.00	5.00	3.30	MS3112E14-19PX	4 Phase	250-350	–	4 Brushes Common Output
SYNCHRO ENCODER								
55727	6.60	5.20	3.30	MS3112E14-19PX	–	1 Rev. of Ball = 1.64 Revs. ±10%	–	3 Wire Synchro Output
POTENTIOMETER								
55715	7.90	7.90	3.75	Terminal Block	Linear	6-7 Revs. of Ball = 1 Rev. of Pot	–	500 Ohms, 10 Turn Pot

* SINGLE PULSE ** 2-90° PULSES ° DIRECTION CODE
† HYSTERESIS ‡ ANTIDITHER

For More Information. Circle No. 441

RENCO

RENCO CORPORATION

DIVISION OF ELECTRO-CRAFT CORPORATION
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RENCO RETURNS TO INDUSTRIAL AUTOMATION.

We have been a major supplier of optical encoders to the machine tool and computer peripheral market since 1968. With the need for cost reductions through industrial automation, Renco supports this emerging industry with its complete line of state-of-the-art encoders.

Our research and engineering departments are second to none, and over the years have consistently found and developed innovative ways to apply new technologies to encoder design and manufacturing processes. Today, Renco encoders incorporate solid state electronics, LED light sources, and our own Radial-line sensor array to improve performance and reliability.

Watch us as we expand our product lines to incorporate interface electronics for industrial robotics and other position and velocity control systems to meet the challenges of industrial automation.

CNC + PC COMPATIBLE ENCODERS IMMEDIATE DELIVERY PROGRAM

Renco is meeting the challenge of industrial automation by offering CNC + PC compatible encoders and fast delivery. Various TTL, CMOS, and Line Driver models are available from our 48-hour or maximum of two weeks delivery programs. Consult our order desk or application engineers for availability information or assistance in selecting encoders compatible with your CNC or Programmable Controller.

INCREMENTAL

HEAVY DUTY INDUSTRIAL ENCODER *HDR70*

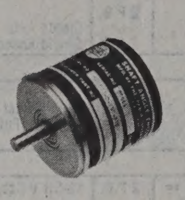
2.5 inch cast aluminum housing
Flange or servo mount
Direction sensing logic
Resolution to 5000 PPR
LED
Radial-line sensor array
Optional gated index
Phase quadrature 90° ± 36°

SPECIFICATIONS

Mechanical
Moment of inertia: 4.0×10^{-4} oz-in-sec^2 maximum
Shaft loading: Radial 35 lbs. max.; axial 40 lbs. max.
Slew speed: 5000 RPM STD. (10,000 special)
Weight: 20 oz.

Electrical
Output: TTL or CMOS
Operating frequency: Data 75 kHz, Index 20 kHz
Input power: 5V, 12V, 15V and 24V @ 125 mA
Light source: LED
Useful life: 100,000 hours min.
MTBF: 41,000 hours

Environmental
Operating temp.: 0°C to +70°C
Storage temp.: −25°C to +90°C
Humidity: 98% relative, noncondensing
Shock: 50 G's for 11 milliseconds
Vibration: 5-2000 Hz @ 20 G's



INCREMENTAL SHAFT ENCODER *R2520*

2.5 inch servo housed
LED
Radial-line sensor array
Resolution to 5000 PPR
Phase quadrature 90° ± 36°

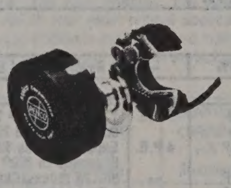
SPECIFICATIONS

Mechanical
Shaft size: ¼ or ⅜ inch diameter available
Moment of inertia: 5×10^{-4} oz-in-sec^2 max.
Shaft loading: Radial 15 lbs. max.; axial 15 lbs. max.
Slew speed: 5000 RPM max.
Weight: 7 oz.

Electrical
Type 1. Differential sine wave
Type 2. Amplified sine wave
Type 3. TTL square wave
Type 4. CMOS square wave
Operating frequency: Data to 60 kHz, Index 20 kHz
Input power: 5V, 12V, ±15V and 24V @ 125 mA
Useful life: 100,000 hours
MTBF: 41,000 hours

Environmental
Operating temp.: 0°C to +60°C
Storage temp.: −25°C to +90°C
Shock: 20 G's for 11 milliseconds
Vibration: 5-2000 Hz @ 10 G's
Humidity: 95° relative, noncondensing

MODULAR



MODULAR OPTICAL ENCODER *R80*

2 inch
Modular kit
Synthetic base material
LED
Radial-line sensor array
Optional index
Phase quadrature: 90° ± 36°

SPECIFICATIONS

Mechanical
Height: .84 inches
Moment of inertia: 1.5×10^{-4} oz-in-sec^2
Resolution: Up to 5000 counts
Slew speed: 9000 RPM max.

Electrical
Type 1. Differential sine wave
Type 2. Amplified sine wave
Type 3. TTL square wave
Type 4. CMOS square wave
Operating frequency: Data 50 kHz; Index 20 kHz
Input power: 5V DC ±5%, ±15V DC; 10 to 24 V DC @ 125 mA

Environmental
Operating temp.: 0°C to +70°C
Storage temp.: −30°C to +90°C
Humidity: 90% relative, noncondensing

HIGH PERFORMANCE MODULAR ENCODER *R1500*

1.5 inch
Factory aligned modular kit
Metal base
LED
Radial-line sensor array
Phase Quadrature 90° ± 18°; optional ±9° available

SPECIFICATIONS

Mechanical
Height: .75 inches
Moment of inertia: 3.0×10^{-5} oz-in-sec^2
Resolution: Up to 1250 counts per revolution
Slew speed: 9000 RPM max.

Electrical
Type 1. Differential sine wave
Type 3. TTL square wave
Operating frequency: Data to 75 kHz
Input voltage: 5V DC ±5% @ 125 mA

Environmental
Operating temp.: 0°C to +60°C
Storage temp.: −30°C to +90°C
Humidity: 90% relative, noncondensing

HIGH PERFORMANCE MODULAR ENCODER *R2000*

2 inch
Factory aligned modular kit
Metal base
Radial-line sensor array
LED
Optional gated index
Phase quadrature: 90° ± 18°

SPECIFICATIONS

Mechanical
Height: .80 inches
Moment of inertia: 1.5×10^{-4} oz-in-sec^2
Resolution: Up to 1500 counts per revolution
Slew speed: 9000 RPM max.

Electrical
Type 1. Differential sine wave
Type 2. Amplified zero crossing sine wave
Type 3. TTL square wave
Type 4. CMOS square wave
Operating frequency: Data 50 kHz; Index 25 kHz
Input Power: 5V DC ±5%; ±15V DC; 10 to 24V DC @ 125 mA

Environmental
Operating temp.: 0°C to +60°C
Storage temp: −30°C to +90°C
Humidity: 90% relative, noncondensing

PANEL

FRONT PANEL ENCODER *RFP*

1.5 inch
Potentiometric mounting
Built-in shaft tension
Phase Quadrature 90° ± 45°
Card-edge, Cable or PC Board Header Interconnect
Designed to replace Potentiometers and A to D Converters

SPECIFICATIONS

Mechanical
Shaft torque: 2 ± 1 oz. in.
Mounting bushing: ⅜ x 32 UNEF

Electrical
Input voltage: 5V, +12V, or +15V @ <40 mA
Output: TTL or CMOS compatible square wave, 2 channel phase quadrature 90° ± 45°

Environmental
Operating temp.: 0°C to +70°C
Storage temp.: −40°C to +70°C
Humidity: 90% relative, noncondensing

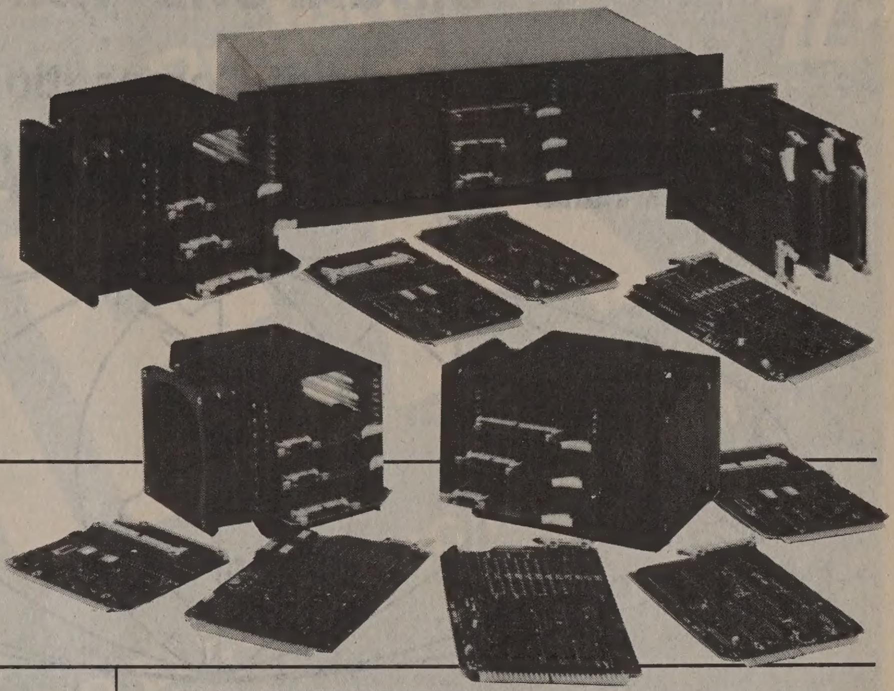
For More Information. Circle No. 442

RENCO CORPORATION

DIVISION OF ELECTRO-CRAFT CORPORATION

26 COROMAR DRIVE, GOLETA, CA 93117 • (805) 968-1525 TWX 910-334-1180

STD BUS MODULES FOR INDUSTRIAL AUTOMATION



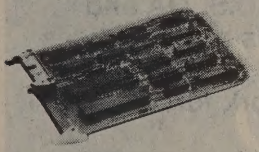
The STD BUS is used by over 100 card manufacturers to standardize the physical and electrical aspects of 8-bit microprocessor systems. The bus is dedicated to internal communications; all external communications are through I/O interface connectors on the outer edge of the card. The STD BUS is used for both independent devices and as an I/O subsystem for larger computers.

Ideally suited for factory automation in many industries, benefits provided by the STD BUS include:

- Modularity by function and physical specification
- Card slot independence
- Separate buses for power, data address and control signal

Renco Corporation offers the industrial automation engineer a wide selection of STD BUS card modules and accessories which include: Quad 12-bit digital-to-analog convertors; Quad TTL encoder interface; communications interface with IEEE-488, RS-232 and parallel I/O; intelligent servo control. Additional motion control related modules and systems are soon to be released.

STD BUS SERIES RSTD-ENCODE4 QUAD ENCODER INPUT



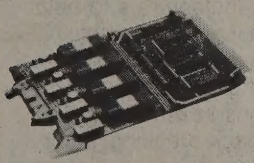
FEATURES

- Full STD BUS compatibility
- Four 16-bit or two 32-bit counters
- X1, X2, or X4 encoder count multiplier
- Direction sensing
- Error detection
- Binary or BCD counting
- Count rates up to 2 MHz
- Time of day clock option
- 5 volt operation
- Switch selectable addressing

The RSTD-ENCODE4 provides direction sensing and error detection for up to four quadrature encoder signals. Count rate may be 1, 2, or 4 times the encoder line count, software selectable or jumpered. Separate 16-bit count registers are provided for forward and reverse counts of each encoder.

TTL input signals may be strobed with the system clock, or an optional crystal oscillator may be used to obtain clock rates up to 5 MHz. When using three encoders, the unused count registers may be configured as a time of day clock.

STD BUS SERIES RSTD-DAC4 QUAD DIGITAL TO ANALOG CONVERTER

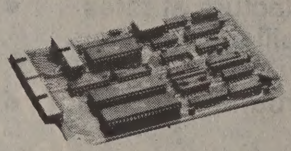


FEATURES

- Full STD BUS compatibility
- 12-bit accuracy
- ±10V, ±5V, or 0-10V output voltage range
- Switch selectable addressing
- Memory mapped, or I/O select
- 3 x 10^{-6} sec settling time
- 13 x 10^{+6} volt/sec slew rate

The Renco RSTD-DAC4 board provides four independent analog control signal outputs each with a range of ±10 volts, ±5 volts, or 0 to 10 volts at the user's option. Command word is 12 bits. Switch selectable addressing. Optional use of IORQ, MEMEX, IOEXP, or MEMRQ. Timing is user selectable for Z80, 8085, 6800, or 6809 microprocessors. The unit is assembled on a single STD BUS compatible card. The analog outputs are presented through a 20 pin IDC connector at the front of the card.

STD BUS SERIES RSTD-COM IEEE-488, RS-232, 16 BIT PARALLEL, TIMER

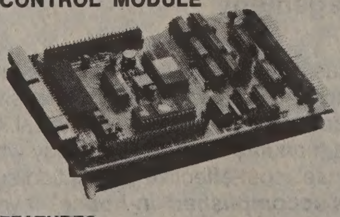


FEATURES

- IEEE-488
  Listener/Talker/Controller
  8-bit address switch port
  6809 assembly language
  Utilities
- RS-232 ACIA
  Programmable 50-19, 200 baud
- VIA
  16-bit parallel I/O
  Two timers
  Serial port
- SWITCH SELECTABLE BOARD ADDRESS
  8- or 16-bit address, MEM or IOREQ

One economical communications card handles multiple I/O tasks for STD BUS systems. T.I. TMS9914 IEEE-488 interface handles listener, talker and controller functions. Assembly language 488 utilities for 6809 are provided as programming examples. An 8-bit switch port is provided to input the 488 device address and RS-232 baud rate. A 6551 ACIA provides programmable baud rate for RS-232. The RS-232 port may be configured as needed with wire wrap jumpers. The 6522 VIA provides 16 I/O lines, two timers and another serial port. Signal connectors are standard ribbon cable headers.

RSTD PROPOS PROGRAMMABLE POSITIONER AND MACHINE CONTROL MODULE



FEATURES

- Non-volatile memory of user programs and parameters
- Program position, velocity, acceleration
- Time delays, conditional waits
- Looping and branching
- Program with RS-232 terminal 300, 1200, 9600 baud STD BUS Interface with 128 bytes dual port RAM
- Dual STD BUS card set
- Optically coupled encoder inputs A, B, Index up and down 1x, 2x, 4x direction sensing, 16-bit counter, 12-bit DAC provides ±10V output ot motor amplifier, Forward and reverse limit switch, home switch
- 8 user input/output lines
- Programmed outputs
- Conditional branching on input state
- Low cost machine controller
- Rotary tables
- Cut to length
- Point to point positioning

The RSTD-PROPOS is a broad level programmable position controller for DC Servo motors, providing high performance motion profile control and eight user programmable input/output lines for control of external machine function.

RSTD-PROPOS can be easily installed in an STD BUS computer, several PROPOS cards can be combined with a STD CPU CARD to configure an intelligent multi-axis controller. ANY personal computer can be interfaced with this intelligent multi-axis controller through the RSTD-COM CARD.

For More Information. Circle No. 442

Offshore Manufacture and Assembly

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WORLD CLASS MANUFACTURING!

- **Skilled electronics manufacture at rates only 25% or less of prevailing U.S. rates**
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- **I-TR coordinates and expedites all shipping and customs clearances**

For over sixteen years, I-TR has collaborated with many of the world's leading electronics manufacturers to help solve expensive and time-consuming problems of labor-intensive manufacture and electronic assembly. Combining the best of experienced American management and technical know-how with a carefully selected and trained, local work force, I-TR has evolved a manufacturing methodology which provides its clients the best of both worlds, and enables it to offer 'quick response', cost-effective production support and subcontract operations ***at but a fraction of the cost of those functions accomplished 'in-house'***. If your manufacturing suffers from back-breaking, labor-intensive costs, or time-consuming production bottlenecks, we respectfully suggest you do as many other prudent OEM's have done to alleviate their problems—simply ***contact I-TR today!*** The ***NET RESULT*** will be ***production savings of up to 50% or more***, and ***you will have solved the dilemma of ever-spiraling production costs!***

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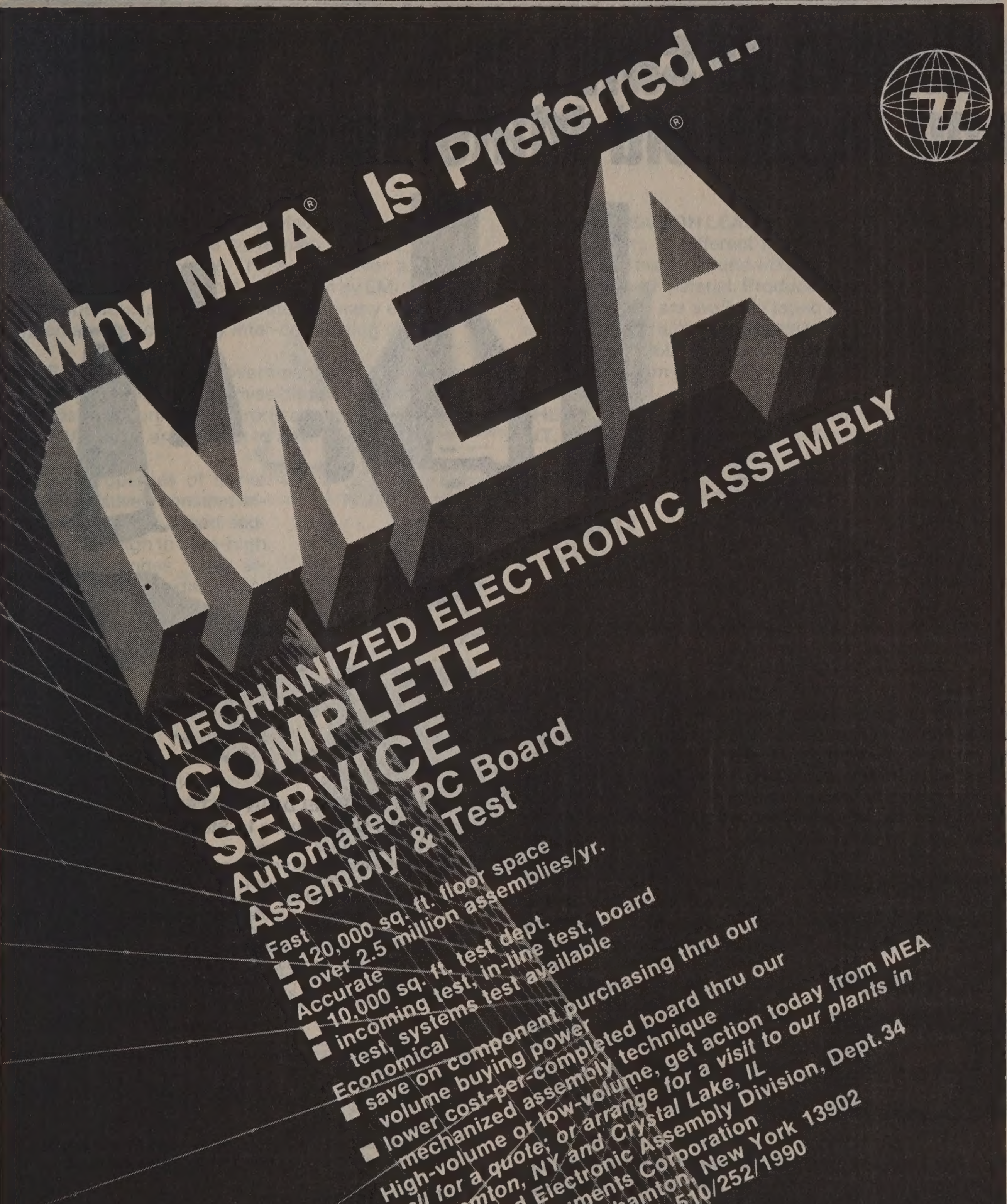
19201 Parthenia Street, Northridge, California 91324
Tel: (818) 885-7872 • Telex: 910-493-5967 • Fax: (818) 885-8683
I-TR, a U.S. corporation, owns and operates facilities in Singapore and Haiti.



Why MEA® Is Preferred...

MEA®

MECHANIZED ELECTRONIC ASSEMBLY

COMPLETE SERVICE

Automated PC Board Assembly & Test

Fast
- 120,000 sq. ft. floor space
- over 2.5 million assemblies/yr.

Accurate
- 10,000 sq. ft. test dept.
- incoming test, in-line test, board test, systems test available

Economical
- save on component purchasing thru our volume buying power
- lower cost-per-completed board thru our mechanized assembly technique

High-volume or low-volume, get action today from MEA
Call for a quote; or arrange for a visit to our plants in Binghamton, NY and Crystal Lake, IL

Mechanized Electronic Assembly Division, Dept. 34
Universal Instruments Corporation
P.O. Box 825, Binghamton, New York 13902
Tel: 607/772/7563 TWX: 510/252/1990

Universal® DOVER CORPORATION

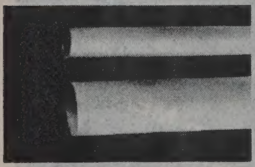
For More Information. Circle No. 444

MAGNETIC SHIELDS and MμShield Materials

**World's most complete sourc
of custom shields for PM
Cathode Ray, and Storag
Tubes; Seamless Tubin
Shields; and Magnet
Shielding Material**

Custom Fabricated Shields

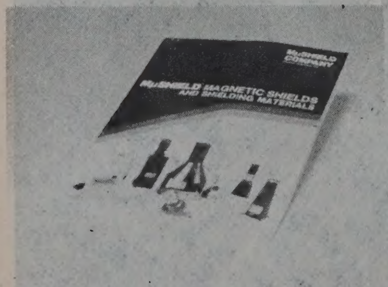
MμShield offers 35 years experience in the design and production of magnetic shields for research and industry. We can help you with prototype design and provide custom shields in any quantities. Metal forming and heat treating expertise insures shields of unsurpassed quality with guaranteed listed field reductions. Your inquiries are invited.



Seamless Tubing Shields

MμShield Company is the only source of **seamless** tubing magnetic shields for lasers, electron microscopes, cables, and seamless rectangular shields for bubble memory devices. Our special technology eliminates the non-uniformity of permeability from tubing shields having welded seams.

Send For Free Designer's Guide and MμShield Catalog



A "must have" magnetic shielding reference for the design engineer. Technical information, design aids, descriptions of shielding materials, and MμShield's special heat treating and processing services are presented.

HI-PERM SHIELDING MATERIALS
Sheets, Coils, Tubes In Stock

1. **High Saturation Shielding**
   Permeability range from 200 to 50,000. Saturation Point between 18,000 and 20,000 gauss.
2. **Medium Permeability Shielding**
   Normally used as a buffer. Permeability range from 12,500 to 150,000. Saturation Point 15,000 gauss approx.
3. **High Permeability Shielding**
   Permeability from 80,000, at B-40, to 350,000.
   Saturation Point 7,500 gauss approx.

All materials heat treated for maximum permeability.

COILS .002", .005", .010" thicknesses. 5½", 7", 15" widths.
Minimum order 2'.
SHEETS .015" to .060" thicknesses. Full sheet 30" x 10'.
Minimum order 30" x 36".
TUBES 0.10" to 4.50" I.D. Wall thicknesses from .010" to .060"
Any lengths to 20'.

Shielding Materials Kit
Contains assortment of materials for making experimental magnetic shields, and a shielding characteristics chart.

Heat Treating Service

Customers may use our Special Heat Treating and Processing Service to give their own fabrications optimum permeability and low shock characteristics. Permeability of MμShield materials is guaranteed.

MμSHIELD COMPANY
DIVISION OF BOMCO, INC.
121 MADISON ST., P.O. BOX W
MALDEN, MA 02148-6890 617/321-4410

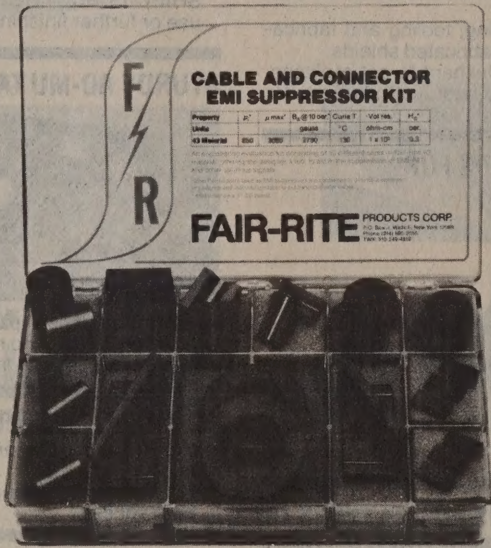
HOW TO STOP EMI

BEFORE IT STOPS YOUR PRODUCT.

The rapidly evolving world of electronics opens new vistas of efficiency and convenience in our professional and personal lives. There is, however, a reverse side to the electronic "coin": pollution by EMI/RFI and other spurious signals generated in many electronic systems and radiated by inter-connecting cables.

U.S.F.C.C. and foreign government regulations of increasing severity limit permissible EMI/RFI emissions for most electronic or electronically controlled equipment. Violators are subject to costly penalties.

Unique properties of ferrite provide relatively constant impedances over a broad segment of the high to ultra-high frequency ranges. They attenuate unwanted signals without contributing to power loss at DC and low frequencies. Fair-Rite beads, sleeves and toroids have become industry standards. They are installed simply by sliding or clamping one or more onto the leads of involved components or on connecting wires, or inserting "beads on leads" into PC boards.



THE NEW CABLE & CONNECTOR EMI SUPPRESSOR KIT.

To aid the designer in selecting and specifying ferrite components to solve specific EMI/RFI problems, Fair-Rite, the leader in ferrites for shielding, has developed three Engineering Evaluation Kits providing the necessary ferrite cores, with descriptions and technical data to help solve given EMI/RFI problems.

FAIR-RITE'S NEW CABLE AND CONNECTOR EMI SUPPRESSOR KIT offers 13 different large beads and toroids, one-piece and split sleeves, and the new multi-hole shielding plates for use with IC/DIP's and multi-pin connectors. All are in the ferrite material of choice for shielding applications, Fair-Rite No. 43; impedance (Z) values are from 47 to 285 ohms typical at 100 MHz.

THE NEW BEAD ON LEAD AND WOUND BEAD, OR |Z| KIT offers 10 different beads on leads, plus two 6-hole shield beads wound with 1½ and 2½ turns, all in Fair-Rite No. 43 material. Production quantities of the beads on leads are available taped and reeled for use with high speed automatic insertion equipment per EIA Standard RS296D. The beads supplied yield impedance values from 68 to 680 ohms typical at 100 MHz.

THE FAIR-RITE BEAD, BALUN AND BROADBAND KIT, "JOULE BOX" provides 34 different shield beads, balun and broadband cores in seven different Fair-Rite materials. Literally thousands of designers have used this kit to guide them in the suppression of unwanted circuit noise over the past seven years. Its continued popularity is proof of its value as a design tool. Impedance values range from 30 ohms to 550 ohms, typical, at 25 MHz or 100 MHz, depending on material.

EACH KIT comes with its own Engineering Bulletin fully describing the contents and guiding the designer in the use of Fair-Rite components to solve his EMI/RFI problems. Also, Impedance vs. Frequency and other curves are included, as well as concise explanations of the function of ferrites in EMI/RFI suppression.

KITS ARE $25.00 EACH postpaid from stock against your payment; or plus shipping when ordered on your PO or letterhead.

The Engineering Bulletins are **FREE** for the asking. So is our catalog.

Fair-Rite also manufactures a broad range of ferrite cores for other electronic applications, including: coil forms; U, E and I cores; rods and slugs; pot cores; and a wide range of bobbin (drum) cores, as well as custom shapes to special order.

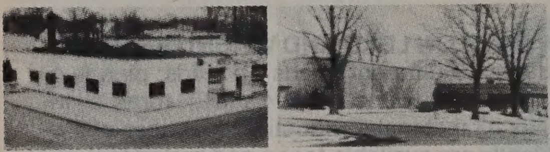
FAIR-RITE PRODUCTS CORP.

Dept. GB4, PO Box J, Wallkill, NY 12589 Phone 914-895-2055 TWX 510-249-4819 FRWALK

Bring Your Magnetic Interference Problems To The Problem Solving Magnetic Shielding Specialists

AD-MU AD-VANCE MAGNETICS SHIELDING

COMPLETE FACILITIES IN 3 LARGE MODERN PLANTS • 4 DECADES OF MAGNETIC SHIELDING LEADERSHIP


Rochester, Indiana

West Coast

Over 90% past and present magnetic shield designs have been created by engineers and fabricated by production personnel with Ad-Vance.

AD-MU shielding is everywhere: off planet in spacecraft and satellites; planet-wide in exacting industrial, military, laboratory and consumer applications.

ECONOMICAL AD-MU FOILS—CUT & APPLY IN MINUTES

Cut with Ordinary Scissors

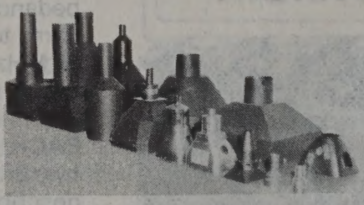
These do-it-yourself foils solve many magnetic shielding problems for designers, experimenters, production people and relatively small production runs.

- No waiting—save days or weeks of valuable time. Always keep a supply handy for emergencies.
- Eliminate designing, tooling and fabrication costs of pre-fabricated shields.
- Especially suited for hard-to-get-at places.
- Delivered already heat treated, ready for instant use.

AD-MU CUSTOM FABRICATED SHIELDS FOR CATHODE RAY TUBES

Enhance CRT performance by eliminating effects of external magnetic fields on the electron beam.

Ad-Vance already owns tooling for many types of magnetic shields used during the past quarter century, making tooling savings possible. Or, our Engineering Dept. will gladly help design and produce the optimum shield for your application.


Typical CRT Shields; others to your specs

AD-MU HIGH PERMEABILITY SHIELDS FIT 324 TYPES OF PHOTOMULTIPLIER TUBES

Typical PM Tube Shields

For your special application or specific magnetic environment, Ad-Vance engineers can either modify a stock shield or custom design a shield to your exact requirement.

AD-MU TRANSFORMER SHIELDS

Reduce or eliminate the problem of stray field emission caused by transformers. Custom designed and fabricated to your precise specification.

AD-MU CUSTOM FABRICATED SHIELDS FOR OTHER COMPONENTS & SYSTEMS

Any specified configuration or shielding requirement from the simplest component to the most complex system can be handled by the Ad-Vance Engineering Dept.

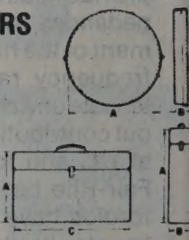
AD-MU SHEET STOCK—DELIVERY FROM STOCK

- For your in-house designing and manufacturing convenience.
- Easy to work, bend, stamp, draw, finish, etc. on ordinary sheet metal working equipment. SHIELDS MUST BE HEAT TREATED before end use or further finishing by plating, painting, etc.

STURDY AD-MU TAPE DATA PROTECTORS

Holds up to 36 Cassette Cartridges

Round or Rectangular Types



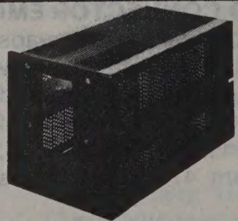
- Prevent distortion, partial erasure or degradation of valuable tape recorded data during routine safekeeping or transport.
- Provide inexpensive insurance against magnetic pollution.

AD-MU ALLOYS PROTECT PERMANENTLY

- Won't saturate when properly used.
- No excessive permeability loss from shock.
- No costly periodic annealings expense/inconvenience.
- Minimum retentivity.

84-PAGE TIME-SAVING ENGINEERING REFERENCE MANUAL/CATALOG

- Gives Major Guidelines for magnetic shielding design/procurement.
- 2/3 of pages contain valuable technical/engineering information about the entire magnetic shielding field.
- 1/3 is product/facilities data.

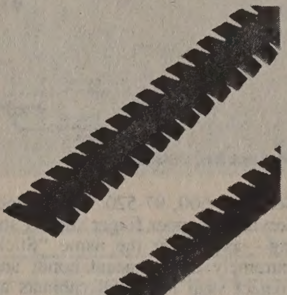

3984 hits in only 10.6 minutes on CNC press vs. 56 minutes average on manual turret duplicator press.

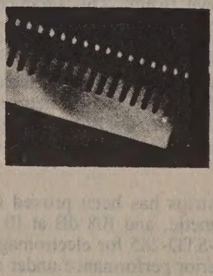
LOWER COSTS TO AD-VANCE CUSTOMERS ON THEIR PUNCHED PRODUCTS

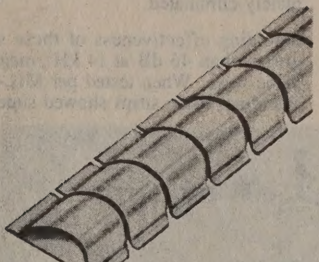
- New CNC Control Capability also increases product quality and provides absolute precision.
- Repeatability to ±.005 accuracy. .002 accuracy not unusual.
- From prototype quantities to tens of thousands.

YOUR MAGNETIC SHIELDING PROBLEMS END HERE · AD-VANCE SHIELDING—THE "NICKEL'S" WORTH

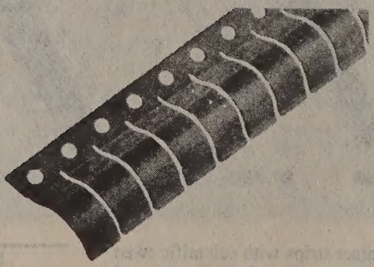
AD-VANCE MAGNETICS, INC., 625 MONROE ST. / ROCHESTER, IN. 46975 / (219) 223-3158 / TWX 810-290-0294







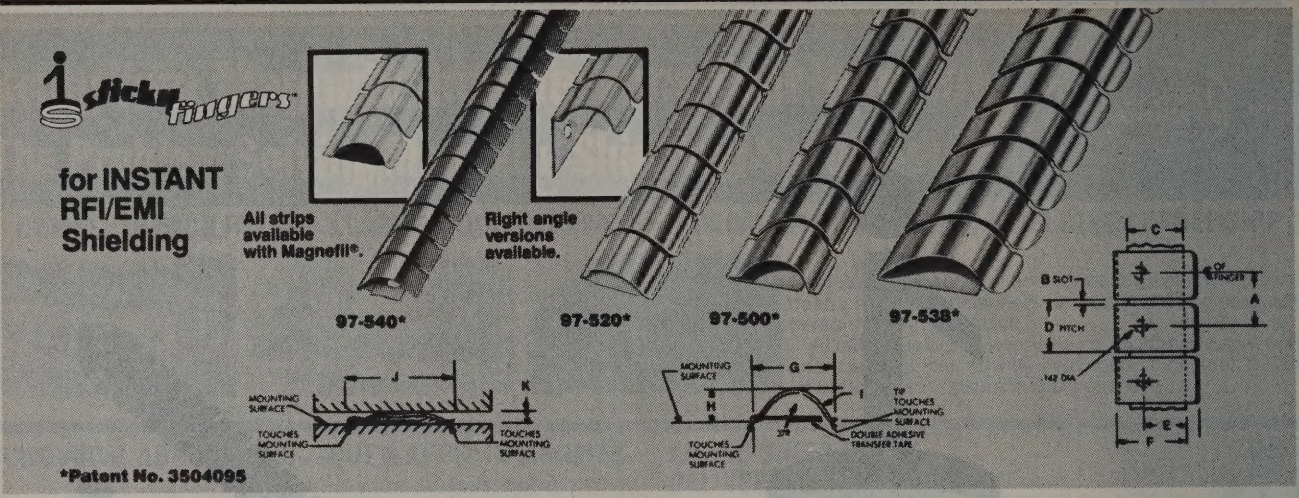
beryllium copper RFI-EMI shielding



INSTRUMENT SPECIALTIES CO., INC.

DELAWARE WATER GAP, PA 18327
DEPT. G–85
Telephone: (717) 424-8510

Specialists in beryllium copper since 1938


sticky fingers
for INSTANT RFI/EMI Shielding
All strips available with Magnefil®.
Right angle versions available.
97-540*
97-520*
97-500*
97-538*
MOUNTING SURFACE
J
K
TOUCHES MOUNTING SURFACE
TOUCHES MOUNTING SURFACE
MOUNTING SURFACE
G
H
I
TIP TOUCHES MOUNTING SURFACE
DOUBLE ADHESIVE TRANSFER TAPE
TOUCHES MOUNTING SURFACE
C
B SLOT
A
D PITCH
.142 DIA
E
F

*Patent No. 3504095

Series 97-500, 97-520, 97-538 and 97-540 are high-performance beryllium copper finger contact strips with a self-adhesive backing—sold under the name "Sticky Fingers". They provide an extremely tight, instant bond, and are ideal as an all-purpose contact strip for metal cabinets and electronic enclosures, particularly where space is critical.

To install, simply peel off the protective paper backing... place strip into position... and press down firmly. This produces an instant seal against RFI/EMI interference in all types of metal cabinets and electronic enclosures.

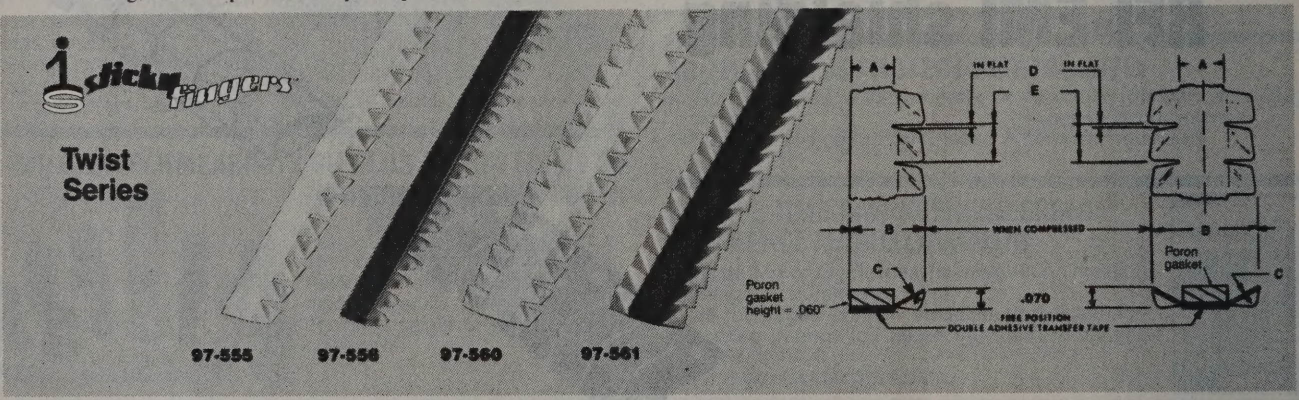
The adhesive strengthens as it cures with age and is unaffected by temperatures from −40F to 250F. Moreover, the geometry of the strip design when fully compressed further assists in strengthening the bond. Soldering and mechanical fastenings are thus completely eliminated.

Shielding effectiveness of these strips has been proved to be greater than 46 dB at 14 kHz magnetic, and 108 dB at 10 GHz plane wave. When tested per MIL-STD-285 for electromagnetic shielding, these strips showed superior performance under minimum compression. They proved to be especially effective where variations exist in the space to be shielded, and in applications that require high shielding performance despite frequent opening and closing of the cabinet.

Series	A	B	C	D	E	F	G (ref)	H (min)	I	J (max)	K (min)
97-500	.375	.032	.40	.375	.31	.50	.58	.219	.0035	.77	.062
97-520	.250	.022	.187	.250	.094	.30	.37	.130	.003	.52	.062
97-540	.188	.018	.150	.188	.075	.234	.280	.107	.0027	.370	.040
97-538	.375	.04	.469	.375	.375	.531	.78	.250	.0043	.938	.062

Note that all strips are available with Magnefil®, a rubber strip filled with magnetic particles, and inserted within the curve of the fingers. Magnefil® provides increased magnetic field shielding.

Strips 97-500 and 97-538 are furnished in lengths of approximately 24 inches (measured between centers of each slot) and Series 97-520 and 97-540 are supplied in standard 16″ lengths. All four may be ordered in your choice of a variety of finishes.


sticky fingers
Twist Series
97-555
97-556
97-560
97-561
A
IN FLAT
D
E
IN FLAT
A
B
WHEN COMPRESSED
B
Poron gasket
C
C
Poron gasket height = .060″
.070
FREE POSITION
DOUBLE ADHESIVE TRANSFER TAPE

Self-adhesive beryllium copper contact strips with scientific twist design offer narrower-than-ever electronic gaskets for general shielding applications where space is at a premium.

Series 97-555 single edge contact strip measures only .375″ wide, yet shielding effectiveness is greater than 85 dB at 100 MHz plane wave. Ideal for all types of panels or electric enclosures.

Series 97-560 strips are especially suitable for cabinets with panel-divider bars. Unique double edge design, .50″ wide permits panels to be easily removed and replaced without damage to the installed strip. This design also provides increased shielding effectiveness: greater than 110 dB at 100 MHz plane wave.

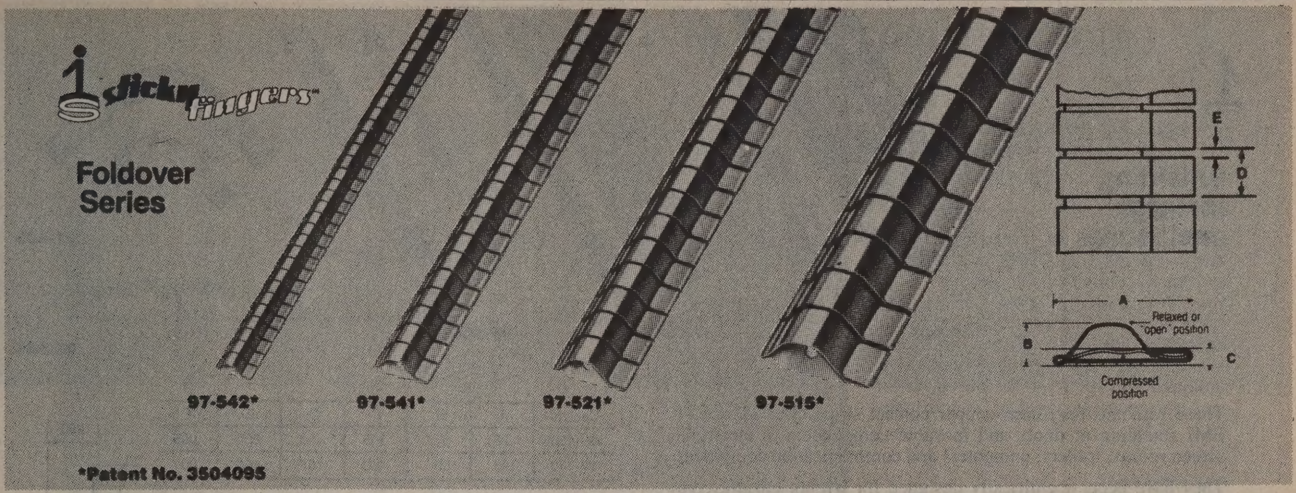
Series	A	B	C	D	E
97-555, -556	.187	.34	.003	.015	.165
97-560, -561	.187	.50	.003	.015	.165

Series 97-556 and 97-561 are versions of 97-555 and 97-560, respectively, incorporating a rubber gasket to act as an environmental shield, offering a high degree of protection against dust and moisture.

All Twist Series are furnished in 24″ lengths.

INSTRUMENT SPECIALTIES CO., INC.
DELAWARE WATER GAP, PA 18327
Telephone: (717) 424-8510

Sticky fingers™ Foldover Series



*Patent No. 3504095

The newest version of Sticky-Fingers beryllium copper shielding gaskets features a special, U-shaped end that permits the upper part of the strip to slide when enclosure doors are closed and retains the strip's fingers when enclosure doors are open, thus protecting against accidental damage to the strip's fingers.

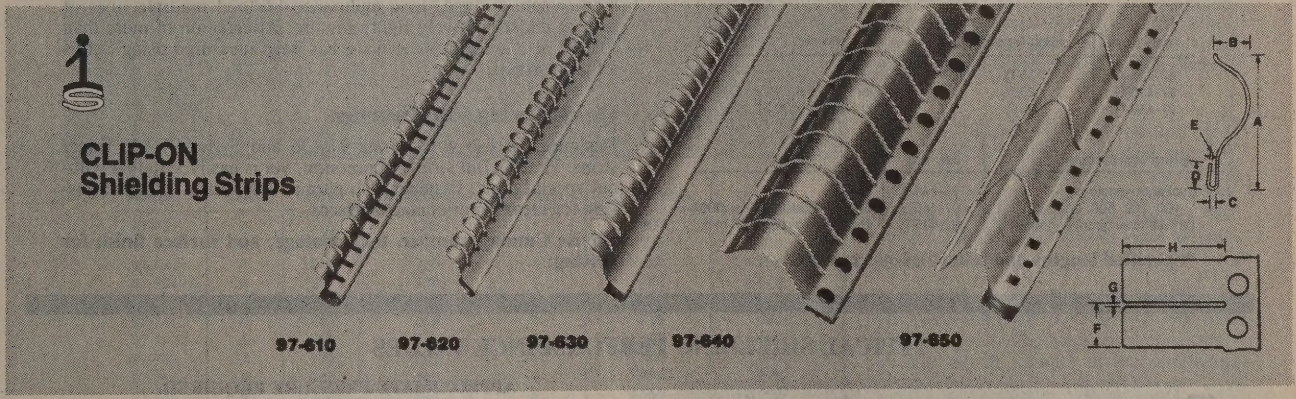
Four models provide you a choice of widths to suit your application. As with all Instrument Specialties Sticky-Fingers shielding strips, they attach quickly and securely with a *really* sticky self-adhesive strip. You simply peel off the backing, press the strip to the surface selected, and it's there to stay!

At the same time, you get the same high shielding effectiveness offered by all Sticky-Fingers.

SERIES	A	B	C	D	E
97-542	.250	.079 MIN.	.035 MIN GAP	.188	.018
97-541	.380	.100 MIN.	.040 MIN GAP	.188	.018
97-521	.612	.130 MIN.	.062 MIN GAP	.250	.022
97-515	.760	.220 MIN.	.062 MIN GAP	.375	.032

Available in standard 16″ lengths, except for Series 97-515, which is furnished in 24″ lengths, and in all standard finishes.

CLIP-ON Shielding Strips



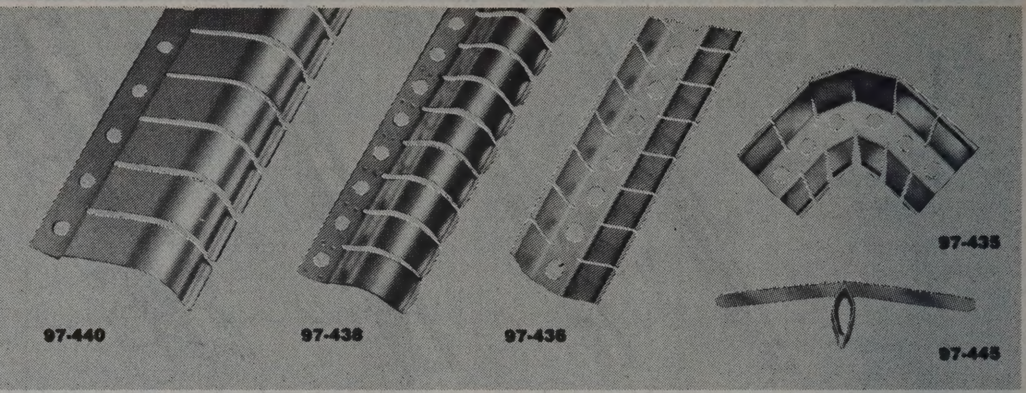
For use where high temperatures or other considerations preclude the use of adhesive-backed Sticky Fingers.

Available in five sizes and in 16″ lengths, they exhibit the same shielding characteristics and effectiveness as Instrument Specialties' Sticky Fingers.

Catalog no.	A	B	C	D	E	F	G	H
97-610	.297	.100	.070	.187	.0048	.187	.047	.195
97-620	.438	.078	.070	.187	.0048	.187	.047	.248
97-630	.600	.205	.070	.187	.0048	.187	.047	.290
97-640	1.093	.255	.070	.281	.0048	.375	.040	.843
97-650	.940	.400	.200	.300	.0039	1.000	.030	.660

INSTRUMENT SPECIALTIES CO., INC.
DELAWARE WATER GAP, PA 18327
Telephone: (717) 424-8510

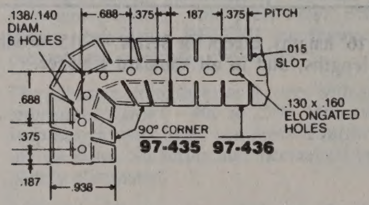
Shielding for large enclosures

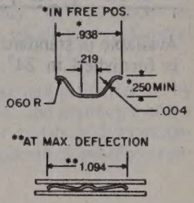

97-440
97-438
97-436
97-435
97-445

These standard beryllium copper contact strips offer ideal RFI/EMI shielding of doors and movable components in electronic screen rooms, trailers, computers and communication equipment.

They have been scientifically designed for wiping closures, but are also usable in compression. Moreover, these contact strips feature extremely good endurance life as well as a high dynamic range. In tests, attenuation up to 112 dB has been measured at 100 MHz plane wave. Fastening of strip is usually accomplished using screws or rivets. Soldering is optional.

For pricing, please advise catalog number, total footage and surface finish required.


.138/.140
DIAM.
6 HOLES
.688
.375
.187
.375
PITCH
.015
SLOT
.688
.375
.187
.938
.130 x .160
ELONGATED
HOLES
90° CORNER
97-435
97-436


*IN FREE POS.
*.938
.219
.060 R
*.250 MIN.
.004
**AT MAX. DEFLECTION
**1.094

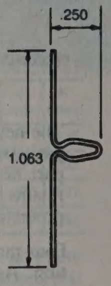
prefabricated 90° corners	cat. no.	finish*
(advise number of corners needed.)	97-435-A 97-435-S 97-435-G	Bright Silver Plated .0002" ± .0001 Gold Plated .000050" min.

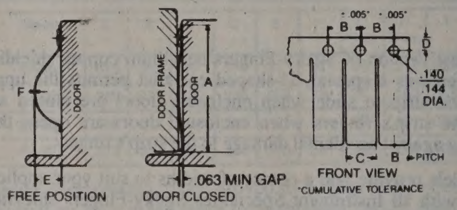
cat. no.	max. length*	finish*
97-436-A	35 ft.	Bright
97-436-S	25 ft.	Silver Plated .0002" ± .0001
97-436-G	25 ft.	Gold Plated .000050" min.

spring clip fastener	cat. no.	finish*
packaged in lots of 100, 200, 500, or 1000 (advise total quantity needed.)	97-445-A 97-445-S 97-445-G	Bright Silver Plated .0002" ± .0001 Gold Plated .000050" min.

***Specified lengths and other finishes to order.**

Cat. No.	A	B	C	D	E	F
97-438	1.281	.375	.355	.156	.250	.005
97-440	1.90	.50	.460	.187	.406	.007




F
DOOR
E
FREE POSITION
DOOR FRAME
DOOR
A
.063 MIN GAP
DOOR CLOSED
±.005*
±.005*
B
B
D
.140
.144
DIA.
C
B
PITCH
FRONT VIEW
*CUMULATIVE TOLERANCE

Balanced Finger Strips offer 90° corners

When contact strips are required for rectangular openings or structural joints, they can be quickly and easily installed in field or factory.

Matching 90° corners provide a perfect fit and spring clips hold the strips firmly in place. (No special tools or soldering required.) Result: More simplified design and construction of cabinets and enclosures.

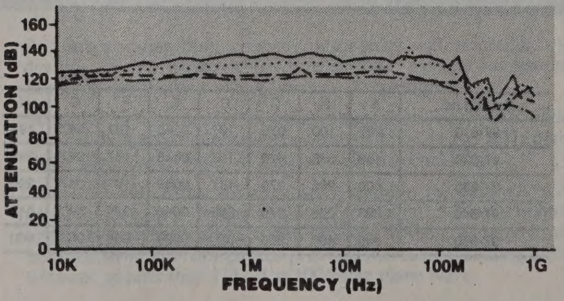
These strips feature a mechanically balanced design to provide high dynamic range, long endurance life and multiple lines of contact under relatively light pressure. Attenuation of more than 102 dB at 100 HMz plane wave has been measured using Series 97-436 gaskets.

Quick Spring Clip Fastener

Designed for use with Series 97-436 and Series 97-435 finger strips. Permits full strip compression, yet is easily installed without special tools. Fastener also permits temporary lifting of gaskets for cleaning of contact surfaces.

Advise Catalog number, total footage, and surface finish for pricing:

TYPICAL SHIELDING PERFORMANCE VALUES



APPROXIMATE PRESSURE REQUIRED FOR 25% DEFLECTION

97-500	97-520	97-538	97-540
12 lbs./ft.	18 lbs./ft.	17 lbs./ft.	21 lbs./ft.

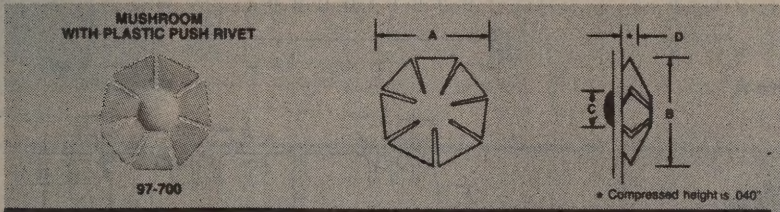
Note: Attenuation per one meter length measured I.A.W. SAE ARP-1705, at deflection of 25% of dynamic range.

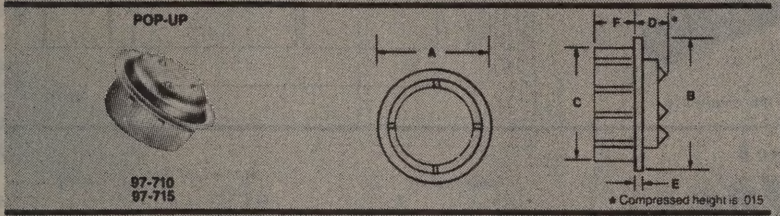
97-520: ··············
97-540: — — — — —
97-500: —·—·—·—
97-538: ————————

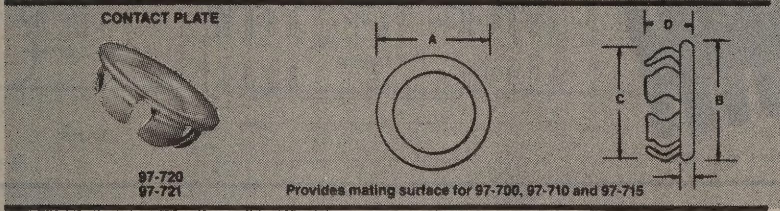
FINISH: Bright clean
SURFACE: Copper

INSTRUMENT SPECIALTIES CO., INC.
DELAWARE WATER GAP, PA 18327
Telephone: (717) 424-8510

ELECTROSTATIC DISCHARGE AND GROUNDING PRODUCTS

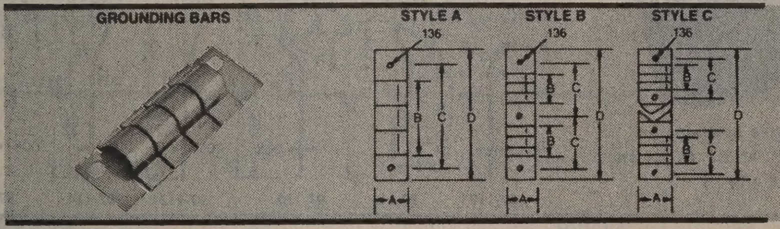






Provides mating surface for 97-700, 97-710 and 97-715

SERIES	A	B	C	D	E	F
97-700	580	580	250	040	N/A	N/A
97-710	938	938	750	115	015	375
97-715	500	500	375	115	015	375
97-720	950	950	750	250	050	N/A
97-721	500	500	375	250	050	N/A



Catalog Number	Style	A Width	B Dimension—# of Fingers		C Hole-to-Hole	D Length
97-731	A	.512	.228	1	.500	.728
97-732	A	.512	.478	2	.750	.978
97-733	A	.512	.728	3	1.000	1.228
97-734	A	.512	.978	4	1.250	1.478
97-735	A	.512	1.228	5	1.500	1.728
97-741	A	.760	.343	1	.750	1.093
97-742	A	.760	.718	2	1.125	1.468
97-743	A	.760	1.093	3	1.500	1.843
97-744	A	.760	1.468	4	1.875	2.218
97-745	A	.760	1.843	5	2.250	2.593
97-751	B	.512	.228	1	.500	1.228
97-752	B	.512	.478	2	.750	1.728
97-753	B	.512	.728	3	1.000	2.228
97-754	B	.512	.978	4	1.250	2.728
97-755	B	.512	1.228	5	1.500	3.228
97-761	B	.760	.343	1	.750	1.843
97-762	B	.760	.718	2	1.125	2.593
97-763	B	.760	1.093	3	1.500	3.343
97-764	B	.760	1.468	4	1.875	4.093
97-765	B	.760	1.843	5	2.250	4.843
97-775	C	.512	1.228	5	1.500	15.228
97-785	C	.760	1.843	5	2.250	22.843

For grounding of high voltage static discharge with discrete points of contact

This breakthrough in beryllium copper electrostatic discharge assemblies provides omnidirectional loading and deflection offering optimum contact force with a minimum of stress on the contact. Mounting is compatible with all surface textures and materials, and galvanic relationships are assured by our complete spectrum of platings if necessary.

Standard Finishes	Add suffix to catalog number
As heat treated User to apply finish	–H
Bright finish Ready to install	–A
Silver plated .0002 (± .0001) inch thick	–S
Gold plated .000050 inch minimum	–G
Nickel plated .0002 (±.0001) inch thick	–Ni
Tin plated .0002 (± .0001) inch thick	–Sn

The 97-700 "Mushroom" is a two-piece assembly consisting of a beryllium-copper top plate and a plastic push rivet which mounts through a .250 inch diameter hole.

The 97-710 and 97-715 "Pop-ups" are spring assemblies in a serrated cup for easy snap-in mounting. One pound of compression pressure yields over 1000 pounds contact force/sq. in. The 97-708 and 97-709 installation tools make assembly even easier.

The 97-720 and 97-721 "Contact Plates" are used with the 97-700, 97-710 and 97-715 as a mating surface of consistent quality which mounts in the opposing plane.

The "Grounding Bars" are identical in style and deflection characteristics to parts 97-515 and 97-521 shown on page 7. They are mounted on chassis and cabinet frame components by riveting, heat staking, or by using common hardware such as screws and fasteners. Redundancy of contact points is varied by selecting the number of fingers necessary. Many custom variations are also possible.

INSTRUMENT SPECIALTIES CO., INC.
DELAWARE WATER GAP, PA 18327
Telephone: (717) 424-8510

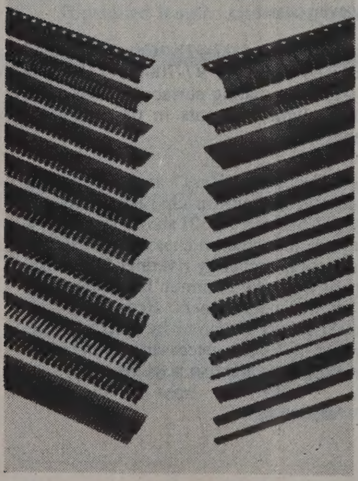
contact strips

for grounding and shielding in high-frequency equipment . . . for forming large-diameter contact rings

A wide variety of beryllium copper contact strips provides engineers and designers with flexibility in the solution of grounding and shielding problems. Various lengths, widths, thicknesses, contours and hole locations are possible for many of the standard catalog items shown here.

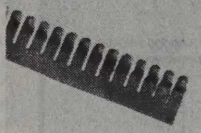
Engineering Design Kit Available

An Engineering Design Kit is available to permit the engineer the utmost latitude in his search for the exact strip configuration to effectively meet his needs. Each assortment contains short lengths of at least 34 items listed on Pages 540 and 541. Includes data sheet on elastic performance of finger strips.

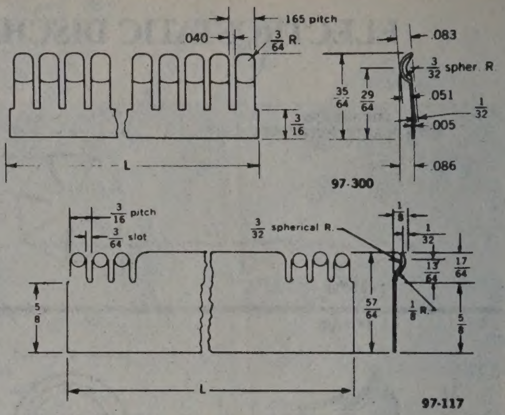


Order assortment by Number 97-272. **Price: $30.00**

figure A

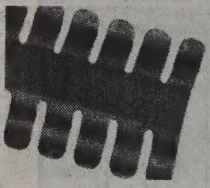


CONTIPS available

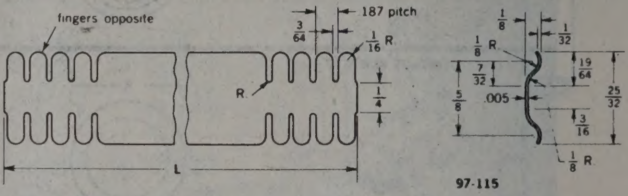


165 pitch
040
3/64 R.
3/16
L
.083
3/32 spher. R
.051
1/32
.005
35/64
29/64
.086
97-300
3/16 pitch
3/64 slot
3/32 spherical R.
1/8
1/32
13/64
17/64
57/64
1/8 R.
5/8
5/8
L
97-117

figure B

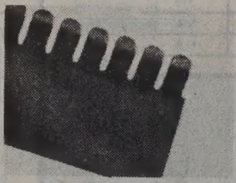


CONTIPS available

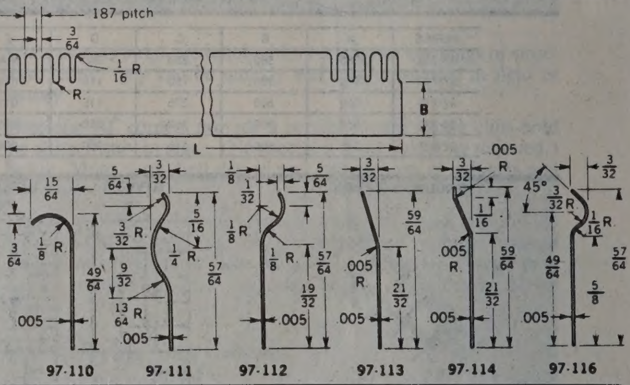


fingers opposite
187 pitch
3/64
1/16 R
R.
1/4
L
1/8
1/32
1/8 R.
7/32
19/64
25/32
.005
5/8
3/16
1/8 R.
97-115

figure C

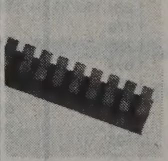


CONTIPS available on 97-111, 97-112, 97-114 and 97-116 only

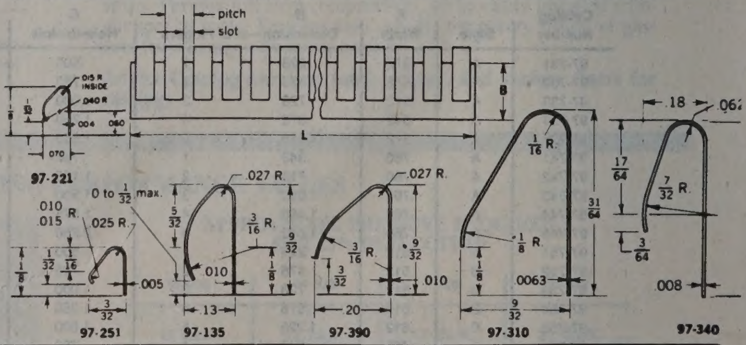


187 pitch
3/64
1/16 R.
R.
B
L
15/64
3/64
1/8 R.
.005
97-110
5/64
3/32
3/32 R.
5/16
1/4 R.
49/64
9/32
57/64
13/64 R.
.005
97-111
1/8
1/32
5/64
1/8 R.
1/8 R.
57/64
19/32
.005
97-112
3/32
59/64
.005 R.
21/32
.005
97-113
.005
3/32
R.
1/16
.005 R.
59/64
21/32
.005
97-114
45°
3/32
3/32 R.
1/16 R.
49/64
57/64
5/8
.005
97-116

figure D

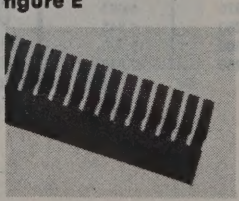


not available with CONTIPS

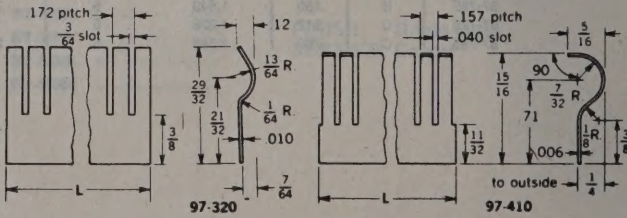


pitch
slot
B
L
.015 R INSIDE
.040 R
.004
.080
.070
97-221
0 to 1/32 max.
.010
.015 R.
.025 R.
1/8
1/32
1/16
.005
3/32
97-251
.027 R.
5/32
3/16 R.
.010
9/32
1/8
.13
97-135
.027 R.
3/16 R.
9/32
3/32
.010
.20
97-390
1/16 R.
1/8 R.
1/8
.0063
31/64
9/32
97-310
.18
.06
17/64
7/32 R.
3/64
.008
97-340

figure E



CONTIPS available

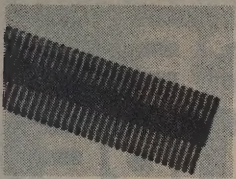


172 pitch
3/64 slot
3/8
L
.12
13/64 R.
29/32
1/64 R.
21/32
.010
7/64
97-320
.157 pitch
.040 slot
11/32
L
5/16
90
15/16
7/32 R.
71
1/8 R.
3/8
.006
to outside
1/4
97-410

INSTRUMENT SPECIALTIES CO., INC.
DELAWARE WATER GAP, PA 18327
Telephone: (717) 424-8510

contact strips

figure F



CONTIPS available

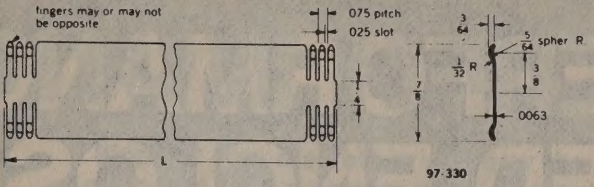
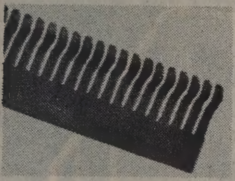

fingers may or may not be opposite
075 pitch
025 slot
3/64
5/64 spher. R
1/32 R
3/8
7/8
4
0063
L
97-330

figure G



CONTIPS available

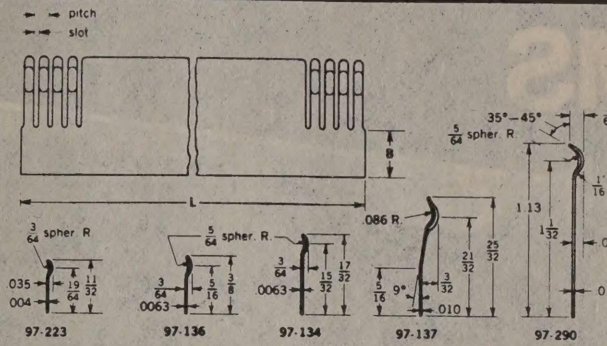
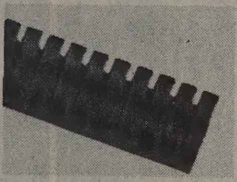

pitch
slot
B
L
35°–45°
5/64
5/64 spher. R
1/16 R
1.13
1 1/32
.06
.010
.086 R
25/32
21/32
3/32
9°
5/16
.010
3/64 spher. R
5/64 spher. R
.035
.004
19/64
11/32
3/64
5/16
3/8
.0063
15/32
17/32
.0063
97-223
97-136
97-134
97-137
97-290

figure H



CONTIPS available

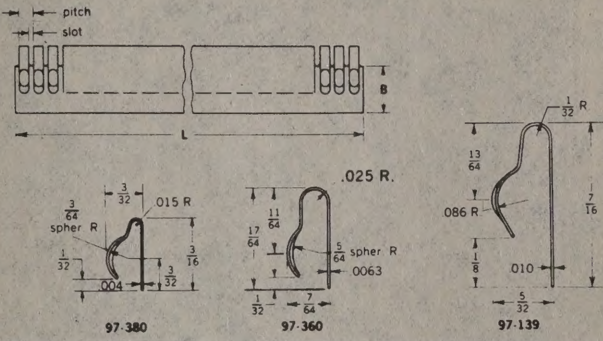
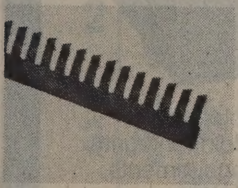

pitch
slot
B
L
1/32 R
13/64
7/16
.086 R
1/8
.010
5/32
.025 R.
11/64
17/64
5/64 spher. R
.0063
1/32
7/64
3/32
.015 R
3/64 spher. R
1/32
3/16
3/32
.004
97-380
97-360
97-139

figure I



not available with CONTIPS

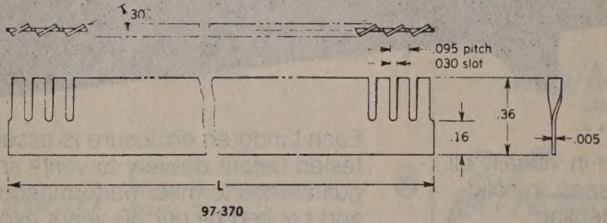
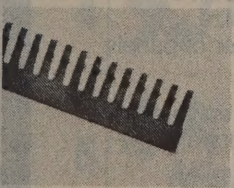

30°
.095 pitch
.030 slot
.36
.16
.005
L
97-370

figure J



CONTIPS available

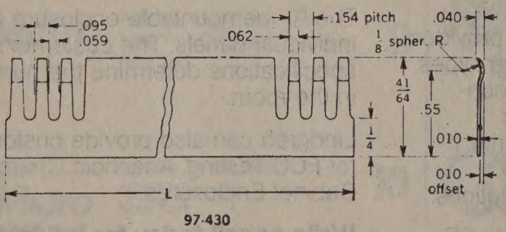
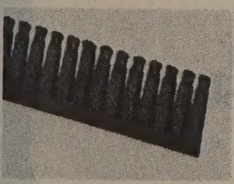

.095
.059
.154 pitch
.062
.040
1/8 spher. R.
41/64
.55
1/4
.010
.010 offset
L
97-430

figure JJ



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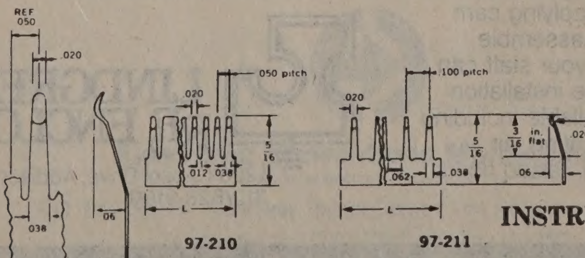
REF .050
.020
.038
.06
.050 pitch
.020
5/16
.012
.038
L
.100 pitch
.020
5/16
3/16 in. flat
.020 R
.062
.038
.06
L
97-210
97-211

dimensions in inches

catalog number	figure	pitch	slot	B	stock length L■	wt. per 1000 in., lb
97-110	C	.187	.047	5/8	16	1.3
97-111	C	.187	.047	5/8	16	1.3
97-112	C	.187	.047	5/8	16	1.3
97-113	C	.187	.047	5/8	16	1.3
97-114	C	.187	.047	5/8	16	1.3
97-115	B	.187	.047		16	1.1
97-116	C	.187	.047	41/64	16	1.3
97-117	A	.187	.047	5/8	16	1.3
97-134	G	.075	.025	7/32	16	.9
97-135	D	.134	.040	15/64	16	1.4
97-136	G	.075	.025	1/16	16	.6
97-137	G	.094	.031	5/16	16	2.0
97-139	H	.094	.031	5/16	16	2.0
97-210	JJ	.050	.012	1/8	12	.5
97-211	JJ	.100	.062	1/8	12	.5
97-221	D	.060	.020	3/32	12	.3
97-223	G	.060	.020	1/8	16	.35
97-251	D	.127	.050	3/32	12	.3
97-290	G	.075	.025	11/16	16	3.0
97-300	A	.165	.040	3/16	16	.8
97-310	D	.187	.062	3/8	16	1.4
97-320	E	.172	.047	3/8	16	2.4
97-330	F	.075	.025		16	1.3
97-340	D	.163	.015	1/4	16	1.6
97-360	H	.075	.025	7/32	16	.9
97-370	I	.095	.030	.16	16	.43
97-380	H	.060	.020	1/8	16	.35
97-390	D	.134	.040	15/64	16	1.4
97-410	E	.157	.040	11/32	16	1.8
97-430	J	.154	.059	1/4	16	1.4

■ **lengths:** Stock lengths supplied unless shorter lengths are specified . . . cut to nearest slot.

widths: Other widths and special contours available to order.

standard finishes	*add suffix to catalog number*
as heat-treated user to apply finish	—H
bright finish for welding, soldering	—A
silver plated .0002 (±.0001) inch thick	—S
gold plated .000050 in. min.	—G

other finishes to specification

CONTIPS

localized deposits of silver or gold (see page 8)

	add suffix to catalog number
SILVER CONTIPS only	—K
SILVER CONTIPS plus silver plating	—KS
GOLD CONTIPS only	—GK
GOLD CONTIPS plus gold plating	—GKG

INSTRUMENT SPECIALTIES CO., INC.
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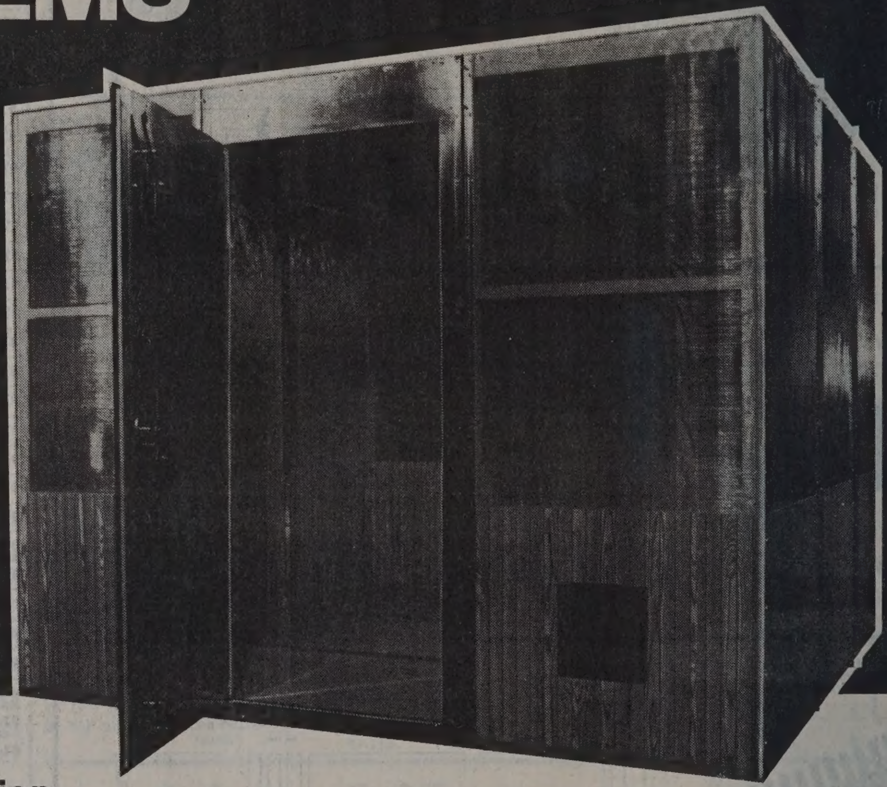
HIGH PERFORMANCE SHIELDED ENCLOSURE SYSTEMS

- **Modular construction**
- **Double electrically isolated (DEI) construction**
- **Variety of shielding materials (including NMR)**
- **Assembled and tested**



Ten times more EMI/RFI protection...

Lindgren enclosures are offered in virtually all shielding materials and thicknesses, in solid-sheet or screen, to cover all shielding requirements.

Independent tests prove that our exclusive double electrically isolated (DEI) design provides up to 10 times more protection than other types of shielding. Our modular demountable construction allows easy room expansion or relocation without loss of shielding integrity. It also allows our standard components to conform easily to unusual room configurations.

Doors feature separate inside and outside RF seals on all four edges, with a single handle that assures an RF-tight closure by applying cam pressure at three points. Rooms assemble easily with common hand tools; your staff can do it, or we can provide complete installation services. Custom finishing is available including suspended ceilings, recessed lighting, air conditioning, decorative paneling, raised floors, and soundproofing.

Each Lindgren enclosure is assembled and tested before delivery to verify shielding integrity, guaranteed to meet performance requirements, and backed by our 30 years experience in designing high-performance enclosures.

The RF demountable enclosure is built of individual panels. The customer's size specifications determine the number of panels in the room.

Lindgren can also provide custom enclosures for FCC Testing, Anechoic Chambers and Cabinet Enclosures.

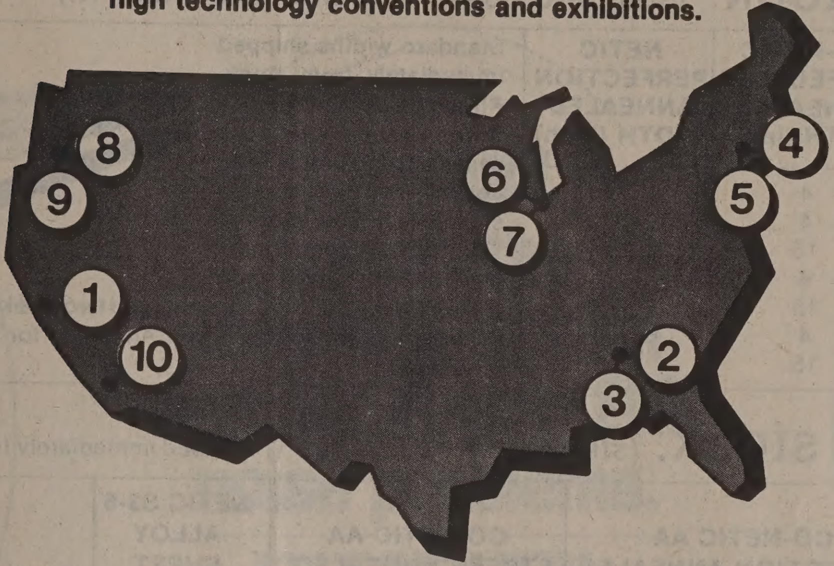
Write or call today for full information or application assistance.

LINDGREN RF ENCLOSURES
1228 Capitol Drive, Addison, IL 60101
312/628-9100

For More Information. Circle No. 449

SHOWTIME '85

Pinpoint your markets or discover the latest in product advancements at America's leading high technology conventions and exhibitions.



1	Mini/Micro West	February 5, 6, 7, 1985	Anaheim Hilton Exposition Center	Anaheim, California
2	Southcon	March 5, 6, 7, 1985	Georgia World Congress Center	Atlanta, Georgia
3	Mini/Micro Southeast	March 5, 6, 7, 1985	Georgia World Congress Center	Atlanta, Georgia
4	Electro	April 23, 24, 25, 1985	New York Coliseum	New York
5	Mini/Micro Northeast	April 23, 24, 25, 1985	Albert Hall	New York
6	Midcon	September 10, 11, 12, 1985	Rosemont Exposition Center	Chicago, Illinois
7	Mini/Micro Midwest	September 10, 11, 12, 1985	Rosemont Exposition Center	Chicago, Illinois
8	Northcon	October 22, 23, 24, 1985	Portland Memorial Coliseum	Portland, Oregon
9	Mini/Micro Northwest	October 22, 23, 24, 1985	Portland Memorial Coliseum	Portland, Oregon
10	Wescon	November 19, 20, 21, 22, 1985	Anaheim Convention Center	Anaheim, California

For Additional Exhibitor or Registration Information, contact:

Electronic Conventions Management
Subsidiary of Electronic Conventions, Inc.
P.O. Box 92275, Worldway Postal Center, Los Angeles, CA 90009
Telephone: 213/772-2965 • Telex: 181350

CO-NETIC® & NETIC® Magnetic shielding material

Foil stock: (standard coils — 50 and 100 linear ft.)

STD. THK. (Inch)	CO-NETIC PERFECTION ANNEALED WIDTH (Inch)	NETIC PERFECTION ANNEALED WIDTH (Inch)
.002	4	—
.004	4	4
.004	15	15
.006	4	—
.006	15	—
.010	4	—
.010	15	—

Standard widths shipped immediately from stock. All sizes available with double-faced pressure sensitive tape and release coated liner. Foils can be slit to a minimum width of ¼", with or without backing. Width tolerance ±.010. Backed and slit foils shipped two weeks after receipt of order. All foil is Perfection Annealed for maximum attenuation.

Sheet stock: (standard — 30" x 120") Shipped immediately from stock.

STD. THK. (Inch)	CO-NETIC AA PERFECTION ANNEALED	CO-NETIC AA STRESS ANNEALED	NETIC S3-6 ALLOY SHEET
.014 .020 .025 .030 .040 .050 .062	High permeability characteristics. Perfection annealed for optimum magnetic properties. No further annealing after fabrication is necessary if severe forming is avoided.	High permeability characteristics. Stress annealed for ease of fabrication. Must be final annealed for maximum attenuation characteristics. Also stocked in .100".	High saturation capability. Also stocked in .095".

Photomultiplier tube shields . . .

Shields shipped from stock for over 650 photomultiplier tubes.

Literature available

CATALOG	DESCRIPTION
MG-5	Material and fabrication guide
EP-3	A.C. magnetic field evaluator probe
LK-2	Lab kit
M & C	Home study course
PM-4	Photomultiplier tube shields
TP-6	Tape data preservers
WC-1	Wire, cable and conduit
ZG-2	Zero gauss chambers
	"Shop Talk" technical notes
K-13	Mica technical manual
K-14	Mica brochure

MAGNETIC SHIELD DIVISION

PERFECTION MICA COMPANY

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TECKNIT solves the toughest design and packaging EMI noise problems.

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- Knitted Wire Mesh • Oriented Wire Gaskets • Conductive Elastomers
- Shielding Optical Windows • Shielding Air-Vent Panels
- Conductive Adhesives and Sealants • Switch and Connector Seals

Write or Call for
the TECKNIT Data Guide
or
to discuss an
EMI shielding problem.

data guide:
TECKNIT

TECKNIT® *a TWP company*

EMI Shielding Products
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(805)963-5811
TWX (710) 996-5951
TELEX 685-3079TCKNT

For More Information. Circle No. 452

Infra-Ready.

The new Vivisun 20/20 switches are ready for anything, including ANVIS night vision goggles or direct sunlight. A unique optics system eliminates the veiling glare and halo effect of conventional displays. So there is no interference with infra-red imaging. When voltages are trimmed to night vision goggle flying levels, Vivisun 20/20 switches can still be read with the unaided eye.

During the day, Vivisun 20/20 switches are readable in direct sunlight and deadface when not energized. They are also easy to install and have the lowest touch temperature and widest viewing angle in the industry. Clearly, no other Mil-Spec switch can match it. And you can specify your Vivisun 20/20 switches with these options: Dustproof/Dripproof • Split Ground • P.C. Termination • EMI. For more information, write, phone or telex today.

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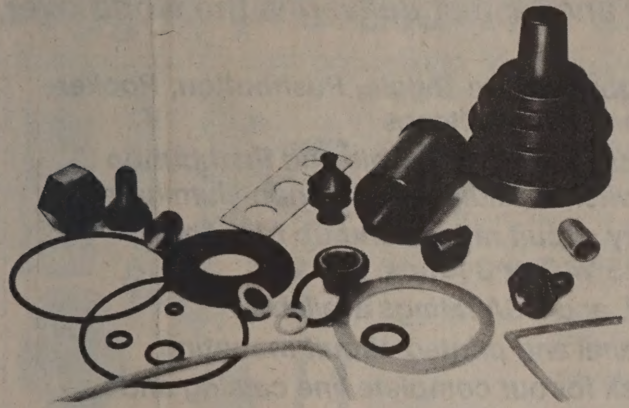
3201 Sandy Lane, Fort Worth, Texas 76112
(817) 451-1141 • Telex 75-8461

SUNLIGHT
READABLE

MIL-S-22885/90

VIVISUN 20/20™

AME SWITCH SEALS



Backed by over 25 years of engineering solutions — for an ever-changing and demanding market.

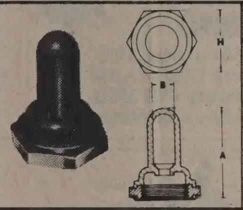
The wide demand for custom-molded panel and switch seals, threaded inserts bonded to rubber, O-rings, boots and seals, etc., translated is really a demand for talent and know-how to handle the engineering and molding of particularly thorny or unusual custom requirements that frequently plague industry. AME meets the demand. . . with experience, service and unique production techniques.

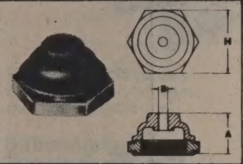
CUSTOM ENGINEERED PRECISION MOLDED ELASTOMERS

- Color filters for incandescent lamps
- Rubber to metal bonding
- Clear silicone products
- Self-sealing hex nuts
- Self-sealing washers
- Extrusions

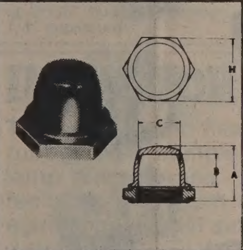
- O-rings
- Boots
- Gaskets
- Seals
- Conductive rubber
- Die cutting

TOGGLE SWITCH SEALS

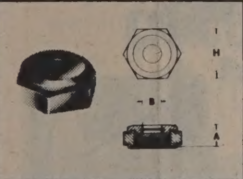
	Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
	1100	M5423/01-01	15/32-32 UNS-2B	in.	.86	.22	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
				mm	(21.84)	(5.59)	(15.88)	
	1102	None	15/32-32 UNS-2B	in.	.86	.22	.625 Hex	
				mm	(21.84)	(5.59)	(15.88)	
	1103	None	15/32-32 UNS-2B	in.	.90	.22	.625 Hex	Nut-Brass, Rubber-Neoprene, 50 Durometer Black
				mm	(22.86)	(5.59)	(15.88)	
	1105	M5423/05-01	¼-40 UNS-2B	in.	.50	.064	.375 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 30 Gray
				mm	(12.70)	(1.63)	(9.53)	

	Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
	1101	M5423/02-01	15/32-32 UNS-2B	in.	.40	.09	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
				mm	(10.16)	(2.29)	(15.88)	
	1104	None	⅝-24 UNEF-2B	in.	.75	.09	.812 Hex	
				mm	(19.05)	(2.29)	(20.62)	
	1106	M5423/11-01	¼-40 UNS-2B	in.	.25	.05	.375 Hex	
				mm	(6.35)	(1.27)	(9.53)	

PUSH BUTTON SWITCH SEALS

	Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	C	H	Material Specifications
	2100	M5423/07-01	15/32-32 UNS-2B	in.	.55	.32	.42	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
				mm	(13.97)	(8.13)	(10.67)	(15.88)	
	2101	None	½-32 UNS-2B	in.	.46	.29	.41	.750 Dia.	
				mm	(11.68)	(7.37)	(10.41)	(19.05)	
	2102	M5423/07-02	15/32-32 UNS-2B	in.	.72	.48	.42	.625 Hex	
				mm	(18.29)	(12.19)	(10.67)	(15.88)	
	2103	M5423/10-01	¼-32 UNEF-2B	in.	.31	.20	.19	.375 Hex	
				mm	(7.87)	(5.08)	(4.83)	(9.53)	
	2104	M5423/10-02	¼-40 UNS-2B	in.	.31	.20	.19	.375 Hex	
				mm	(7.87)	(5.08)	(4.83)	(9.53)	

ROTARY SWITCH & POTENTIOMETER SEALS

	Part Number	Equiv. Military Part Number	Thread Size	Unit	A	Size of Shaft B	H	Material Specifications
	3100	M5423/09-02	⅜-32 UNEF-2B	in.	.22	.250	.500 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
				mm	(5.59)	(6.35)	(12.70)	
	3101	M5423/09-01	⅜-32 UNEF-2B	in.	.22	.125	.500 Hex	
				mm	(5.59)	(3.18)	(12.70)	
	3102	M5423/09-04	15/32-32 UNS-2B	in.	.22	.250	.625 Hex	
				mm	(5.59)	(6.35)	(15.88)	

MANY OTHER SIZES AND TYPES AVAILABLE

Pressure capabilities: Internal Pressure
1 Atmosphere, 15 psi (103.4 kPa)
External Pressure
2 Atmospheres, 30 psi (206.8 kPa)
For Part #1106 — Internal pressure
.7 Atmosphere, 10 psi (69 kPa)
External pressure
1.4 Atmospheres, 20 psi (138 kPa)

Endurance: Exceeds 100,000 actuations (depending on environment).

Useful life: 20 years to unlimited (depending on environment).

Switch Seals are designed and manufactured to meet or exceed applicable military specifications.

Switch Seals

An elastomeric boot which seals, thus protecting a switch and internal components against hazardous foreign elements. AME's one piece switch seal is constructed of a flexible rubber boot element bonded during molding to a threaded metal insert that fully encapsulates the switch and bushing to the panel.

This assembly replaces the panel mounting nut and seals the mounting hole making it watertight. It protects against moisture, oil, dirt, dust, most solvents, many acids (see elastomer selection guide).

Switch seals provide vibration resistant mounting and act as double insulation with no interference to switch movement.

CAST URETHANE & SILICONE

AME supplies cast urethane and silicone products precision engineered to meet your most demanding requirements.

If you need high tensile/tear strength, excellent resistance to abrasion and high impact capability, our cast urethane is ideally suited for the job. Superb temperature resistance to the damaging sub-zero cold or searing heat extremes is found in the cast silicone custom engineered by AME Corporation.

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American Switch Corp.

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- *Snap-in mount Toggle and Pushbutton switches, illuminated or non-illuminated*
- *Dry circuit ratings and up to 6 Amps, 125 VAC or 3 Amps, 250 VAC*
- *UL and CSA ratings available*
- *Panel and printed circuit mounting*
- *Ask for our complete line catalog and a prototype sample*
- *Fast response, short lead-times, competitive prices*

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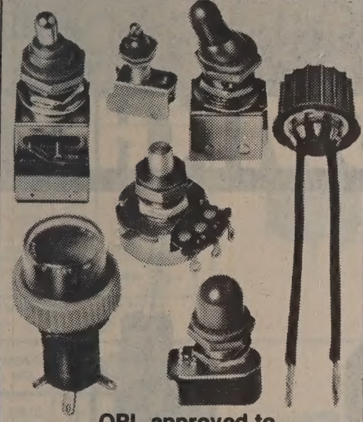
SWITCH ENVIRONMENTAL SEALING

Toggle, pushbutton and rotary switch seals



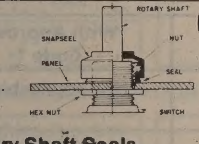
QPL approved to MIL-B-5423 specs. EMI/RFI shielded versions available.

MIL AND INDUSTRIAL VERSION: HEXSEALS®

Provide positive high-pressure environmental sealing for all standard switches and rotary shafts with one-piece silicone boots incorporating a molded-in hex nut for water-tight, dust-tight protection. Replacing regular mounting hardware, vibration-resistant Hexseals fit snugly around the switch neck to seal both the panel mounting hole and the switch—even against a 30 foot head of water or gas. Flexible Hexseals allow free motion of shaft or lever. A variety of boot height, diameter and thread sizes are available. Ask for Bulletin HEX.

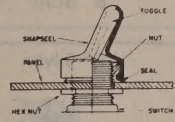
Material:	Boot: Silicone rubber unless otherwise specified. Silicone rubber conforms to ZZ-R-765-Class III, Gr. 50. Other elastomers available on special order.
	Nut: Brass, nickel plated
Temp. Range:	– 94°F TO +400°F (– 70°C TO +260°C)
Pressure Range:	Exceeds 15 psi internal and 1500 psi external
Shelf Life:	Excess of 25 years
Resistant to:	Salt spray, weather, sunlight, ozone, and most acids,
Stock Colors:	grey, transparent (Clear); Other colors available on special order.

COMMERCIAL VERSION: SNAPSEALS™

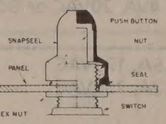


Rotary Shaft Seals
Shaft diameter: ¼" nom.; bushing diameter: ⅜".

Subminiature Toggle Boot
Bat handle height from panel: 9/16"; bat handle diameter: up to 1/8"; bushing diameter: 1/4" maximum.



Toggle Switch Boots
Bat handle height from panel: ⅞"; bat handle diameter: up to ¼"; bushing diameter: ½" max.

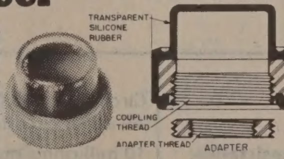


Pushbutton Boots
Pushbutton height from panel: up to 9/16"; pushbutton diameter: up to ¼"; bushing diameter: ⅜" or 15/32".

Low-cost, easy-to-install Snapseels slip easily over standard pushbutton, toggle or rotary switches to provide double insulation while sealing against moisture, dirt and dust, solvents, most acids and external pressures of 10 psi. Many sizes. SPECIFICATIONS: Material: black neoprene (other materials and colors available); Operating temperatures: —65°F to +300°F; Shelf Life: 2 years; Mounting nut: nickel-plated brass.
Ask for Bulletin SNP.

INDICATOR LIGHT SEALS: RubRglas®-Seel

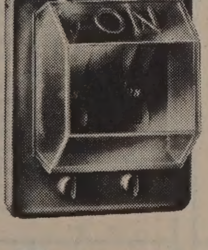
Transparent and flexible pressure switch boots of glass-clear silicone rubber allow complete visibility of the completely enclosed and sealed lamp filament and "press-to-test" markings. Molded to a corrosion-resistant aluminum nut with an integral gasket rib for firm seating against any panel surface. Wide range of thread sizes available.
Ask for Bulletin HEX.



Coupling Thread
13/16-32NS-2B
11/16-32NS-2B
7/8-32NS-2B
11/16-32NS-2B
.850-24NS-2B

CIRCUIT BREAKER BOOTS

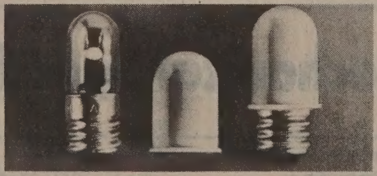
Protective RubRglas®-Seals



QPL approved to MIL-B-5423 specs.

Shield exposed panel openings and circuit breakers with single, double or triple pole switch handles against weather, salt water, acids and dirt without redesigning equipment or hindering operation. Tough but flexible wide-angle boots made of glass-clear silicone rubber keep switch handles visible and accessible for easy manual operation. Boot assemblies consist of RubRglas shield, cadmium-plated steel frame, self-sealing stainless steel screws (Seelskrews®). Over 25-year shelf life.
Ask for Bulletin HEX.

Silikrome® Colored Filters for miniature lamps



Slip over clear incandescent lamps to change their color. Can withstand in excess of 500°F for over 1,000 hours. Made of Silicone rubber, they're unbreakable, interchangeable, and reusable. No mounting hardware needed.
Ask for Bulletin SK.

APM-HEXSEAL
DIVISION OF APM CORPORATION
44 HONECK ST., ENGLEWOOD, N.J. 07631

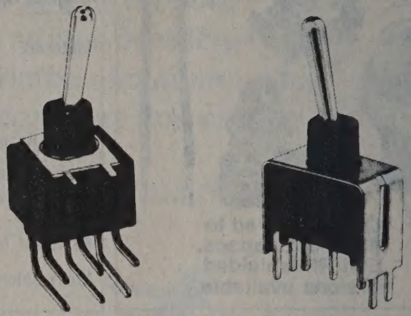
THE CLEAN FIGHTERS

TELEPHONE (201) 569-5700 • APM HEXSL EGW • TELEX 13-3403

For More Information. Circle No. 456

ARROW HART
COOPER INDUSTRIES
103 HAWTHORN STREET/HARTFORD, CT 06101/(203) 249-8471

ARROW HART WASHABLE MINIATURE SWITCHES



Electrical Specifications

Class	Minimum	Maximum	Contact Option	With Approval Code 1
Low-level	10mA, 50mVAC or DC 10μA, 5VAC or DC	.4VA, 20VAC or DC	"B" Gold	Not applicable
Power	100mA, 10VAC or DC	5A, 125VAC 2A, 250VAC	"Q" Silver	UL, CSA pending
Low-level or Power (See Note below)	10mA, 50mVAC or DC 10μA, 5VAC or DC OR 100mA, 10VAC or DC	.4VA, 20VAC or DC OR 5A, 125VAC 2A, 250VAC	"G" Gold over silver	UL, CSA pending

All loads resistive	
Life:	Circuit 01: 100,000 switch operations. All other circuits: 50,000 switch operations
Initial Contact Resistance:	10 milliohms maximum @ 50 millivolts, 10 milliamps
Dielectric Strength:	1000 VRMS minimum
Insulation Strength:	1000 megohms minimum

NOTE: The advantage of gold plate on silver is that the switch can be used in low-level circuits with loads of 0.4 VA and below as well as in circuits with a maximum load of 5 amps at 125VAC. If the low-level rating is exceeded, the gold plating is removed from the contact, rendering the switch unusable at low-levels.

Mechanical Specifications

Temperature Range:	
Operating:	−20°C to +85°C (−4°F to +185°F)
Storage:	−40°C to +85°C (−40°F to +185°F)
Materials:	
Contacts:	Brass with gold (B) or silver (Q) or both (G)
Terminals:	Brass with gold (B) and (G) or silver (Q) (tin-plate available on special basis)
Housing:	Thermoplastic, high temperature UL 94VO
Bracket/Support:	Tin-plated steel
Toggle:	Chrome-plated brass
Rocker:	Nylon 6/6
Approximate Net Weight:	SP: 2.50 grams (.09 oz) DP: 3.70 grams (.13 oz)

For More Information. Circle No. 457

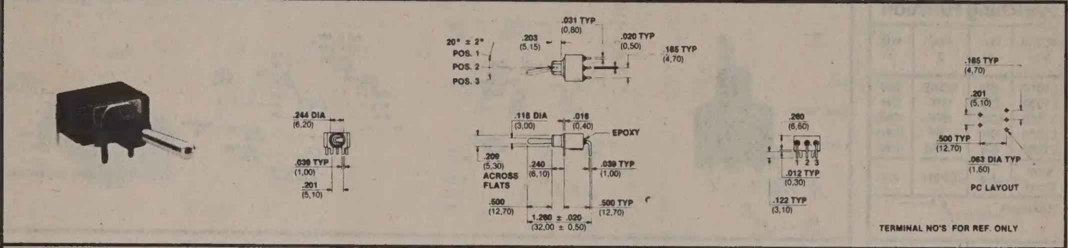
COOPER INDUSTRIES
ARROW HART
103 HAWTHORN STREET/HARTFORD, CT 06101/(203) 249-8471

L Series Washable Toggles

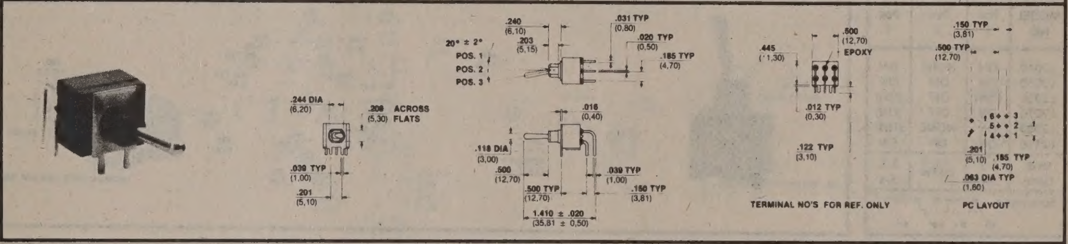
A TERMINATION OPTION

Switching Function

MODEL NO.	Pos 3	Pos 2	Pos 1
L1010	ON	NONE	ON
L1030	ON	OFF	ON
L1050	(ON)	OFF	(ON)
L1070	ON	OFF	(ON)
L1080	ON	NONE	(ON)
Term. Conn.	2-3	OPEN	2-1
Schematic	2(Common) 1 3		


.031 TYP (0,80)
20° ± 2°
POS. 1
POS. 2
POS. 3
.203 (5,15)
.020 TYP (0,50)
.185 TYP (4,70)
.244 DIA (6,20)
.118 DIA (3,00)
.016 (0,40)
EPOXY
.039 TYP (1,00)
.201 (5,10)
.209 (5,30) ACROSS FLATS
.240 (6,10)
.500 (12,70)
.500 TYP (12,70)
1.260 ± .020 (32,00 ± 0,50)
.260 (6,60)
.012 TYP (0,30)
.122 TYP (3,10)
.185 TYP (4,70)
.201 (5,10)
.500 TYP (12,70)
.063 DIA TYP (1,60)
PC LAYOUT
TERMINAL NO'S FOR REF. ONLY

MODEL NO.	Pos 3	Pos 2	Pos 1
L2010	ON	NONE	ON
L2030	ON	OFF	ON
L2050	(ON)	OFF	(ON)
L2070	ON	OFF	(ON)
L2080	ON	NONE	(ON)
L2110	ON	ON	ON
Term. Conn.	2-3, 5-6	OPEN	2-1, 5-4
Schematic	2(Common) 5(Common) 1 3 4 6		

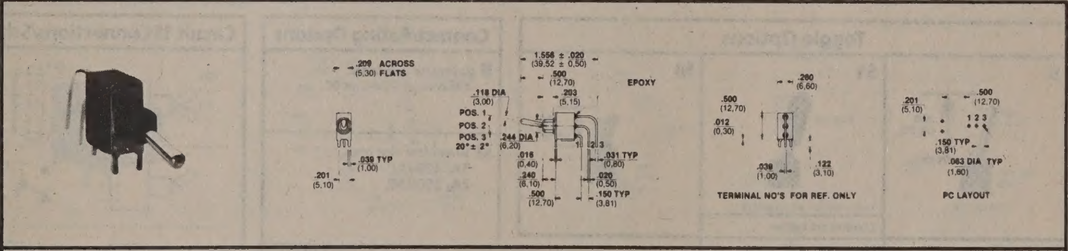

.240 (6,10)
.031 TYP (0,80)
20° ± 2°
POS. 1
POS. 2
POS. 3
.203 (5,15)
.020 TYP (0,50)
.185 TYP (4,70)
.244 DIA (6,20)
.209 ACROSS (5,30) FLATS
.016 (0,40)
.118 DIA (3,00)
.039 TYP (1,00)
.201 (5,10)
.500 (12,70)
.500 TYP (12,70)
.150 TYP (3,81)
1.410 ± .020 (35,81 ± 0,50)
.445 (11,30)
.500 (12,70)
EPOXY
.012 TYP (0,30)
.122 TYP (3,10)
.150 TYP (3,81)
.500 TYP (12,70)
.201 (5,10)
.185 TYP (4,70)
.063 DIA TYP (1,60)
TERMINAL NO'S FOR REF. ONLY
PC LAYOUT

Circuit 11 Connections/Schematic on following page.

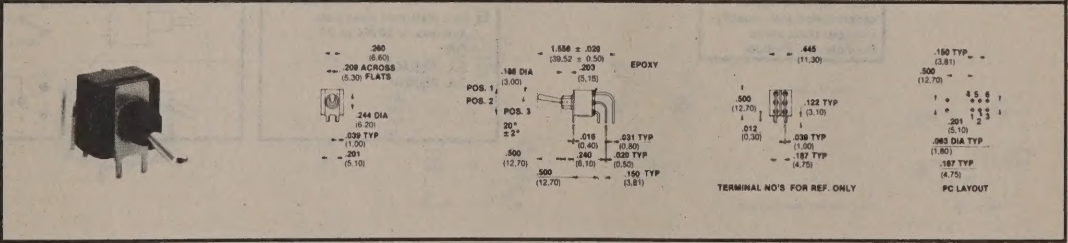
AV2 TERMINATION OPTION

Switching Function

MODEL NO.	Pos 3	Pos 2	Pos 1
L1010	ON	NONE	ON
L1030	ON	OFF	ON
L1050	(ON)	OFF	(ON)
L1070	ON	OFF	(ON)
L1080	ON	NONE	(ON)
Term. Conn.	2-3	OPEN	2-1
Schematic	2(Common) 1 3		


.209 ACROSS (5,30) FLATS
1.556 ± .020 (39,52 ± 0,50)
.500 (12,70)
EPOXY
.118 DIA (3,00)
.203 (5,15)
POS. 1
POS. 2
POS. 3
20° ± 2°
.244 DIA (6,20)
.039 TYP (1,00)
.201 (5,10)
.016 (0,40)
.240 (6,10)
.500 (12,70)
.031 TYP (0,80)
.020 (0,50)
.150 TYP (3,81)
.260 (6,60)
.500 (12,70)
.012 (0,30)
.039 (1,00)
.122 (3,10)
TERMINAL NO'S FOR REF. ONLY
.201 (5,10)
.500 (12,70)
.150 TYP (3,81)
.063 DIA TYP (1,60)
PC LAYOUT

MODEL NO.	Pos 3	Pos 2	Pos 1
L2010	ON	NONE	ON
L2030	ON	OFF	ON
L2050	(ON)	OFF	(ON)
L2070	ON	OFF	(ON)
L2080	ON	NONE	(ON)
L2110	ON	ON	ON
Term. Conn.	2-3, 5-6	OPEN	2-1, 5-4
Schematic	2(Common) 5(Common) 1 3 4 6		

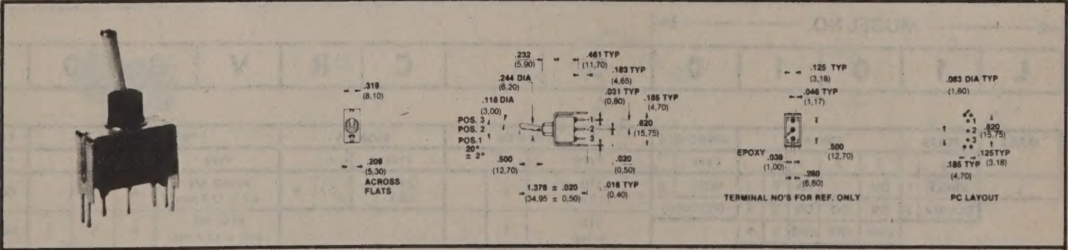

.260 (6,60)
.209 ACROSS (5,30) FLATS
.244 DIA (6,20)
.039 TYP (1,00)
.201 (5,10)
1.556 ± .020 (39,52 ± 0,50)
.203 (5,15)
EPOXY
.118 DIA (3,00)
POS. 1
POS. 2
POS. 3
20° ±2°
.016 (0,40)
.240 (6,10)
.031 TYP (0,80)
.020 TYP (0,50)
.500 (12,70)
.150 TYP (3,81)
.445 (11,30)
.500 (12,70)
.012 (0,30)
.122 TYP (3,10)
.039 TYP (1,00)
.187 TYP (4,75)
TERMINAL NO'S FOR REF. ONLY
.150 TYP (3,81)
.500 (12,70)
.201 (5,10)
.063 DIA TYP (1,60)
.187 TYP (4,75)
PC LAYOUT

Circuit 11 Connections/Schematic on following page.

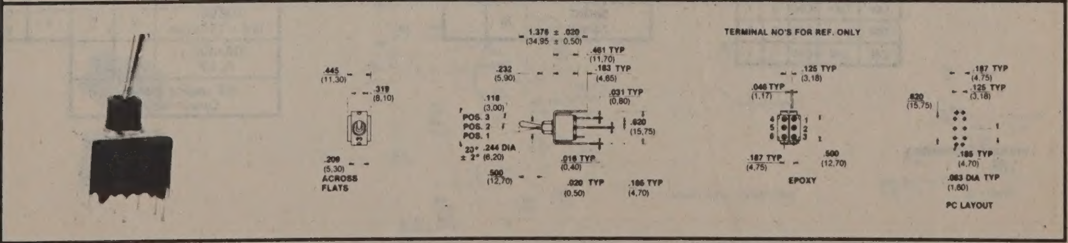
V30 TERMINATION OPTION

Switching Function

MODEL NO.	Pos 3	Pos 2	Pos 1
L1010	ON	NONE	ON
L1030	ON	OFF	ON
L1050	(ON)	OFF	(ON)
L1070	ON	OFF	(ON)
L1080	ON	NONE	(ON)
Term. Conn.	2-3	OPEN	2-1
Schematic	2(Common) 1 3		


.319 (8,10)
.209 (5,30) ACROSS FLATS
.232 (5,90)
.461 TYP (11,70)
.183 TYP (4,65)
.244 DIA (6,20)
.031 TYP (0,80)
.185 TYP (4,70)
.118 DIA (3,00)
POS. 3
POS. 2
POS. 1
20° ± 2°
.620 (15,75)
.500 (12,70)
.020 (0,50)
1.376 ± .020 (34,95 ± 0,50)
.016 TYP (0,40)
.125 TYP (3,18)
.046 TYP (1,17)
EPOXY
.039 (1,00)
.500 (12,70)
.260 (6,60)
TERMINAL NO'S FOR REF. ONLY
.063 DIA TYP (1,60)
.620 (15,75)
.125 TYP (3,18)
.185 TYP (4,70)
PC LAYOUT

MODEL NO.	Pos 3	Pos 2	Pos 1
L2010	ON	NONE	ON
L2030	ON	OFF	ON
L2050	(ON)	OFF	(ON)
L2070	ON	OFF	(ON)
L2080	ON	NONE	(ON)
L2110	ON	ON	ON
Term. Conn.	2-3, 5-6	OPEN	2-1, 5-4
Schematic	2(Common) 5(Common) 1 3 4 6		


1.376 ± .020 (34,95 ± 0,50)
.461 TYP (11,70)
.445 (11,30)
.319 (8,10)
.232 (5,90)
.183 TYP (4,65)
.031 TYP (0,80)
.118 (3,00)
POS. 3
POS. 2
POS. 1
20° ± 2°
.244 DIA (6,20)
.620 (15,75)
.209 (5,30) ACROSS FLATS
.500 (12,70)
.016 TYP (0,40)
.020 TYP (0,50)
.185 TYP (4,70)
TERMINAL NO'S FOR REF. ONLY
.125 TYP (3,18)
.046 TYP (1,17)
.187 TYP (4,75)
.500 (12,70)
EPOXY
.187 TYP (4,75)
.125 TYP (3,18)
.620 (15,75)
.185 TYP (4,70)
.063 DIA TYP (1,60)
PC LAYOUT

Circuit 11 Connections/Schematic on following page.

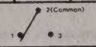
For More Information. Circle No. 457

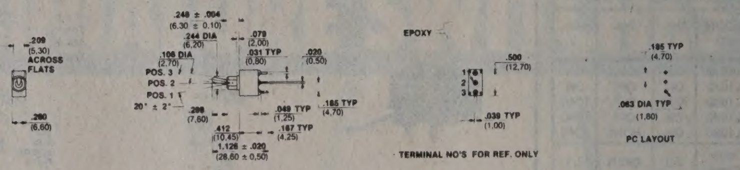
COOPER INDUSTRIES
ARROW HART
103 HAWTHORN STREET/HARTFORD, CT 06101/(203) 249-8471

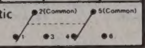
L Series Washable Toggles

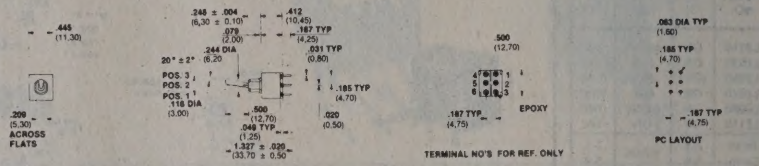
C TERMINATION OPTION (Recommended ONLY for applications providing proper bushing support.)

Switching Function

MODEL NO.	Pos 3	Pos 2	Pos 1
L1010	ON	NONE	ON
L1030	ON	OFF	ON
L1050	(ON)	OFF	(ON)
L1070	ON	OFF	(ON)
L1080	ON	NONE	(ON)
Term. Conn.	2-3	OPEN	2-1
Schematic	 2(Common) 1 3		


.209
(5,30)
ACROSS
FLATS
.260
(6,60)
.248 ± .004
(6,30 ± 0.10)
.244 DIA
(6,20)
.079
(2,00)
.106 DIA
(2,70)
.031 TYP
(0,80)
.020
(0,50)
POS. 3
POS. 2
POS. 1
20° ± 2°
.299
(7,60)
.049 TYP
(1,25)
.185 TYP
(4,70)
.412
(10,45)
.167 TYP
(4,25)
1.126 ± .020
(28,60 ± 0,50)
EPOXY
.500
(12,70)
1
2
3
.039 TYP
(1,00)
TERMINAL NO'S FOR REF. ONLY
.185 TYP
(4,70)
.063 DIA TYP
(1,60)
PC LAYOUT

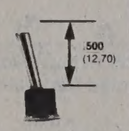
MODEL NO.	Pos 3	Pos 2	Pos 1
L2010	ON	NONE	ON
L2030	ON	OFF	ON
L2050	(ON)	OFF	(ON)
L2070	ON	OFF	(ON)
L2080	ON	NONE	(ON)
L2110	ON	ON	ON
Term. Conn.	2-3, 5-6	OPEN	2-1, 5-4
Schematic	 2(Common) 5(Common) 1 3 4 6		


.445
(11,30)
.209
(5,30)
ACROSS
FLATS
.248 ± .004
(6,30 ± 0.10)
.412
(10,45)
.079
(2,00)
.167 TYP
(4,25)
.244 DIA
(6,20
.031 TYP
(0,80)
20° ± 2°
POS. 3
POS. 2
POS. 1
.118 DIA
(3,00)
.185 TYP
(4,70)
.500
(12,70)
.049 TYP
(1,25)
.020
(0,50)
1.327 ± .020
(33,70 ± 0,50)
.500
(12,70)
4
5
6
1
2
3
.187 TYP
(4,75)
EPOXY
TERMINAL NO'S FOR REF. ONLY
.063 DIA TYP
(1,60)
.185 TYP
(4,70)
.187 TYP
(4,75)
PC LAYOUT

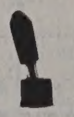
Circuit 11 Connections / Schematic below.

Toggle Options

S



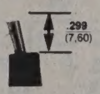
S1



Color chart below.

Plastic cap U270 may be ordered separately. Specify color per chart below. Example: U272 = Black

M



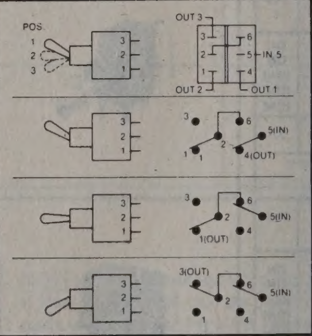
Contact/Rating Options

B Gold plate over brass.
.4VA max. @ 20VAC or DC.

Q Silver plate over brass.
5A, 125VAC
2A, 250VAC

G Gold plate over silver plate.
.4VA max. @ 20VAC or DC.
OR
5A, 125VAC
2A, 250VAC

Circuit 11 Connections/Schematic


POS.
1
2
3
OUT 3
3
2
1
6
5
4
IN 5
OUT 2
OUT 1
5(IN)
4(OUT)
1(OUT)
3(OUT)
5(IN)

To specify switch, insert desired codes and suffixes. Write catalog number: L1010SCRV30BE* (example).
Packaging note: Add * to catalog number for 250/carton OEM packaging. Without *, packaging is 25/carton individually polybagged.

|◄—— MODEL NO. ——►|

L	1	0	1	0	S		C	R	V	3	0	B	E	

SERIES	
L	

POLES NO.	
SINGLE	1
DOUBLE	2

CIRCUIT 3	2	1		
ON	—	ON	0	1
ON	OFF	ON	0	3
(ON)	OFF	(ON)	0	5
ON	OFF	(ON)	0	7
ON	—	(ON)	0	8
ON	ON	ON	1	1

APPROVALS TYPE	
NONE	0
(PENDING)	

ACTUATOR TYPE		
STD. 12.7 mm	S	
STD. w/cap	S	1
SHORT 7.6 mm	M	

BUSHING TYPE		
O-RING INT.	C	R

TERMINATION TYPE			
HORIZ. MT. 4.7 × 12.7 mm	A		
VERT. MT. 3.81 × 12.7 mm	A	V	2
SUP. BKT. 12.8 × 15.75 mm	V	3	0
STRAIGHT PC 4.7	C		
.200″ spacing available. Consult factory.			

CONTACT TYPE	
GOLD	B
SILVER	Q
Gold/ Silver	G

SEAL TYPE	
EPOXY	E

COLOR (S1 Only)	
Blue	1
Black	2
Green	3
Grey	4
Yellow	5
Red	6
White	7
Orange	9

( ) indicates momentary

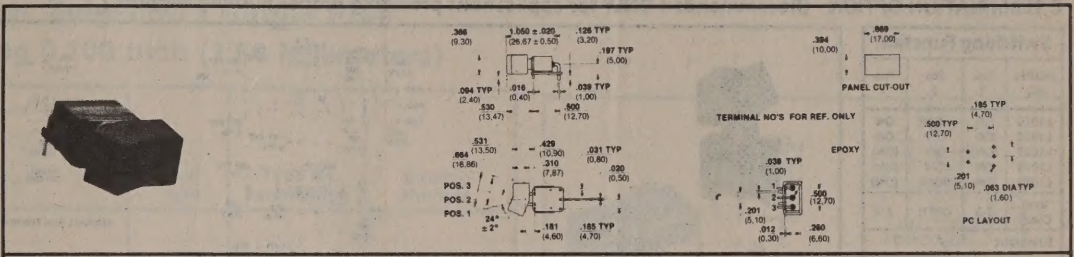
COOPER INDUSTRIES
ARROW HART
103 HAWTHORN STREET/HARTFORD, CT 06101/(203) 249-8471

L Series Washable Rockers

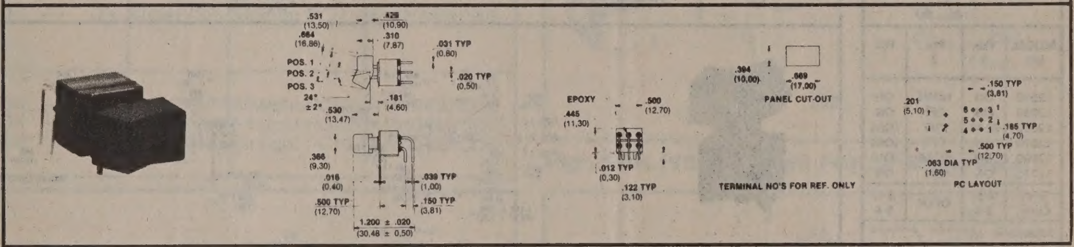
A TERMINATION OPTION

Switching Function

MODEL NO.	Pos 3	Pos 2	Pos 1
L1010	ON	NONE	ON
L1030	ON	OFF	ON
L1050	(ON)	OFF	(ON)
L1070	ON	OFF	(ON)
L1080	ON	NONE	(ON)
Term. Conn.	2-3	OPEN	2-1
Schematic	1 2(Common) 3		


.366 (9.30)
1.050 ± .020 (26.67 ± 0.50)
.126 TYP (3.20)
.197 TYP (5.00)
.094 TYP (2.40)
.016 (0.40)
.039 TYP (1.00)
.530 (13.47)
.500 (12.70)
.531 (13.50)
.664 (16.86)
.429 (10.90)
.310 (7.87)
.031 TYP (0.80)
.020 (0.50)
POS. 3
POS. 2
POS. 1
24° ±2°
.181 (4.60)
.185 TYP (4.70)
.394 (10.00)
.669 (17.00)
PANEL CUT-OUT
TERMINAL NO'S FOR REF. ONLY
EPOXY
.039 TYP (1.00)
.201 (5.10)
.012 (0.30)
.260 (6.60)
.500 (12.70)
.185 TYP (4.70)
.500 TYP (12.70)
.201 (5.10)
.063 DIA TYP (1.60)
PC LAYOUT

MODEL NO.	Pos 3	Pos 2	Pos 1
L2010	ON	NONE	ON
L2030	ON	OFF	ON
L2050	(ON)	OFF	(ON)
L2070	ON	OFF	(ON)
L2080	ON	NONE	(ON)
L2110	ON	ON	ON
Term. Conn.	2-3, 5-6	OPEN	2-1, 5-4
Schematic	1 2(Common) 3 4 5(Common) 6		

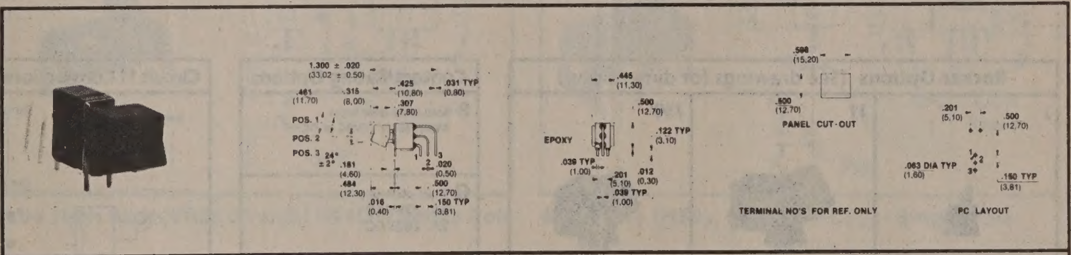

.531 (13.50)
.664 (16.86)
.429 (10.90)
.310 (7.87)
.031 TYP (0.80)
POS. 1
POS. 2
POS. 3
.020 TYP (0.50)
24° ±2°
.530 (13.47)
.181 (4.60)
.366 (9.30)
.016 (0.40)
.039 TYP (1.00)
.500 TYP (12.70)
.150 TYP (3.81)
1.200 ± .020 (30.48 ± 0.50)
EPOXY
.445 (11.30)
.500 (12.70)
.012 TYP (0.30)
.122 TYP (3.10)
.394 (10.00)
.669 (17.00)
PANEL CUT-OUT
TERMINAL NO'S FOR REF. ONLY
.150 TYP (3.81)
.201 (5.10)
.185 TYP (4.70)
.500 TYP (12.70)
.063 DIA TYP (1.60)
PC LAYOUT

Circuit 11 Connections/Schematic on opposite page.

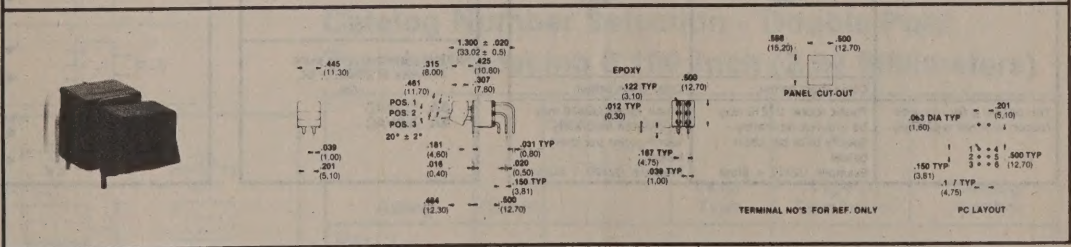
AV2 TERMINATION OPTION

Switching Function

MODEL NO.	Pos 3	Pos 2	Pos 1
L1010	ON	NONE	ON
L1030	ON	OFF	ON
L1050	(ON)	OFF	(ON)
L1070	ON	OFF	(ON)
L1080	ON	NONE	(ON)
Term. Conn.	2-3	OPEN	2-1
Schematic	1 2(Common) 3		


1.300 ± .020 (33.02 ± 0.50)
.461 (11.70)
.315 (8.00)
.425 (10.80)
.031 TYP (0.80)
.307 (7.80)
POS. 1
POS. 2
POS. 3
24° ±2°
.181 (4.60)
.484 (12.30)
.020 (0.50)
.500 (12.70)
.016 (0.40)
.150 TYP (3.81)
.445 (11.30)
.500 (12.70)
EPOXY
.122 TYP (3.10)
.039 TYP (1.00)
.201 (5.10)
.012 (0.30)
.039 TYP (1.00)
.598 (15.20)
.500 (12.70)
PANEL CUT-OUT
TERMINAL NO'S FOR REF. ONLY
.201 (5.10)
.500 (12.70)
.063 DIA TYP (1.60)
.150 TYP (3.81)
PC LAYOUT

MODEL NO.	Pos 3	Pos 2	Pos 1
L2010	ON	NONE	ON
L2030	ON	OFF	ON
L2050	(ON)	OFF	(ON)
L2070	ON	OFF	(ON)
L2080	ON	NONE	(ON)
L2110	ON	ON	ON
Term. Conn.	2-3, 5-6	OPEN	2-1, 5-4
Schematic	1 2(Common) 3 4 5(Common) 6		


.445 (11.30)
1.300 ± .020 (33.02 ± 0.5)
.315 (8.00)
.425 (10.80)
.461 (11.70)
.307 (7.80)
POS. 1
POS. 2
POS. 3
20° ± 2°
.039 (1.00)
.201 (5.10)
.181 (4.60)
.016 (0.40)
.031 TYP (0.80)
.020 (0.50)
.150 TYP (3.81)
.484 (12.30)
.500 (12.70)
EPOXY
.122 TYP (3.10)
.500 (12.70)
.012 TYP (0.30)
.187 TYP (4.75)
.039 TYP (1.00)
.598 (15.20)
.500 (12.70)
PANEL CUT-OUT
TERMINAL NO'S FOR REF. ONLY
.063 DIA TYP (1.60)
.201 (5.10)
.500 TYP (12.70)
.150 TYP (3.81)
.187 TYP (4.75)
PC LAYOUT

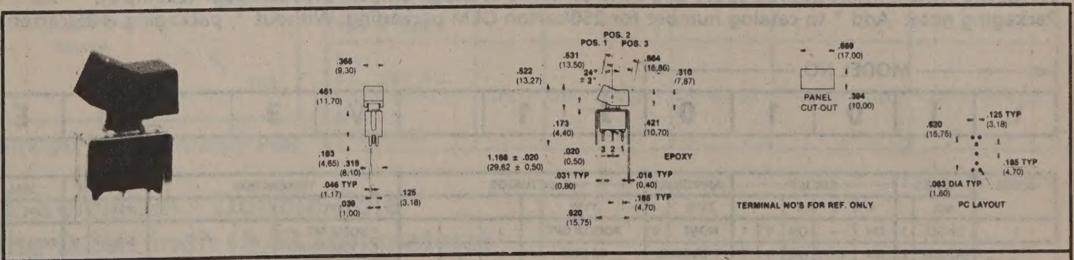
May differ from industry standard.

Circuit 11 Connections/Schematic on opposite page.

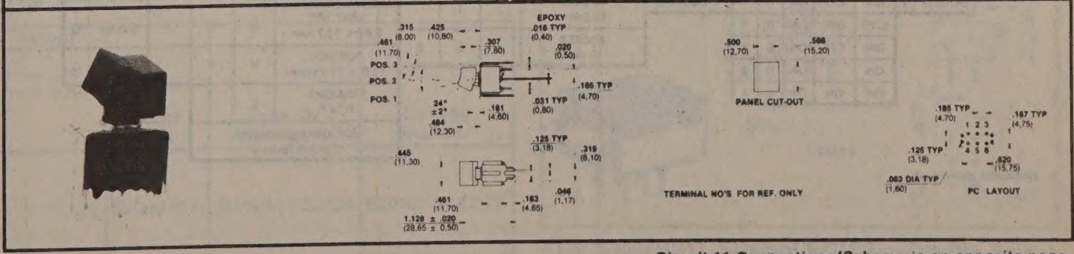
V3 TERMINATION OPTION

Switching Function

MODEL NO.	Pos 3	Pos 2	Pos 1
L1010	ON	NONE	ON
L1030	ON	OFF	ON
L1050	(ON)	OFF	(ON)
L1070	ON	OFF	(ON)
L1080	ON	NONE	(ON)
Term. Conn.	2-3	OPEN	2-1
Schematic	1 2(Common) 3		


POS. 2
POS. 1
POS. 3
.366 (9.30)
.531 (13.50)
.664 (16.86)
.522 (13.27)
24° ±2°
.310 (7.87)
.461 (11.70)
.173 (4.40)
.421 (10.70)
.183 (4.65)
.319 (8.10)
.046 TYP (1.17)
.039 (1.00)
.125 (3.18)
1.166 ± .020 (29.62 ± 0.50)
.020 (0.50)
3 2 1
EPOXY
.031 TYP (0.80)
.016 TYP (0.40)
.185 TYP (4.70)
.620 (15.75)
.669 (17.00)
PANEL CUT-OUT
.394 (10.00)
TERMINAL NO'S FOR REF. ONLY
.125 TYP (3.18)
.620 (15.75)
.185 TYP (4.70)
.063 DIA TYP (1.60)
PC LAYOUT

MODEL NO.	Pos 3	Pos 2	Pos 1
L2010	ON	NONE	ON
L2030	ON	OFF	ON
L2050	(ON)	OFF	(ON)
L2070	ON	OFF	(ON)
L2080	ON	NONE	(ON)
L2110	ON	ON	ON
Term. Conn.	2-3, 5-6	OPEN	2-1, 5-4
Schematic	1 2(Common) 3 4 5(Common) 6		


EPOXY
.315 (8.00)
.425 (10.80)
.016 TYP (0.40)
.461 (11.70)
.307 (7.80)
.020 (0.50)
POS. 3
POS. 2
POS. 1
.185 TYP (4.70)
24° ±2°
.181 (4.60)
.031 TYP (0.80)
.484 (12.30)
.125 TYP (3.18)
.445 (11.30)
.319 (8.10)
.046 (1.17)
.461 (11.70)
.183 (4.65)
1.128 ± .020 (28.65 ± 0.50)
.500 (12.70)
.598 (15.20)
PANEL CUT-OUT
TERMINAL NO'S FOR REF. ONLY
.185 TYP (4.70)
.187 TYP (4.75)
1 2 3
4 5 6
.125 TYP (3.18)
.620 (15.75)
.063 DIA TYP (1.60)
PC LAYOUT

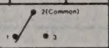
Circuit 11 Connections/Schematic on opposite page.

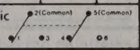
COOPER INDUSTRIES
ARROW HART
103 HAWTHORN STREET/HARTFORD, CT 06101/(203) 249-8471

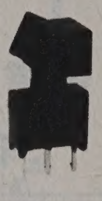
L Series Washable Rockers

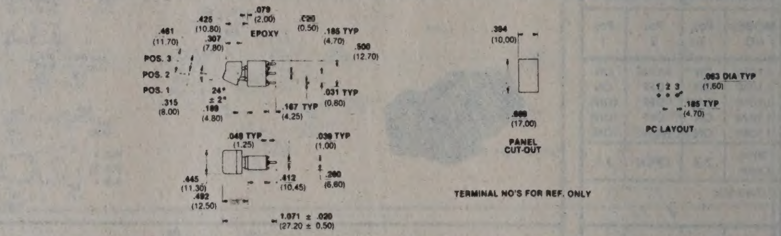
C TERMINATION OPTION (Recommended ONLY for applications providing proper bushing support.)

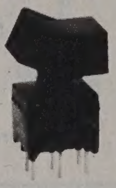
Switching Function

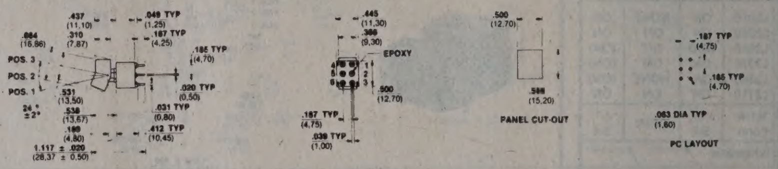
MODEL NO.	Pos 3	Pos 2	Pos 1
L1010 L1030 L1050 L1070 L1080	ON ON (ON) ON ON	NONE OFF OFF OFF NONE	ON ON (ON) (ON) (ON)
Term. Conn.	2-3	OPEN	2-1
Schematic			

MODEL NO.	Pos 3	Pos 2	Pos 1
L2010 L2030 L2050 L2070 L2080 L2110	ON ON (ON) ON ON ON	NONE OFF OFF OFF NONE ON	ON ON (ON) (ON) (ON) ON
Term. Conn.	2-3, 5-6	OPEN	2-1, 5-4
Schematic	 2(Common) 5(Common) 1 3 4 6		




.079
(2,00)
.425
(10,80)
.461
(11,70)
.307
(7,80)
EPOXY
.020
(0,50)
.185 TYP
(4,70)
.500
(12,70)
POS. 3
POS. 2
POS. 1
24°
± 2°
.315
(8,00)
.189
(4,80)
.167 TYP
(4,25)
.031 TYP
(0,80)
.049 TYP
(1,25)
.039 TYP
(1,00)
.445
(11,30)
.492
(12,50)
.412
(10,45)
.260
(6,60)
1.071 ± .020
(27,20 ± 0,50)
.394
(10,00)
.669
(17,00)
PANEL CUT-OUT
1 2 3
.063 DIA TYP
(1,60)
.185 TYP
(4,70)
PC LAYOUT
TERMINAL NO'S FOR REF. ONLY




.437
(11,10)
.049 TYP
(1,25)
.664
(16,86)
.310
(7,87)
.167 TYP
(4,25)
.185 TYP
(4,70)
POS. 3
POS. 2
POS. 1
.531
(13,50)
.020 TYP
(0,50)
24°
±2°
.538
(13,67)
.031 TYP
(0,80)
.189
(4,80)
.412 TYP
(10,45)
1.117 ± .020
(28,37 ± 0,50)
.445
(11,30)
.366
(9,30)
EPOXY
1
2
3
4
5
6
.500
(12,70)
.187 TYP
(4,75)
.039 TYP
(1,00)
.500
(12,70)
.598
(15,20)
PANEL CUT-OUT
.187 TYP
(4,75)
.185 TYP
(4,70)
.063 DIA TYP
(1,60)
PC LAYOUT

Circuit 11 Connections / Schematic below.

Rocker Options (See drawings for dimensions.)

J	J1	J50
	Color chart below.	Color chart below.
This option is for use with rockers ordered separately.	Plastic rocker U2210 may be ordered separately. Specify color per chart below. Example: U2212 = Black	Plastic rocker U2420 may be ordered separately. Specify color per chart below. Example: U2422 = Black.

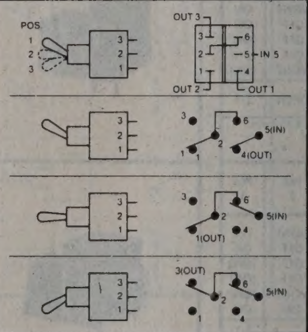
Contact/Rating Options

B Gold plate over brass.
.4VA max. @ 20VAC or DC.

Q Silver plate over brass.
5A, 125VAC
2A, 250VAC

G Gold plate over silver plate.
.4VA max. @ 20VAC or DC.
OR
5A, 125VAC
2A, 250VAC

Circuit 11 Connections/Schematic


POS.
1
2
3
3
2
1
OUT 3
3
6
2
5
IN 5
1
4
OUT 2
OUT 1
3
6
5(IN)
2
1
4(OUT)
3
6
2
5(IN)
1(OUT)
4
3(OUT)
6
5(IN)
2
1
4

To specify switch, insert desired codes and suffixes. Write catalog number: L1010J1V3BE* (example).
Packaging note: Add * to catalog number for 250/carton OEM packaging. Without *, packaging is 25/carton individually polybagged.

|←—— MODEL NO. ——→|

L	1	0	1	0	J	1		V	3		B	E	

SERIES	POLES		CIRCUIT					APPROVALS		ACTUATOR				TERMINATION				CONTACT		SEAL		COLOR	
	NO.		3	2	1			TYPE		TYPE				TYPE				TYPE		TYPE		(J1 J50)	
L	SINGLE	1	ON	—	ON	0	1	NONE	0	ROCKER OPT.	J			HORIZ. MT. 4.7 × 12.7 mm	A			GOLD	B	EPOXY	E	Blue	1
	DOUBLE	2	ON	OFF	ON	0	3	(PENDING)		ROCKER 13.5 mm	J	1										Black	2
			(ON)	OFF	(ON)	0	5			ROCKER 15 mm	J	5	0	VERT. MT. 3.81 × 12.7 mm	A	V	2	SILVER	Q			Green	3
			ON	OFF	(ON)	0	7															Grey	4
			ON	—	(ON)	0	8							SUP. BKT. 12.8 × 15.75 mm	V	3		Gold/ Silver	G			Yellow	5
			ON	ON	ON	1	1															Red	6
														STRAIGHT PC 4.7	C							White	7
														.200" spacing available. Consult factory.								Orange	9

( ) indicates momentary

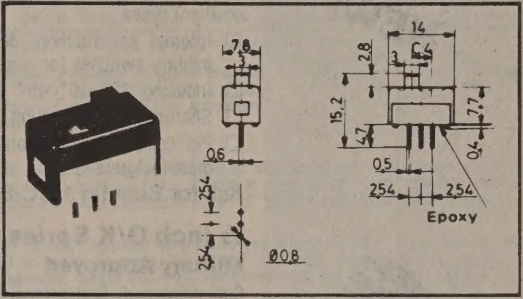
For More Information. Circle No. 457

COOPER INDUSTRIES
ARROW HART
103 HAWTHORN STREET/HARTFORD, CT 06101/(203) 249-8471

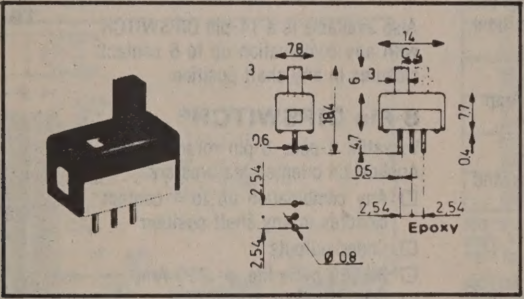
Miniature AC And DC Slide Switches K Series - Single And Double Pole

Catalog Number Selection - Single Pole Terminal Spacing 0.100 Inch (2,54 Millimeters)

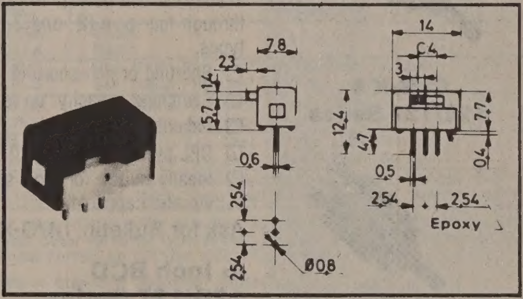
Rating	Circuit	Action	Lever Type	Type Of Termination	Catalog Number
Max.: 100mA, 30V DC Min.: 10μA, 5V DC: 10mA, 50mV	SPDT	On — On	Slide(VS2)	Straight PC(C)	K1010VS2CBE
Max.: 4A, 125V AC: 2A, 250V AC Min.: 100mA, 10V	SPDT	On — On On — On On — On	Slide(VS2) Slide(HS1) Slide(VS3)	Straight PC(C) Straight PC(C) Straight PC(C)	K1010VS2CQE K1010HS1CQE K1010VS3CQE


7,8
0,6
2,54
2,54
Ø0,8
14
C4
3
2,8
15,2
4,7
7,7
0,4
0,5
2,54
2,54
Epoxy

High Slide (VS2), Straight PC(C) - Single Pole

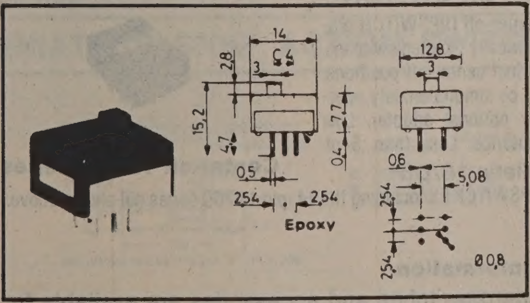

7,8
3
6
18,4
4,7
0,6
2,54
2,54
Ø 0,8
14
C4
3
7,7
0,4
0,5
2,54
2,54
Epoxy

Extra High Slide(VS3), Straight PC(C) - Single Pole


7,8
2,3
5,7
1,4
0,6
2,54
2,54
Ø0,8
14
C4
3
12,4
4,7
7,7
0,4
0,5
2,54
2,54
Epoxy

Side Slide (HS1), Straight PC(C) - Single Pole

Catalog Number Selection - Double Pole Terminal Spacing 0.100 Inch (2,54 Millimeters)

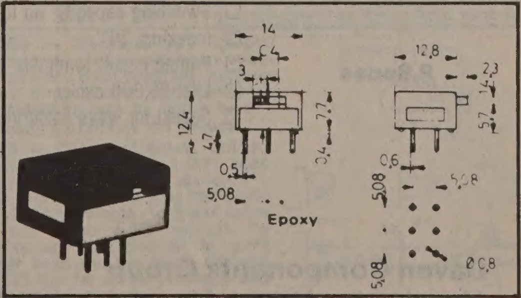

14
C4
3
2,8
15,2
4,7
7,7
0,4
0,5
2,54
2,54
Epoxy
12,8
3
0,6
5,08
2,54
Ø0,8

High Slide(VS2), Straight PC(C) - Double Pole

Rating	Circuit	Action	Lever Type	Type Of Termination	Catalog Number
Max.: 100mA, 30V DC Min.: 10μA, 5V DC: 10mA, 50mV	DPDT	On — On	Slide(VS2)	Straight PC(C)	K2010VS2CBE
Max.: 4A, 125V AC; 2A, 250V AC Min.: 100mA, 10V	DPDT	On — On	Slide(VS2)	Straight PC(C)	K2010VS2CQE

Catalog Number Selection - Double Pole Terminal Spacing 0.200 Inch (5,08 Millimeters)

Rating	Circuit	Action	Lever Type	Type Of Termination	Catalog Number
Max.: 4A, 125V AC 2A, 250V AC Min.: 100mA, 10V	DPDT	On — On	Slide(HS1)	Straight PC(C2)	K2010HS1C2QE

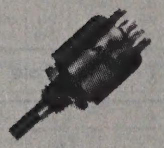

14
C4
3
12,4
4,7
7,7
0,4
0,5
5,08
Epoxy
12,8
2,3
1,4
5,7
0,6
5,08
5,08
5,08
Ø0,8

Side Slide(HS1), Straight PC(C2) - Double Pole

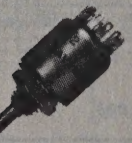
Daven

Miniature Switches

NEW!



C, G/K & 126/127 Series



NEW!

P Series

½ Inch C Series (Die Cast)

Competitively Priced

Subminiature C Series rotary switches are available in one pole, (2- to 12-position) through four pole, (2- and 3-position) types.

- ☐ Internal construction identical to military switches for long life
- ☐ Indexing: 30°, 36°, 45°, 60°
- ☐ Shorting or non-shorting
- ☐ Pin compatible with other major manufacturers

Ask for Bulletin 14/C-STD

½ Inch G/K Series

Military Approved

Subminiature G Series (sealed) and K Series (unsealed) rotary switches are available in one-pole (2- to 12-position) through four-pole (2- and 3- position) types.

- ☐ Shorting or non-shorting
- ☐ Switching capacity: up to 1 Amp
- ☐ Indexing: 30°, 36°, 45°, 60°
- ☐ QPL per MIL-S-3786/20E
- ☐ Ideally suited for high shock and vibration applications

Ask for Bulletin 14/G-K

½ Inch BCD 126/127 Series

Coded Outputs

The Series 126 is available with up to 12 positions fixed stop or continuous rotation binary coded decimal (BCD) with 30° indexing. Its complement, the Series 127, is also furnished with up to 12 positions $\overline{\text{BCD}}$.

- ☐ Gold plated contacts and terminals
- ☐ P/C and standard solder terminals
- ☐ Pin compatible with other major manufacturers
- ☐ One piece bushing and housing

Ask for Bulletin 14/126 BCD

P Series

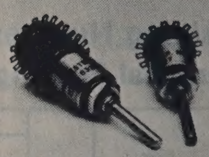
Subminiature P Series rotary switches are available in one-pole (up to 10 positions) and two-pole (up to 5 positions) types.

- ☐ Shorting or non-shorting
- ☐ Switching capacity: up to ½ Amp
- ☐ Indexing: 36°
- ☐ Printed circuit terminals
- ☐ Life: 25,000 cycles
- ☐ Sealed for wave soldering

S Series

The S Series provides up to 10 decks, 20 positions per deck (200 poles), in a miniature (¾" over terminals) bushing mounted rotary switch. Coded outputs.

Ask for Bulletins 14/S STD, 14/S BCD



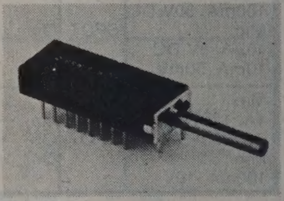
S Series

16-Pin DIPSWITCH®

Versatile 8-pole rotary switch. Application oriented features are:

- ☐ Any combination up to 8 contact closures in any shaft position
- ☐ Coded outputs
- ☐ 1.125 L x .440 W x .232 H
- ☐ 60°, 45°, 36° indexing

Also available is a 14-pin DIPSWITCH with any combination up to 6 contact closures in any shaft position.



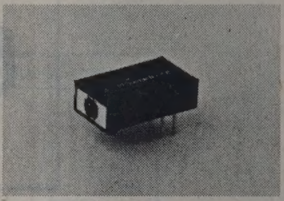
16-pin 12300 Series

8-Pin DIPSWITCH®

Versatile 4-pole, 8-pin rotary switch. Application oriented features are:

- ☐ Any combination up to 4 contact closures in any shaft position
- ☐ Coded outputs
- ☐ 35,000 cycle life @ .250 Amp
- ☐ .730 L x .440 W x .232 H
- ☐ 60°, 45°, 36° indexing

The 16, 14 and 8 pin switches are available with a bushing mounted front panel adapter.



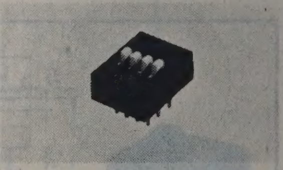
8-pin 12100 Series

Center-Off DIPSWITCH®

This 12-pin center-off DIPSWITCH provides four electrically isolated switches, each with distinct center-off positions. Switches may be simultaneously operated with our optional adapter. Low contact capacitance. Less than .5 pf.

Ask for Bulletin 18/DIP

(Covers all DIPSWITCHES including the 14-pin 11700 series not shown above.)



Center-off 12000 Series

For More Information

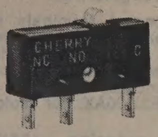
Many standard switches and accessories are available for immediate delivery from stock. Standard switches can be modified quickly and economically by our custom design service to meet special application requirements. Contact our sales department, or your local representative, for application assistance and prices. Detailed information is available in free bulletins as noted.

ARMTEC

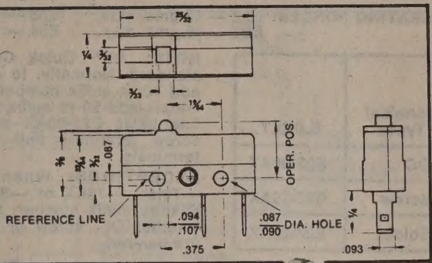
Daven Components Group **Armtec Industries, Inc.**
Manchester Airport, Manchester, NH 03103 Tel: (603) 669-0940 TWX: 710 220 1747

CHERRY Subminiature Snap Action Switches

SERIES E61 — Light Force/SERIES E62 — Standard Force

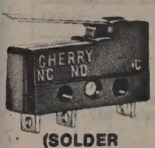


(.093 Q.C. TERMINAL)
E61-00A
E62-00A

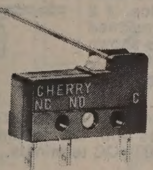

25/32
1/4
3/32
3/32
13/64
OPER. POS.
3/8
23/64
3/32
.087
REFERENCE LINE
.094
.107
.087
.090
DIA. HOLE
1/4
.375
.093

Part No.	Circuitry	Description
E61-00A	SPDT	Button, .093 Q.C. Terminals
E61-10A	SPDT	Button, Solder Terminals
E61-30A	SPDT	Button, .110 Q.C. Terminals
E61-00H	SPDT	5/32″ Actr, Std. Lever Ratio, .093 Q.C. Terminals
E61-10H	SPDT	5/32″ Actr, Std. Lever Ratio, Solder Terminals
E61-30H	SPDT	5/32″ Actr, Std. Lever Ratio, .110 Q.C. Terminals
E61-50H	SPDT	13/32″ Actr, High Lever Ratio, .093 Q.C. Terminals
E61-60H	SPDT	13/32″ Actr, High Lever Ratio, Solder Terminals
E61-80H	SPDT	13/32″ Actr, High Lever Ratio, .110 Q.C. Terminals
E61-00K	SPDT	13/64″ Roller Actr, Std. Lever Ratio, .093 Q.C. Terminals
E61-10K	SPDT	13/64″ Roller Actr, Std. Lever Ratio, Solder Terminals
E61-30K	SPDT	13/64″ Roller Actr, Std. Lever Ratio, .110 Q.C. Terminals
E61-50K	SPDT	21/64″ Roller Actr, High Lever Ratio, .093 Q.C. Terminals
E61-60K	SPDT	21/64″ Roller Actr, High Lever Ratio, Solder Terminals
E61-80K	SPDT	21/64″ Roller Actr, High Lever Ratio, .110 Q.C. Terminals

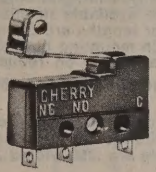
Note: To specify 10.1 Amps. merely change the Prefix E61 to E62.



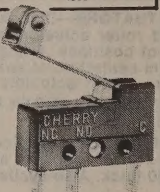
(SOLDER TERMINAL)
E61-00H
E62-00H



E61-50H
E62-50H



E61-00K
E62-00K

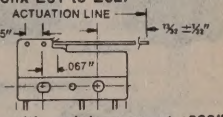


E61-50K
E62-50K

SWITCH BODY: 25/32″ x 23/64″ x ¼″

RATINGS: E61 — 5 Amps. 125/250 VAC
E62 — 10.1 Amps. 125/250 VAC — ¼ H.P. 125 VAC

Und. Lab. Inc. listed and CSA approved.

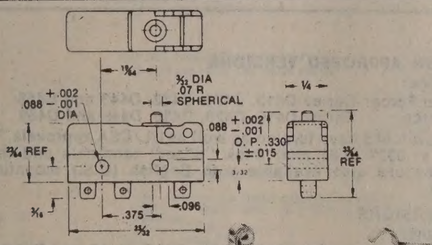

ACTUATION LINE
.125″
13/32 ±1/32″
.067″

ACTUATORS — Actuator lengths are dimensioned from centerline of switch mounting hole as shown. Other actuators available on request.

TERMINALS — Subminiature series is available with quick connect .093″ wide (mates with AMP part no. 60432-1) and .110″ wide (mates with AMP part no. 42399-2). Also available in short solder terminal .139″ wide x .125″ long.

NOTE: .093″ Quick Connect terminals are standard. To order solder terminals add 10 to suffix number. To order .110″ QC terminals add 30 to suffix number. (Example: basic E61-00A becomes E61-10A for solder terminals and E61-30A for .110″ QC terminals.

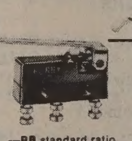
SERIES E91 — 5 Amp./Series E92 — 11 Amp.


13/64
3/32 DIA
.07 R
SPHERICAL
+.002
.088 −.001
DIA
1/4
.088 +.002 −.001
O. P. .330
±.015
23/64 REF
3/32
33/64 REF
3/16
.375
.096
25/32

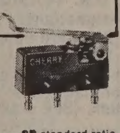
Basic Button
—AA standard ratio
unsealed

Flat Leaf
—LB standard ratio
unsealed

—LM standard ratio
unsealed



—RB standard ratio
unsealed



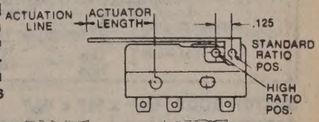
—SB standard ratio
unsealed

SWITCH BODY: 23/64″ x 25/32″ x ¼″

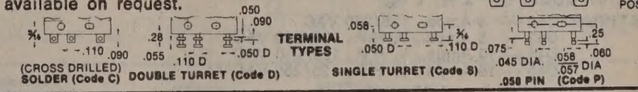
TERMINALS — Choice of Solder/Cross Drilled, Double Turret, .058″ Pin or Single Turret.

Part No.	Description
E913-C1AA	Basic
E923-C1AA	Basic
E913-C1LB	Std. Ratio Flat Leaf Act. (Act. length .285″)
E923-C1LB	Std. Ratio Flat Leaf Act. (Act. length .285″)
E913-C1LM	Std. Ratio Act. (Act. length 1.765″)
E923-C1LM	Std. Ratio Act. (Act. length 1.765″)
E913-C1RB	Std. Ratio Act. (Act. length .250″) Roller
E923-C1RB	Std. Ratio Act. (Act. length .250″) Roller
E913-C1SB	Std. Ratio Simulated Roller Act. (Act. length .245″)
E923-C1SB	Std. Ratio Simulated Roller Act. (Act. length .245″)

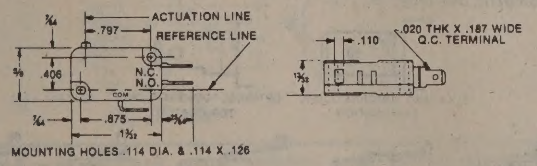
NOTE: First letter (C) in suffix signifies Solder/Cross Drilled terminal (standard). To order other terminal type substitute "C" with "D" for Double Turret, "S" for Single Turret, or "P" for .058″ Pin terminal.

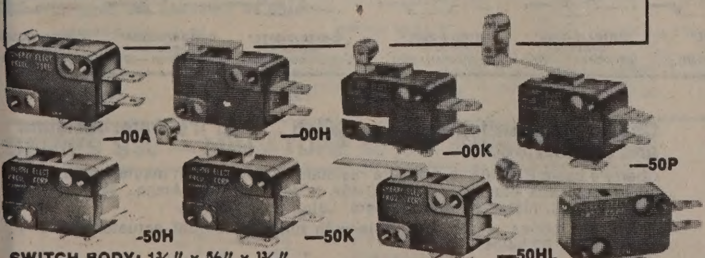

ACTUATION LINE
ACTUATOR LENGTH
.125
STANDARD RATIO POS.
HIGH RATIO POS.

ACTUATORS — Standard external hinged lever and roller actuators are available in choice of 2 pivot positions (standard ratio and high ratio). Actuator lengths are dimensioned from centerline of switch mounting hole as shown. Other actuators available on request.


3/16
.110
.090
(CROSS DRILLED)
SOLDER (Code C)
.050
.090
.28
.055
.110 D
.050 D
DOUBLE TURRET (Code D)
TERMINAL TYPES
.058
3/16
.050 D
.110 D
SINGLE TURRET (Code S)
.25
.075
.060
.045 DIA.
.058
.057
DIA
.058 PIN
(Code P)

MINIATURE SNAP ACTION SWITCHES SERIES E22/E23/E33/E34 (Standard Force)


7/64
ACTUATION LINE
.797
REFERENCE LINE
5/8
.406
N.C.
N.O.
COM
7/64
.875
23/64
1 3/32
MOUNTING HOLES .114 DIA. & .114 X .126
.110
.020 THK X .187 WIDE
Q.C. TERMINAL
13/32


—00A
—00H
—00K
—50P
-50H
—50K
—50HL
—50KL

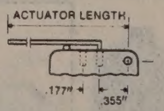
Part No.	Circuitry	Terminal	Description
STANDARD FORCE			
E23-00A	SPDT	QC	Button
E23-10A	SPDT	Screw	Button
E23-20A	SPDT	Solder	Button
E23-00H	SPDT	QC	27/32″ Actr, Std. Ratio
E23-50H	SPDT	QC	1 13/32″ Actr, Std. Ratio
E23-70H	SPDT	Solder	1 13/32″ Actr, Std. Ratio
E23-50HL	SPDT	QC	1 9/16″ Actr, High Ratio
E23-00K	SPDT	QC	13/16″ Roller Actr, Std. Ratio
E23-10K	SPDT	Screw	13/16″ Roller Actr, Std. Ratio
E23-20K	SPDT	Solder	13/16″ Roller Actr, Std. Ratio
E23-50K	SPDT	QC	1 11/32″ Roller Actr, Std. Ratio
E23-70K	SPDT	Solder	1 11/32″ Roller Actr, Std. Ratio
E23-50KL	SPDT	QC	1½″ Roller Actr, High Ratio
E23-00P	SPDT	QC	13/16″ One-Way Roller Actr., Std. Ratio
E23-50P	SPDT	QC	1 11/32″ One-way Roller Actr, Std. Ratio
E23-50PL	SPDT	QC	1½″ One-way Roller Actr, High Ratio

SWITCH BODY: 1 3/32″ x 5/8″ x 13/32″

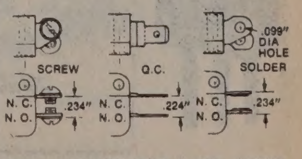
OPERATING FORCES: E22 — 75 gms. max.
E23 — 170 gms. max.
E33 — 285 gms. max.
E33 — 400 gms. max.

RATINGS: E22 — 3 Amps. 125/250 VAC.
E23 — 5 Amps. ¼ H.P. 125/250 VAC
E33 — 10 Amps. ½ H.P. 125/250 VAC
E34 — 15 Amps. ½ H.P. 125/250 VAC

Und. Lab. Inc. listed and CSA approved.


ACTUATOR LENGTH
.177″
.355″

ACTUATORS — Standard type integral hinged lever and roller actuators are available in choice of 2 pivot positions. Actuator lengths are dimensioned from centerline of switch mounting hole as shown here. Other actuators available on request.

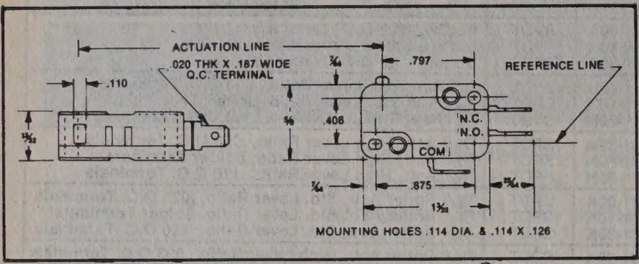

SCREW
Q.C.
.099″ DIA HOLE
SOLDER
N. C.
N. O.
.234″
N. C.
N. O.
.224″
N. C.
N. O.
.234″

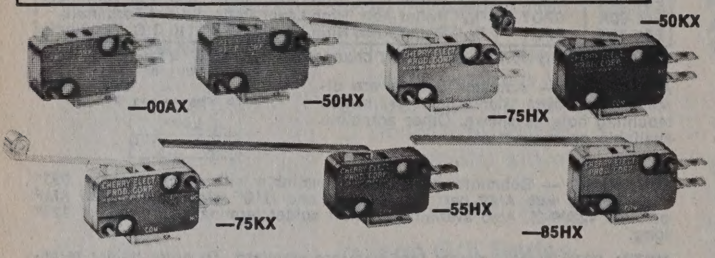
TERMINALS — Choice of Screw, Solder, or Quick Connect Terminals. .187″ wide Quick Connect terminals are standard x .020″ thick. Also available are .250″ wide x .032″ thick QC terminals. To order screw terminals add 10 to suffix number. To order solder terminals add 20 to suffix number. For example: the basic E23-00A becomes E23-10A for screw terminals and E23-20A for solder terminals.

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

CHERRY Light Force Miniature Snap Action Switches

SERIES E22 — SERIES E23/SERIES E33 — SERIES E34 LIGHT FORCE


ACTUATION LINE
.020 THK X .187 WIDE Q.C. TERMINAL
.110
.797
REFERENCE LINE
.406
N.C.
N.O.
COM
.875
MOUNTING HOLES .114 DIA. & .114 X .126


—00AX
—50HX
—75HX
—50KX
—75KX
—55HX
—85HX

SWITCH BODY: 1³⁄₃₂″ x ⅝″ x ¹³⁄₃₂″

RATINGS: E22 Series — 3 Amps., 125/250 VAC
E23 Series — 5 Amps., ¼ H.P., 125/250 VAC
E33 Series — 10 Amps., ½ H.P., 125/250 VAC
E34 Series — 15 Amps., ½ H.P., 125/250 VAC

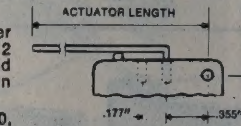
Und. Lab. Inc. listed, and CSA approved.

OPERATING FORCES: E22 — 15 gms. max. E23 — 45 gms. max. E33 — 75 gms. max. E34 — 100 gms. max.

Terminal Types	S.P.D.T.
QC	E22-00AX
Screw	E22-10AX
Solder	E22-20AX

NOTE: .187″ Quick Connect terminals are standard. Normally, to order screw terminals add 10 to suffix number. To order solder terminals add 20 to suffix number. For example: The basic E22-00AX becomes E22-10AX for screw terminals and E22-20AX for solder terminals.

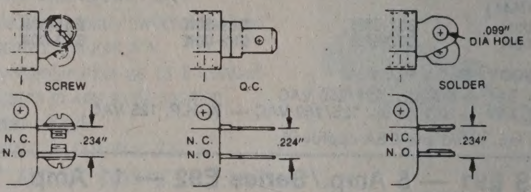
EXCEPTIONS: When ordering —55HX, —75HX, —75KX or —85HX switches, do **not** change suffix number. Simply state on order whether QC, screw or solder terminal types are desired.


ACTUATOR LENGTH
.177″
.355″

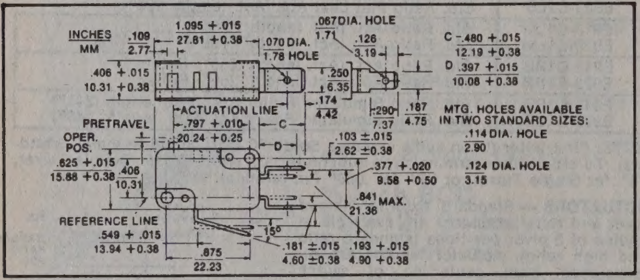
ACTUATORS—Standard type integral hinged lever and roller actuators are available in choice of 2 pivot positions. Actuator lengths are dimensioned from centerline of switch mounting hole as shown here. Other actuators available on request.

ACTUATOR LENGTH INCHES: 1.400, 1.580, 1.340, 1.516, 2.757, 2.932.

TERMINALS — Choice of Screw, Solder, or Quick Connect Terminals. Unless otherwise specified switches are furnished with QC terminals .187 wide x .020 thick. Also available are .250 wide x .032 QC terminals.


SCREW
Q.C.
SOLDER
.099″ DIA HOLE
N.C.
N.O.
.234″
.224″
.234″

D4 INTERNATIONAL MINIATURE SNAP ACTION SWITCH


INCHES
MM
.109 / 2.77
1.095 + .015 / 27.81 + 0.38
.070 DIA. / 1.78 HOLE
.067 DIA. HOLE / 1.71
.126 / 3.19
C -.480 + .015 / 12.19 + 0.38
D .397 + .015 / 10.08 + 0.38
.406 + .015 / 10.31 + 0.38
.250 / 6.35
.174 / 4.42
.290 / 7.37
.187 / 4.75
MTG. HOLES AVAILABLE IN TWO STANDARD SIZES:
.114 DIA. HOLE / 2.90
.124 DIA. HOLE / 3.15
ACTUATION LINE
PRETRAVEL
OPER. POS.
.797 + .010 / 20.24 + 0.25
.103 ±.015 / 2.62 ±0.38
.625 + .015 / 15.88 + 0.38
.406 / 10.31
.377 + .020 / 9.58 + 0.50
.841 / 21.36 MAX.
REFERENCE LINE
.549 + .015 / 13.94 + 0.38
.875 / 22.23
15°
.181 ±.015 / 4.60 ±0.38
.193 + .015 / 4.90 + 0.38

SWITCH BODY: 1³⁄₃₂″ x ⅝″ x ¹³⁄₃₂″

RATINGS: D42 — 3 Amps., 125/250 VAC
D43 — 5 Amps., ¼ H.P., 125/250 VAC**
D44 — 10 Amps., ½ H.P., 125/250 VAC
D45 — 15 Amps., ½ H.P., 125/250 VAC***

Und. Lab. Inc. listed, and CSA approved.

CONTACTS AND RATINGS

	Rating	Contact Material
SERIES (E22) D42	3 amps., 125/250 VAC	Fine Silver
SERIES (E23) D43	5 amps., ¼ H.P.,* 125/250 VAC	Silver Cadmium Oxidized
SERIES (E33) D44	10 amps, ½ H.P., 125/250 VAC	Silver Cadmium Oxidized
SERIES (E34) D45	15 amps., ½ H.P.,** 125/250 VAC	Silver Cadmium Oxidized

* VDE (Germany) rating: 6 amps. ** VDE (Germany) rating: 16 amps.

1. FOREIGN APPROVED VERSIONS

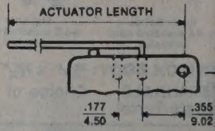
Designations:
Standard Force: Series D413, D423, D433, D443 and D453
Light Force: Series D419, D429, D439, D449 and D459

These D4 switches have foreign as well as UL/CSA approvals. They have .250″ (6.35mm) x .032″ (0.81 mm) thick "offset" terminals and metric mounting holes. They are also available with English (U.S.) mounting holes. (See drawings.)

2. U.S. VERSIONS

Designations:
Standard Force: Series D41C, D42C, D43C, D44C and D45C
Light Force: Series D41L, D42L, D43L, D44L and D45L

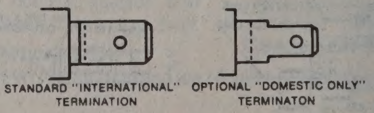
These are D4 switches with UL and CSA approvals for domestic use only. Terminals are "straight" and measure .187″ (4.75 mm) x .020″ (0.50 mm) thick. (See drawings.)

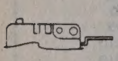

ACTUATOR LENGTH
.177 / 4.50
.355 / 9.02

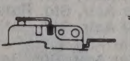
ACTUATORS: Standard type integral hinged lever and roller actuators are available in choice of 2 pivot positions. Actuator lengths are dimensioned from centerline of switch upper mounting hole as shown here. Other actuators available on request.

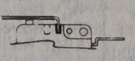
ACTUATOR LENGTH INCHES: .865, 1.400, 1.580, 2.757, .810, 1.340, 1.516, .810, 1.340.

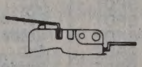
TERMINALS: Choice of two QC terminations: .250″ (6.35 mm) x .032″ (0.81 mm) thick "offset" terminals with foreign as well as UL/CSA approvals . . . or .187″ (4.75 mm) x .020″ (0.50 mm) thick with UL and CSA approval for domestic use only.

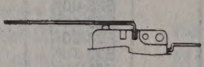

STANDARD "INTERNATIONAL" TERMINATION OPTIONAL "DOMESTIC ONLY" TERMINATON

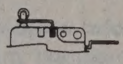

C-R1AA/3-Q3AA* (Similar to Conventional —00A)

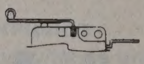

C-R1LA/3-Q3LA* (Similar to Conventional —00H)

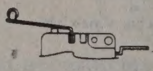

C-R1LD/3-Q3LD* (Similar to Conventional —50H)

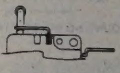

C-R1MD/3-Q3MD* (Similar to Conventional —50HL)

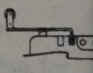

C-R1JL/3-Q3JL* (Similar to Conventional —55H)


C-R1RA/3-Q3RA* (Similar to Conventional —00K)

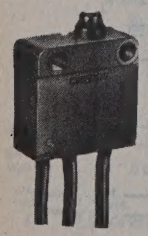

C-R1RC/3-Q3RC* (Similar to Conventional —50K)

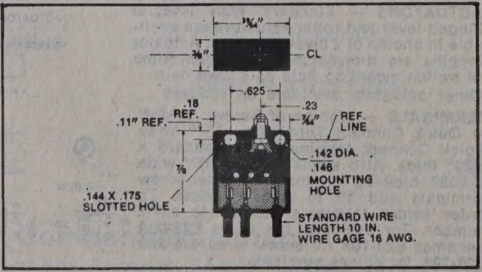

C-R1TC/3-Q3TC* (Similar to Conventional —50KL)


C-R1GA/3-Q3GA* (Similar to Conventional —00P)


C-R1GD/3-Q3 (Similar to Conventional —

SERIES E72 WEATHERPROOF




³⁹⁄₆₄″
⅜″
CL
.625
.18 REF.
.11″ REF.
.23
¾″
REF. LINE
.142 DIA.
.146 MOUNTING HOLE
⅞
.144 X .175 SLOTTED HOLE
STANDARD WIRE LENGTH 10 IN. WIRE GAGE 16 AWG.

Cherry put a switch inside a switch . . . so it's water-resistant and weatherproof!

Cherry's basic E72-40A is moisture resistant. It comes with insulated, 10 inch, 16 gauge leads attached. The E72-40A is rated at 10.1 Amps., ¼ H.P. and 125/250 VAC. Listed by Underwriters' Laboratories, Inc.

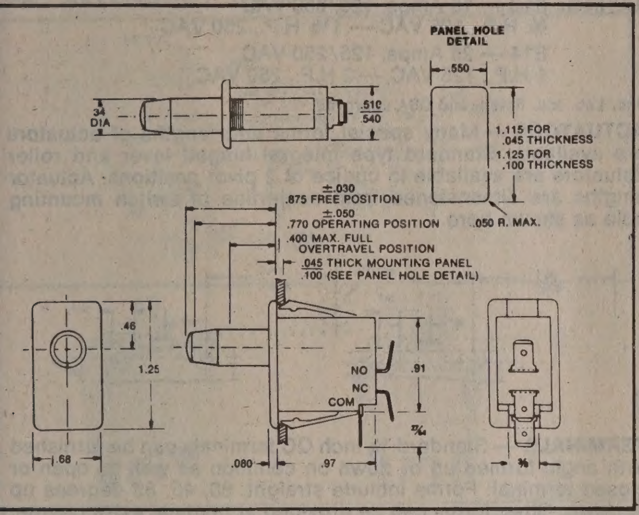
The E72 series is also available with hinged external actuators, Cherry part number E72-40H.

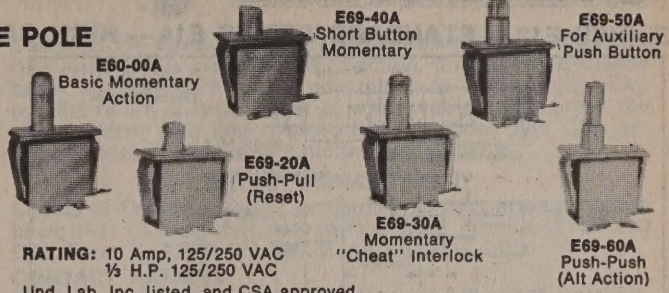
CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

For More Information. Circle No. 459

CHERRY Panel Mount Pushbutton Switches

SERIES E69 — PANEL MOUNT PUSHBUTTON/SINGLE POLE


PANEL HOLE DETAIL
.550
.34 DIA
.510
.540
1.115 FOR .045 THICKNESS
1.125 FOR .100 THICKNESS
±.030
.875 FREE POSITION
±.050
.770 OPERATING POSITION
.050 R. MAX.
.400 MAX. FULL OVERTRAVEL POSITION
.045 THICK MOUNTING PANEL
.100 (SEE PANEL HOLE DETAIL)
.46
1.25
NO
NC
COM
.91
.68
.080
.97
⅜



E60-00A Basic Momentary Action

E69-40A Short Button Momentary

E69-50A For Auxiliary Push Button

E69-20A Push-Pull (Reset)

E69-30A Momentary "Cheat" Interlock

E69-60A Push-Push (Alt Action)

RATING: 10 Amp, 125/250 VAC
⅓ H.P. 125/250 VAC

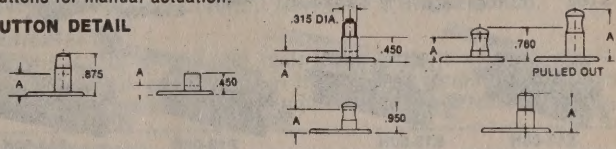
Und. Lab. Inc. listed, and CSA approved.

TERMINALS — This switch series has quick connect terminals .187″ x .020″.

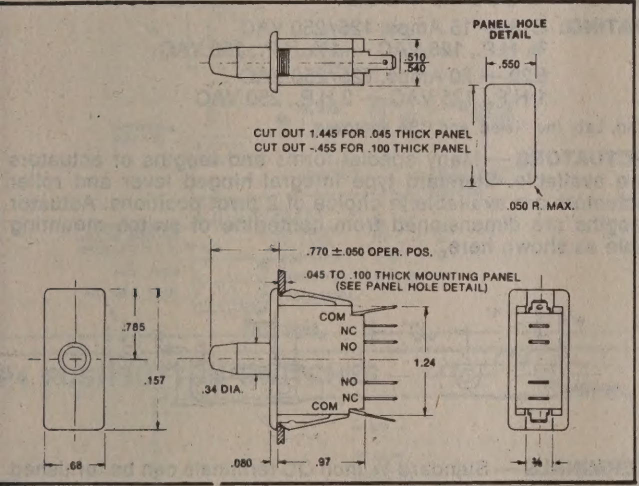
APPLICATIONS — Door and drawer light/interlock switch; test function switch; EDP and business machine starts switch; photocopy machines and other equiment requiring either manual or mechanical actuation and panel mounting.

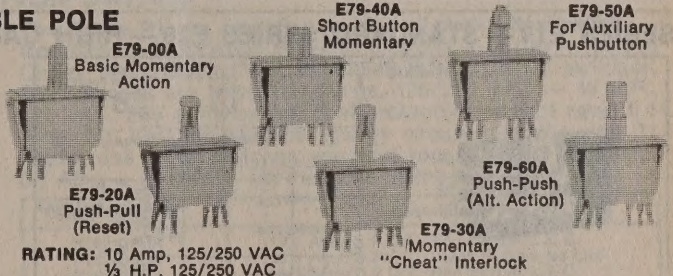
Switch E69-50A has button with special shaft to accept auxiliary push buttons for manual actuation.

BUTTON DETAIL


.315 DIA.
A
.875
.450
.450
.760
PULLED OUT
.950

SERIES E79 — PANEL MOUNT PUSHBUTTON/DOUBLE POLE


PANEL HOLE DETAIL
.510
.540
.550
CUT OUT 1.445 FOR .045 THICK PANEL
CUT OUT -.455 FOR .100 THICK PANEL
.050 R. MAX.
.770 ±.050 OPER. POS.
.045 TO .100 THICK MOUNTING PANEL (SEE PANEL HOLE DETAIL)
COM
NC
NO
NO
NC
COM
1.24
.785
.157
.34 DIA.
.68
.080
.97
⅜



E79-00A Basic Momentary Action

E79-40A Short Button Momentary

E79-50A For Auxiliary Pushbutton

E79-20A Push-Pull (Reset)

E79-60A Push-Push (Alt. Action)

E79-30A Momentary "Cheat" Interlock

RATING: 10 Amp, 125/250 VAC
⅓ H.P. 125/250 VAC

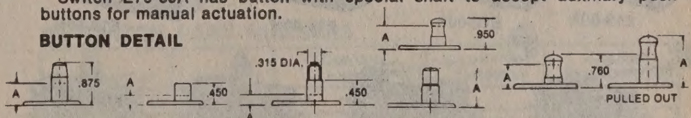
Und. Lab. Inc. listed, and CSA approved.

TERMINALS — This switch series has quick connect terminals .187″ x .020″.

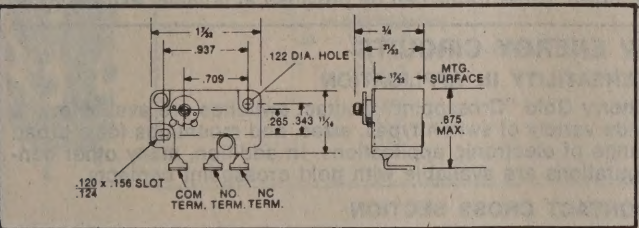
APPLICATIONS — Door and drawer light/interlock switch; test function switch; EDP and business machine start switch; photocopy machines and other equipment requiring either manual or mechanical actuation and panel mounting.

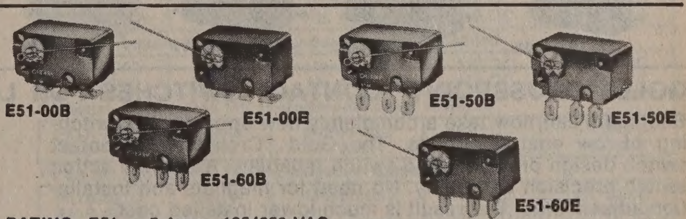
Switch E79-50A has button with special shaft to accept auxiliary push buttons for manual actuation.

BUTTON DETAIL


A
.950
.315 DIA.
.875
.450
.450
.760
PULLED OUT

SERIES E51 — LOW TORQUE SWITCHES


1³⁄₃₂
.937
.709
.122 DIA. HOLE
¾
²¹⁄₃₂
¹⁵⁄₃₂
MTG. SURFACE
.265
.343
¹¹⁄₁₆
.875 MAX.
.120 x .156 SLOT
.124
COM TERM.
NO TERM.
NC TERM.



E51-00B

E51-00E

E51-50B

E51-50E

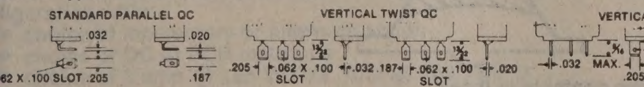
E51-60B

E51-60E

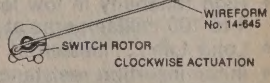
RATING: E51 — 5 Amps, 125/250 VAC

Und. Lab. Inc. listed, and CSA approved.

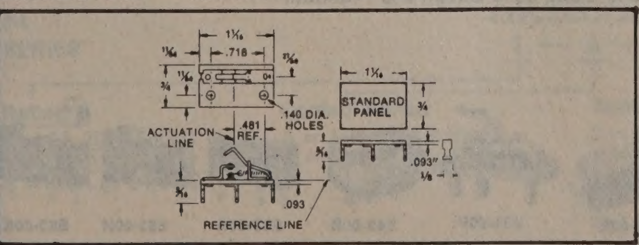
TERMINALS — All terminals are combination quick connect and solder. Several types are available as shown.

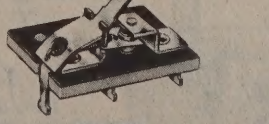

STANDARD PARALLEL QC
.032
.020
62 X .100 SLOT
.205
.187
VERTICAL TWIST QC
.205
.062 X .100 SLOT
.032
.187
.062 x .100 SLOT
.020
VERTICAL STRAIGHT QC
.032
MAX.
.205
.093 DIA. HOLE
.062 x .100 SLOT
.187
.020

ACTUATORS—Wireform actuators are supplied unassembled for each E51 switch. Wireforms may be readily assembled to switch rotor as illustrated below.


WIREFORM No. 14-645
SWITCH ROTOR
CLOCKWISE ACTUATION

SERIES S30 — MINIATURE OPEN TYPE


1⁵⁄₁₆
.718
ACTUATION LINE
.481 REF.
.140 DIA. HOLES
1⅛
STANDARD PANEL
¾
.093″
.093
REFERENCE LINE



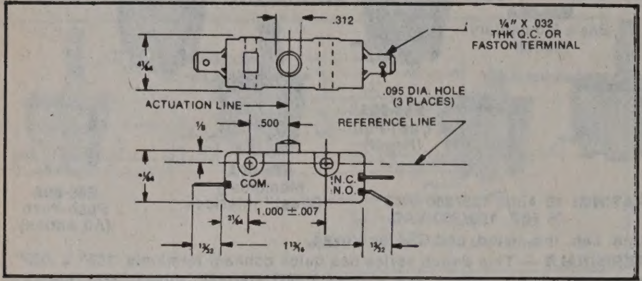
S30-00W

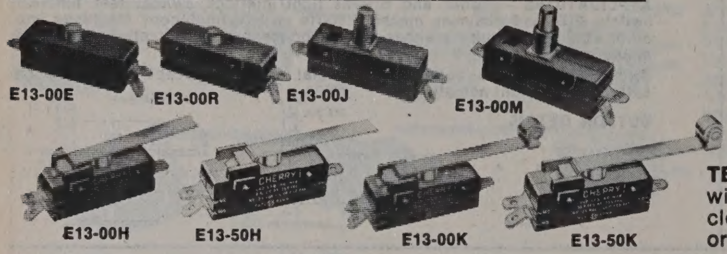
S30-20W

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

CHERRY General Purpose Switches

SERIES E13 — STANDARD/SERIES E14 — HIGH CAPACITY GENERAL PURPOSE

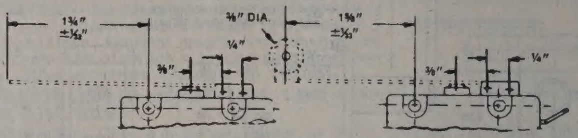

.312
¼" X .032 THK Q.C. OR FASTON TERMINAL
.095 DIA. HOLE (3 PLACES)
ACTUATION LINE
.500
REFERENCE LINE
COM.
N.C.
N.O.
1.000 ± .007


E13-00E
E13-00R
E13-00J
E13-00M
E13-00H
E13-50H
E13-00K
E13-50K

RATING: E13 — 15 Amps, 125/250 VAC
¾ H.P., 125 VAC — 1½ H.P., 250 VAC
E14 — 25 Amps, 125/250 VAC
1 H.P., 125 VAC — 2 H.P., 250 VAC

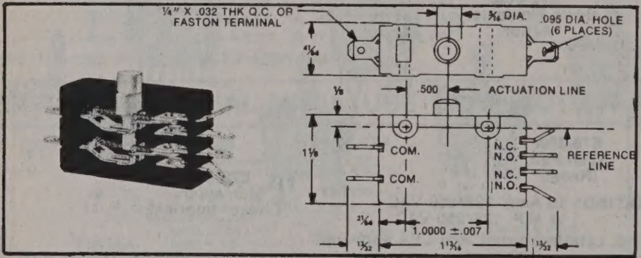
Und. Lab. Inc. listed, and CSA approved.

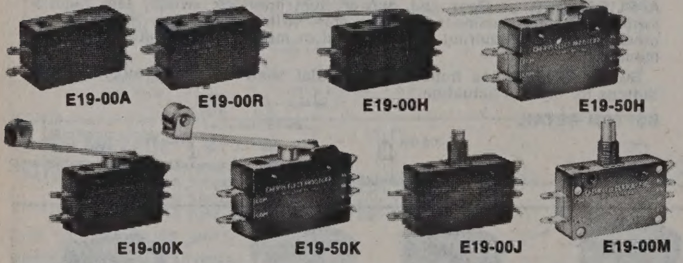
ACTUATORS — Many special forms and lengths of actuators are available. Standard type integral hinged lever and roller actuators are available in choice of 2 pivot positions. Actuator lengths are dimensioned from centerline of switch mounting hole as shown here.


1¾" ±1/32"
⅜" DIA.
1⅝" ±1/32"
¼"
⅜"

TERMINALS — Standard ¼ inch QC terminals can be furnished with angle formed up or down on common as well as open or closed terminal. Forms include straight, 30, 45, 85 degrees up or down. Other forms can be provided at nominal extra charge.

SERIES E19 — STANDARD/SERIES E20 — HIGH CAPACITY — DOUBLE POLE

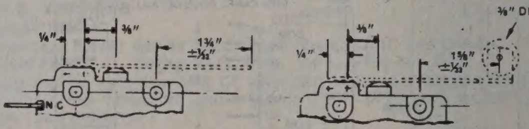

¼" X .032 THK Q.C. OR FASTON TERMINAL
⅜ DIA.
.095 DIA. HOLE (6 PLACES)
.500
ACTUATION LINE
COM.
COM.
N.C.
N.O.
N.C.
N.O.
REFERENCE LINE
1.0000 ± .007


E19-00A
E19-00R
E19-00H
E19-50H
E19-00K
E19-50K
E19-00J
E19-00M

RATING: E19 — 15 Amps, 125/250 VAC
¾ H.P., 125 VAC — 1½ H.P., 250 VAC
E20 — 20 Amps, 125/250 VAC
1 H.P., 125 VAC — 2 H.P., 250 VAC

Und. Lab. Inc. listed, and CSA approved.

ACTUATORS — Many special forms and lengths of actuators are available. Standard type integral hinged lever and roller actuators are available in choice of 2 pivot positions. Actuator lengths are dimensioned from centerline of switch mounting hole as shown here.


⅜" DIA
¼"
⅜"
1¾" ±1/32"
1⅝" ±1/32"
N C

TERMINALS — Standard ¼ inch QC terminals can be furnished with angle formed up or down on common as well as open or closed terminal. Forms include straight, 30, 45, 85 degrees up or down. Other forms can be provided at nominal extra charge.

GOLD "CROSSPOINT" CONTACT SWITCHES FOR LOW ENERGY CIRCUITS

Engineers can now take a completely new approach to switching of low energy circuits. The Gold "Crosspoint" Contact switch design provides reed switch reliability, with snap action switch precision and utility. No need for magnets and installation adjustments. The result is much lower installed cost.

Positive Snap-Action Switching of Low Energy Solid State Circuits

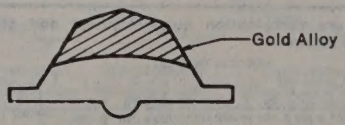
- High reliability in low level switching applications from 4 to 100 milliamperes at 4 to 30 volts
- Long Life . . . measured in millions of operations
- Initial insertion resistance far below 50 milliohms (lower than reed switches)
- Very high force per unit area (contact pressures)
- Reduced susceptibility to contact closure interference from foreign particles

RATING: 0.1 Amp, 125 VAC
Und. Lab. Inc. listed, and CSA approved.

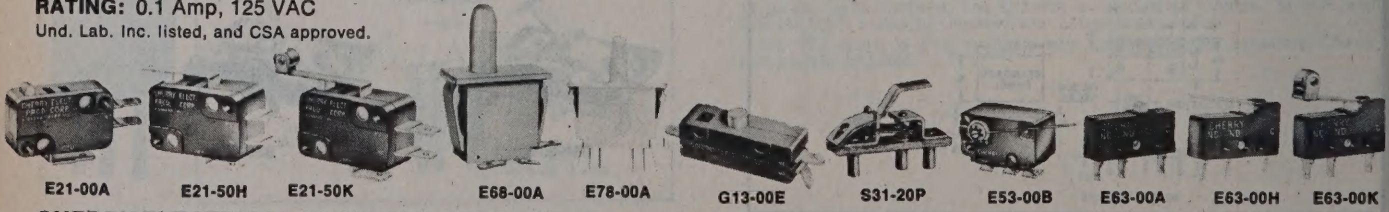
VERSATILITY IN APPLICATION

Cherry Gold "Crosspoint" Contact switches are available in a wide variety of switch types, sizes, and mountings for a broad range of electronic applications. In addition, many other configurations are available with gold crosspoint contacts.

CONTACT CROSS SECTION



The contacts in these switches are W/E Alloy # . . .
69% Gold, 25% Silver, 6% Platinum

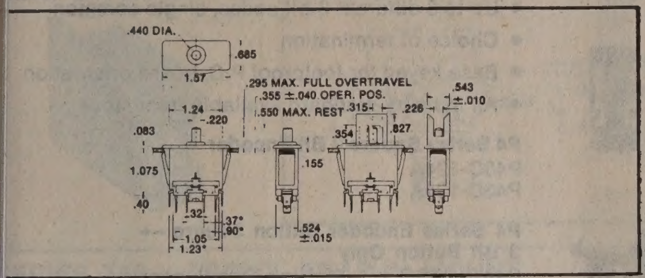

E21-00A
E21-50H
E21-50K
E68-00A
E78-00A
G13-00E
S31-20P
E53-00B
E63-00A
E63-00H
E63-00K

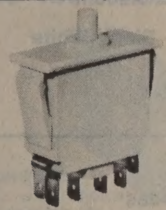
CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

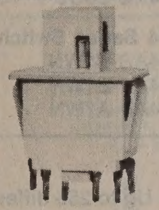
For More Information. Circle No. 459

CHERRY Pushbutton Switches

ERIES F81, F82, F83 AND F84 INE INTERRUPT SWITCHES


.440 DIA.
.685
1.57
.295 MAX. FULL OVERTRAVEL
.355 ±.040 OPER. POS.
.550 MAX. REST
.315
.226
.543 ±.010
1.24
.220
.083
1.075
.40
.32
.37*
.90*
1.05
1.23*
.155
.524 ±.015
.354
.827





Designed for worldwide safety specifications these line interrupt switches incorporate direct action, double make/double break shorting bars and 3 mm minimum contact gap. Two parallel return springs, either of which could safely break the circuit alone, give added protection. UL listed and CSA approved. Meets other international requirements.

CONTACT ARRANGEMENT

Choice of Form X, Form Y or Form Z contact arrangement is basic (A1) case or (B1) case with barrier. Form X (SPST NO DB), Form Y (SPST NC DB), Form Z (SPDT DB).

CONTACT RATINGS

F81: rated 10 Amps at 125 or 250 VAC (¾ HP at 125 VAC, 1½ HP at 250 VAC).

F82: rated 16 Amps at 125 or 250 VAC (¾ HP at 125 VAC, 1½ HP at 250 VAC).

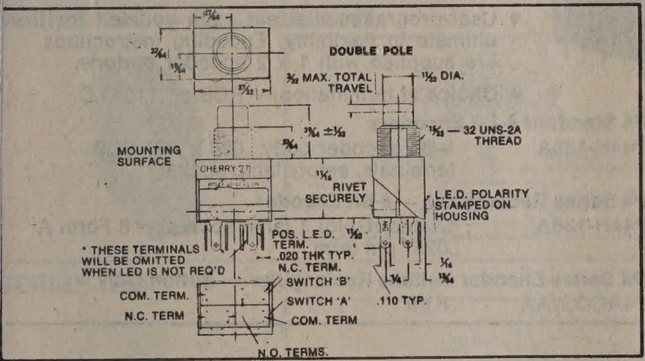
F83: gold crosspoint contacts for low energy switching. Rated 0.1 Amp at 1250 or 250 VAC.

F84: combines two different ratings in a single switch.

TERMINALS

Either 3⁄16″ (10) or ¼″ (20) male push-on terminals are standard. Others can be tooled. In most cases terminal sizes may be mixed on a switch to help minimize wiring errors.

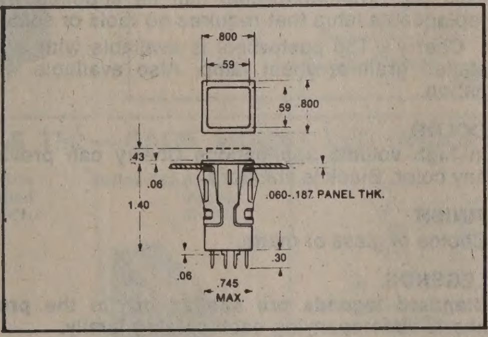
SERIES P1 FERRULE MOUNTED LIGHTED PUSHBUTTON SWITCH


DOUBLE POLE
3⁄32 MAX. TOTAL TRAVEL
15⁄32 DIA.
15⁄32 — 32 UNS-2A THREAD
MOUNTING SURFACE
CHERRY
RIVET SECURELY
L.E.D. POLARITY STAMPED ON HOUSING
* THESE TERMINALS WILL BE OMITTED WHEN LED IS NOT REQ'D
POS. L.E.D. TERM.
.020 THK TYP.
N.C. TERM.
SWITCH 'B'
SWITCH 'A'
COM. TERM.
N.C. TERM
COM. TERM
N.O. TERMS.
.110 TYP.

The Series P1: An entirely new kind of pushbutton switch . . . from Cherry. Pushbutton housing holds one — or two — famous Cherry series E62 or E63 subminiature snap action switches. E62 switches are rated 10.1 Amps, 125/250 VAC — ¼ H.P., 125 VAC. E63 switches are gold crosspoint contact rated 0.1 Amp, 125 VAC for your low energy circuits. Because the P1 houses one or two switches, you have your choice of 10.1 Amp, 0.1 Amp — or both! — in the same pushbutton switch.

Cherry Switch Co.	Description
P162-C3RA	10.1 Amp/S.P.D.T./Red Button/L.E.D.
P162-C3BU	10.1 Amp/S.P.D.T./Black Button/No Lite
P162-D3RA	10.1 Amp/D.P.D.T./Red Button/L.E.D.
P162-D3BU	10.1 Amp/D.P.D.T./Black Button/No Lite
P163-C3RA	0.1 Amp/S.P.D.T./Red Button/L.E.D.
P163-C3BU	0.1 Amp/S.P.D.T./Black Button/No Lite
P163-D3RA	0.1 Amp/D.P.D.T./Red Button/L.E.D.
P163-D3BU	0.1 Amp/D.P.D.T./Black Button/No Lite

P4 PUSHBUTTON SWITCHES


.800
.59
.59
.800
.43
.06
1.40
.060-.187 PANEL THK.
.30
.06
.745 MAX.

SWITCHES

Cherry's P4 switches are available in the popular square configuration with:

- choice of momentary or alternate action
- choice of QC or PCB terminals
- choice of 3 amp @ 125 VAC/2 Amp @ 250 VAC or 0.1 Amp @ 24 VDC
- choice of several contact arrangements

P4 SWITCH PART NUMBERS

Part Number	Contacts	Contact Action	Terminal	Contact Configuration
P4 Series — Square Non Lighted				
P41B-021C	Silver	Momentary	.110 QC	1 Form C
P43A-021C	Gold	Alt. Act.	.110 QC	1 Form C
P4 Series Square One 6.3V Incandescent Lamp Installed				
P41A-621C	Silver	Momentary	.110 QC	1 Form C
P41B-621C	Gold	Alt. Act.	.110 QC	1 Form C
P4 Series Square One 14V Incandescent Lamp Installed				
P41A-722C	Silver	Momentary	.110 QC	1 Form C
P41B-721C	Gold	Alt. Act.	.110 QC	1 Form C
P4 Series Square One 28V Incandescent Lamp Installed				
P41A-821C	Silver	Momentary	.110 QC	1 Form C
P41B-821C	Gold	Alt. Act.	.110 QC	1 Form C

Silver Rating: 3A @ 125 VAC/2A @ 250 VAC
Gold Rating: 0.1A @ 24 VDC

- Three button styles
- Snaps into industry standard mounting hole from front of panel

Mixed ratings can be provided. P4 switches may be specified with or without lamp sockets. Sockets mate with widely accepted wedge-base T 1¾ incandescent lamps.

P4 SERIES

EXPLANATION OF PART NUMBER

1 — A — 0 — 3 — 1C

Rating
1 = 3A @ 125 VAC
2A @ 250 VAC
3 = 0.1A @ 24 VAC

Contact Action
A = Alternate Action
B = Momentary Action

Temperature
0 = No lamp
1 = 1 lamp socket
6 = 6.3V lamp installed
7 = 14V lamp installed
8 = 28V lamp installed

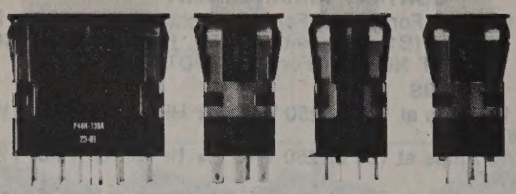
Terminal
2 = .110 QC terminal
3 = .020 pin terminal

Contact Configuration
1 C = 1 Form C contact
2 C = 2 Form C contact
4 A = 4 Form A contact
8 A = 8 Form A contact

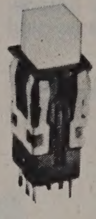
CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

CHERRY Pushbutton and Thumbwheel

CHERRY 3-BIT ENCODER



- Up to 8 different 3-bit codes, single common
- Choice of termination
- Base keyed for foolproof P.C. board orientati
- All industry-standard available from stock



P4 Series Square 3 Bit Encoder
P43C-124A
P43C-134A

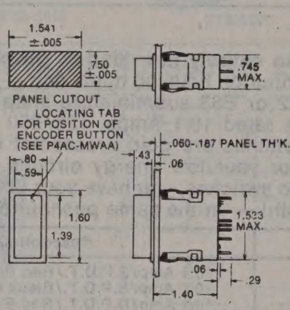
P4 Series Encoder Button Square — 3 Bit Button Only

P4AC-B3SO	.43 High Translucent

P4 Series Switch Button — Blank White

P4AB-C1WN	.19″ high
P4AB-B1WN	.43″ high
P4AB-A1WN	.32″ high

CHERRY 8-BIT ENCODER



- Up to 256 different 8-bit codes
- Dual commons for convenience on printed circuit board
- User-programmable: set code yourself for t ultimate in flexibility. Encoding instructions are supplied with 1 x 2 encoder buttons.
- Choice of termination — PCB or .110 Q.C.

P4 Standard 8-Bit Encoders

P44H-138A	8-Bit encoder body, .020 x .025 PCB terminals, empty lamp socket

P4 Series Rectangular — 8 Bit Encoder

P44H-138A	Coded (Gold) 1 lamp socket — 8 Form A .020″ pin term.

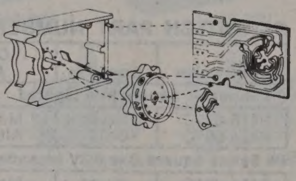
P4 Series Encoder Buttons Rectangular — Button Only

P4AC-XWAA	8 bit

THUMBWHEEL, LEVERWHEEL, PUSHWHEEL

BASIC OPERATING PRINCIPLE

A set of comb-like wiping contacts, rotated manually, shorts together predetermined combinations of traces on a stationary printed circuit board. These same traces also serve as electrical input/output lines. Here's a simplified diagram of the mechanism:



ACTUATION

Cherry offers three kinds of actuation for these rotary multi-position switches. Thumbwheel, Leverwheel and Pushwheel.

Thumbwheel
Rotate the dial directly

Leverwheel
Drive the dial by means of a lever. Convenient for fast resetting to zero position.

Pushwheel
Push one button to index the dial up . . . the other to index down.

MOUNTING

Cherry provides you with 3 mounting styles and choices. Back mount, front mount, and snap in mount.

TERMINATION

Cherry is tooled to supply terminals just right for your application.

PC BOARD

Parallel rows of holes approximately .040″ diameter.

F-PINS

Specify F-pin termination for direct mating with motherboard.

J-PINS

Specify J-pins for wire-wrap applications. More economical than F-pins.

LIGHTED SWITCHES

Cherry's T20 thumbwheel can be supplied with a socke replaceable lamp that requires no tools or soldering.

Cherry's T56 pushwheel is available with a permanently stalled grain-of-wheat lamp. Also available with LED illu nation.

COLOR

In high volume applications Cherry can provide switches any color. Black is standard.

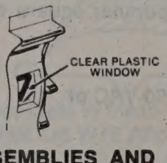
FINISH

Choice of glass or matte.

LEGENDS

Standard legends are spelled out in the product selec charts accompanying each catalog family.

Standard character color is white on black dial. For ligh versions, standard is black on transluscent white dial.



DUSTPROOF THUMBWHEELS

A clear plastic window covers dial ch acter opening for resistance to di dirt and moisture. Available on Cher T24 series and T38 series.

ASSEMBLIES AND COMBINATIONS

Within a given family size, you may gang into multi-digit ass blies, specifying any combination of standard-window switch and spacers. Simply specify exactly the combination that your application. Your local distributor is available to assem these switches.

STOPS

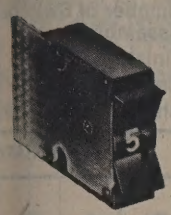
Cherry provides many standard combinations of rotation-lir ing stops to help tailor our switches exactly to your applicat needs.

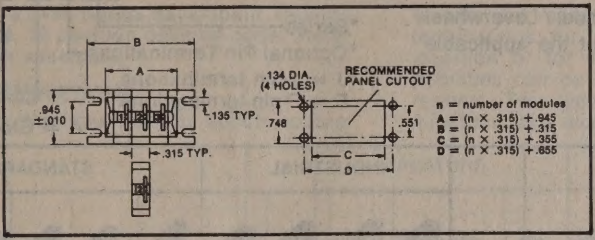
CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-15

For More Information. Circle No. 459

Thumbwheel, Leverwheel, Pushwheel

IES T-50 — BACK MOUNT




B
A
.945
±.010
.135 TYP.
.315 TYP.
.134 DIA.
(4 HOLES)
RECOMMENDED
PANEL CUTOUT
.748
.551
C
D
n = number of modules
A = (n × .315) + .945
B = (n × .315) + .315
C = (n × .315) + .355
D = (n × .315) + .655

Available in 8, 10 and 16 positions. Can be furnished with extended PC board to provide mounting of other components. Stops may be inserted at factory or in the field to control dial rotation. Stops not available on 16 position.

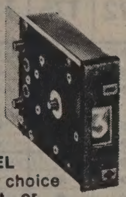
SWITCH CHARACTERISTICS:

Dielectric Strength .... 500 VAC

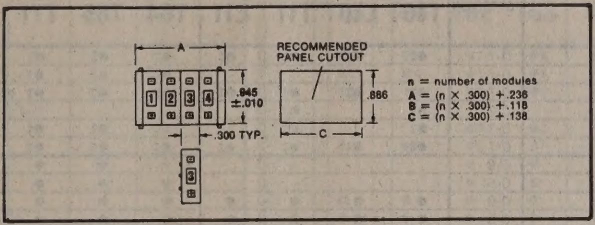
Temperature .... −40°C to +70°C

Note: Applies to all thumbwheel switches

IES T56 — FRONT, SNAP-IN MOUNT

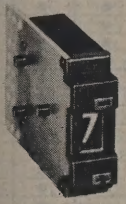


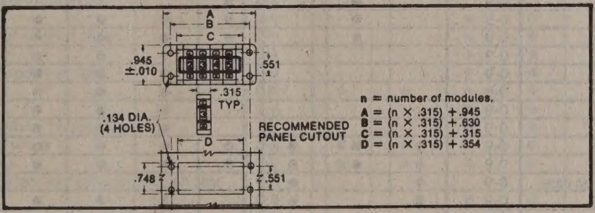
PUSHWHEEL
able with choice
ncandescent or
illumination.


A
RECOMMENDED
PANEL CUTOUT
.945
±.010
.886
.300 TYP.
C
n = number of modules
A = (n × .300) + .236
B = (n × .300) + .118
C = (n × .300) + .138

Ideal for cramped control panels. Dustproof design. Offered in a wide variety of positions and output codes. Can be furnished with extended PC board to provide mounting of other components. Stops may be inserted at factory to control dial rotation.

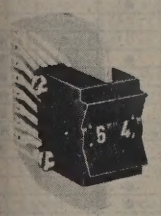
IES T57 — BACK MOUNT

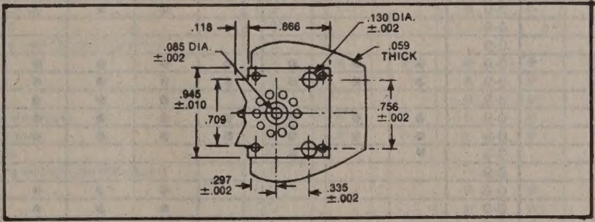



A
B
C
.945
±.010
.551
.315
TYP.
.134 DIA.
(4 HOLES)
RECOMMENDED
PANEL CUTOUT
D
.748
.551
n = number of modules.
A = (n × .315) + .945
B = (n × .315) + .630
C = (n × .315) + .315
D = (n × .315) + .354

Ideal for cramped control panels. Dustproof design. Offered in a wide variety of positions and output codes. Can be furnished with extended PC board to provide mounting of other components. Stops may be inserted at factory to control dial rotation.

IES T54



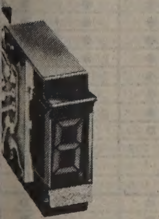

.118
.866
.130 DIA.
±.002
.085 DIA.
±.002
.059
THICK
.945
±.010
.709
.756
±.002
.297
±.002
.335
±.002

CIRCUIT BOARD MOUNT

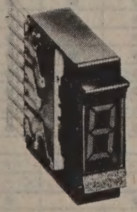
Special elevated mounting of contact wiper set permits direct mounting of this thumbwheel on PC board without modifying the board to recess into the switch housing. Configuration, dimensions and stops information the same as Series T50.

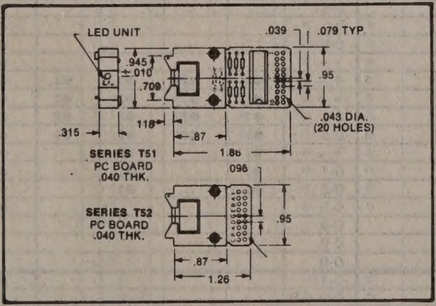
RIES T51 & T52 — BACK MOUNT LED INDICATING UNIT

es T51 comes with driver installed at factory.



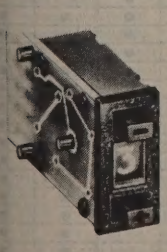
Series T52 does not include driver.

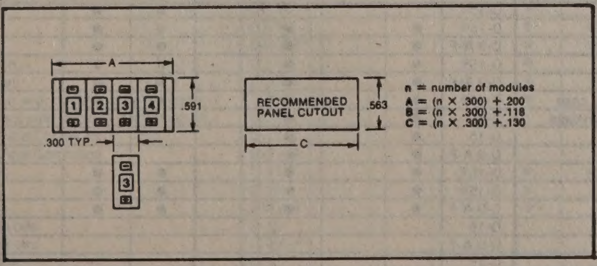



LED UNIT
.039
.079 TYP.
.945
±.010
.709
.95
.043 DIA.
(20 HOLES)
.315
118
.87
1.86
SERIES T51
PC BOARD
.040 THK.
.098
SERIES T52
PC BOARD
.040 THK.
.95
.87
1.26

A seven segment LED indicating unit in a thumbwheel type package. Features bright red, .362″ high digit that operates at logic level voltages. Can be used with any BDC type coded thumbwheel and is also available with supplementary inputs of the ripple-blanking input and blanking input/ripple blanking output type with an automatic zero blanking feature. Additional lamp test input renders possible functional control of the indicating segments. Recommended panel cutout, endcaps and spacers are the same as Series T50.

RIES T55 — FRONT, SNAP-IN MOUNT




A
.591
.300 TYP.
RECOMMENDED
PANEL CUTOUT
.563
C
n = number of modules
A = (n × .300) + .200
B = (n × .300) + .118
C = (n × .300) + .130

The smallest of them all! Dustproof design. Offered in a wide variety of positions and output codes. Can be furnished with extended PC board to provide mounting of other components. Stops may be inserted at factory to control dial rotation.

ERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

For More Information. Circle No. 459

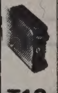
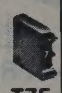
CHERRY Thumbwheel, Leverwheel, Pushwhee

HOW TO USE THIS CHART FOR ORDERING

When ordering standard Cherry Thumbwheel / Leverwheel switches or switch assemblies, please call out the applicable information as at right:

T35J-01 A 3

*Series
*Optional Pin Terminations
*J = J-pin terminations
F = F-pin terminations
Number of Switch
Assembly
Finish**
Code Suffix
**A = Gloss finish M = Matte fi

SUFFIX NO.	POS.	DESCRIPTION	READ OUT SYMBOL	INDUSTRIAL				STANDARD					MINIAT	
				 T10	L10	T11	L11	T64	T65	T71	T72	 T75	T20	L20
-07	8	Binary Coded Octal (BCO)	0-7	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●	●‡
-77	8	BCO Complement Only	0-7					●‡	●‡	●‡	●‡	●‡	●‡	●‡
-27	8	BCO with decimal point on case	0-7	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●‡
-47	8	BCO with separate C to not true bits	0-7	●‡		●‡							●‡	●‡
-57	8	BCO with Diode Provisions	0-7	●‡		●‡		●‡	●‡	●‡	●‡	●‡	●‡	●‡
-17	8	1 of 8 Code	0-7	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●‡	●	●‡
-71	10	Aiken Code Modern 1-2-4-2'	0-9					●	●	●	●	●		
-70	10	Aiken Code 1-2-4-2'	0-9					●	●	●	●	●		
-02	10	Binary Coded Decimal (BCD)	0-9	●	●	●	●	●	●	●	●	●	●	●
-04	10	BCD + Complement, 1 Common	0-9	●	●	●	●	●	●	●	●	●	●	●
-24	10	BCD + Complement, 1 Common with decimal point on case	0-9	●	●	●	●	●	●	●	●	●	●	●
-54	10	BCD + Complement, 1 Common with Diode Provisions	0-9	●		●							●	●
-05	10	BCD + Complement with separate Commons	0-9		●		●							
-10	10	BCD + Even Parity	0-9		●		●	●	●	●	●	●	●	●
-30	10	BCD + Even Parity with decimal point on case	0-9		●		●	●	●	●	●	●	●	●
-06	10	BCD + Odd Parity	0-9					●	●	●	●	●	●	●
-26	10	BCD + Odd Parity with decimal point on case	0-9					●	●	●	●	●	●	●
-12	10	BCD Complement Only	0-9					●	●	●	●	●	●	●
-45	10	BCD Make Before Break	0-9					●	●	●	●	●	●	●
-46	10	BCD Make Before Break with Diode Provisions	0-9					●	●	●	●	●		
-32	10	BCD with black case and white wheel	0-9	●	●	●	●	●	●	●	●	●	●	●
-22	10	BCD with decimal point on case	0-9	●	●	●	●	●	●	●	●	●	●	●
-25	10	BCD with separate C to not true bits with decimal point on case	0-9	●		●							●	●
-52	10	BCD with Diode Provisions	0-9	●		●		●	●	●	●	●	●	●
-15	10	BCD with separate C to not true bits	0-9	●		●							●	●
-73	10	Berkley Code	0-9										●	●
-74	10	Berkley Code with Diode Provisions	0-9										●	●
-90	10	Complement of 7 segment indicator	0-9					●	●	●	●	●		
-75	10	Complement of 9's Complement	0-9											
-72	10	Complement of 9's Complement with Diode Provisions	0-9										●	●
-01	10	Decimal	0-9	●	●	●	●	●	●	●	●	●	●	●
-11	10	Decimal—Double Pole	0-9	●	●	●	●	●	●	●	●	●	●	●
-69	10	Decimal Make Before Break	0-9					●	●	●	●	●	●	●
-31	10	Decimal with black case and white wheel	0-9	●	●	●	●	●	●	●	●	●	●	●
-21	10	Decimal with decimal point on case	0-9	●	●	●	●	●	●	●	●	●	●	●
-78	10	Decimal with Common in Middle	0-9	●		●							●	●
-79	10	Decimal with Common in Middle with Diode Provisions	0-9											
-51	10	Decimal with Diode Provisions	0-9					●	●	●	●	●		
-49	10	Excess 3 Grey Code Negative	0-9					●	●	●	●	●		
-50	10	Excess 3 Grey Code Positive	0-9					●	●	●	●	●		
-84	10	Repeating—Double Pole	—,+										●	●
-85	10	Repeating—Double Pole	0-1										●	●
-86	10	Repeating—Double Pole	0-5										●	●
-92	10	Repeating—Double Pole	0-1					●	●	●	●	●		
-93	10	Repeating—Double Pole	0-5					●	●	●	●	●		
-97	10	Repeating—Double Pole	+,—					●	●	●	●	●		
-80	10	Repeating—Single Pole	+,—	●‡	●‡	●‡	●‡	●	●	●	●	●	●	●
-94	10	Repeating—Single Pole	—,+	●‡	●‡	●‡	●‡	●	●	●	●	●	●	●
-95	10	Repeating—Single Pole	0-1	●‡	●‡	●‡	●‡	●	●	●	●	●	●	●
-96	10	Repeating—Single Pole	0-5	●‡	●‡	●‡	●‡	●	●	●	●	●	●	●
-81	10	Repeating—Single Pole with extended PCB	+,—	●‡		●‡		●	●	●	●	●		
-82	10	Repeating—Single Pole with extended PCB	0-1	●‡		●‡		●	●	●	●	●		
-83	10	Repeating—Single Pole with extended PCB	0-5	●‡		●‡		●	●	●	●	●		
-68	10	2 out of 5 Code	0-9					●	●	●	●	●	●	●
-62	10	9's Complement of BCD	0-9										●	●
-91	10	9's Complement of BCD with Diode Provisions	0-9										●	●
-14	10	9's Complement of BCD + Complement	0-9											
-20	12	1 of 12 Code	0-11					●	●		●	●		●
-61	12	1 of 12 Code	0-9 A-B					●	●		●	●		●
-99	12	1 of 12 Code Make Before Break	0-11											●
-60	12	4 Bit Binary	0-11	●‡		●‡		●	●		●	●	●‡	●
-76	12	4 Bit Binary + Odd Parity	0-11											●
-64	16	Grey Code	0-15					●	●		●	●		
-03	16	Hexidecimal (HEX)	0-15	●		●		●	●		●	●	●	●
-13	16	Hexidecimal (HEX)	0-9 A-F	●		●		●	●		●	●	●	●
-08	16	HEX + Complement, 1 Common	0-15	●		●		●	●		●	●	●	●
-88	16	HEX + Complement, 1 Common	0-9 A-F	●		●		●	●		●	●	●	●
-28	16	HEX + Complement, 1 Common with decimal point on case	0-15	●		●		●	●		●	●	●	●
-29	16	HEX + Complement, 2 Commons with decimal point on case	0-15	●		●							●	●
-09	16	HEX + Complement with separate Commons	0-15	●		●							●	●
-89	16	HEX + Complement with separate Commons	0-9 A-F	●		●							●	●
-23	16	HEX with decimal point on case	0-15	●		●		●	●		●	●	●	●
-53	16	HEX with Diode Provisions	0-15	●		●		●	●		●	●	●	●
-63	16	HEX with Diode Provisions	0-9 A-F	●		●		●	●		●	●	●	●
-16	16	HEX with separate C to not true bits	0-15										●	●
-18	16	HEX with separate C to not true bits	0-9 A-F										●	●
-98	16	1 of 16 Code Make Before Break	0-15										●	●

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-15

For More Information. Circle No. 459

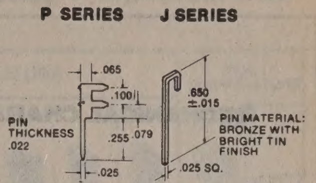
HERRY Thumbwheel, Leverwheel, Pushwheel

IPLETE PRODUCT LISTING

xample at left calls out a **T-35 Series** backmount Thumb- l, with **J-pin terminations, 10 position decimal** code, **black finish**, in a **three switch assembly.**

LABLE PC BOARD TERMINATIONS

C boards have a .040″ diameter hole to accommodate a wire for each output. Pin terminations for mother-board insertion or for wire-wrap capabilities can be applied upon request. Two types of pin terminations are available:



DESCRIPTION	READ OUT SYMBOL	MINIATURE				SUBMINIATURE						SUB-SUBMINIATURE	
		T35	T38	T62	T63	T50	T51	T52	T54	T56	T57	T55	SUFFIX NO.
Binary Coded Octal (BCO)	0-7	●‡	●‡	●‡	●‡	●‡			●‡	●‡		●‡	-07
BCO Complement Only	0-7	●‡	●‡	●‡	●‡	●‡			●‡	●‡		●‡	-77
BCO with decimal point on case	0-7	●‡	●‡	●‡	●‡	●‡			●‡	●‡		●‡	-27
BCO with separate C to not true bits	0-7												-47
BCO with Diode Provisions	0-7			●‡	●‡	●‡			●‡	●‡		●‡	-57
1 of 8 Code	0-7	●‡	●‡	●‡	●‡	●‡			●‡	●‡		●‡	-17
Aiken Code Modern 1-2-4-2′	0-9			●	●								-71
Aiken Code 1-2-4-2′	0-9			●	●								-70
Binary Coded Decimal (BCD)	0-9	●	●	●	●	●	●	●	●	●	●	●	-02
BCD + Complement, 1 Common	0-9	●	●	●	●	●			●	●	●	●	-04
BCD + Complement, 1 Common with decimal point on case	0-9	●	●	●	●	●			●	●	●	●	-24
BCD + Complement, 1 Common with Diode Provisions	0-9												-54
BCD + Complement with separate Commons	0-9												-05
BCD + Even Parity	0-9			●	●								-10
BCD + Even Parity with decimal point on case	0-9			●	●								-30
BCD + Odd Parity	0-9			●	●								-06
BCD + Odd Parity with decimal point on case	0-9			●	●								-26
BCD Complement Only	0-9	●	●	●	●	●			●	●		●	-12
BCD Make Before Break	0-9			●	●								-45
BCD Make Before Break with Diode Provisions	0-9			●	●								-46
BCD with black case and white wheel	0-9	●	●	●	●	●			●	●	●	●	-32
BCD with decimal point on case	0-9	●	●	●	●	●			●	●	●	●	-22
BCD with separate C to not true bits with decimal point on case	0-9												-25
BCD with Diode Provisions	0-9			●	●	●			●	●		●	-52
BCD with separate C to not true bits	0-9												-15
Berkley Code	0-9												-73
Berkley Code with Diode Provisions	0-9												-74
Complement of 7 segment indicator	0-9			●	●								-90
Complement of 9's Complement	0-9												-75
Complement of 9's Complement with Diode Provisions	0-9												-72
Decimal	0-9	●	●	●	●	●			●	●		●	-01
Decimal—Double Pole	0-9			●	●								-11
Decimal Make Before Break	0-9			●	●								-69
Decimal with black case and white wheel	0-9	●	●	●	●	●			●	●		●	-31
Decimal with decimal point on case	0-9	●	●	●	●	●			●	●		●	-21
Decimal with Common in Middle	0-9												-78
Decimal with Common in Middle with Diode Provisions	0-9												-79
Decimal with Diode Provisions	0-9			●	●					●		●	-51
Excess 3 Grey Code Negative	0-9			●	●								-49
Excess 3 Grey Code Positive	0-9			●	●								-50
Repeating—Double Pole	−,+												-84
Repeating—Double Pole	0-1												-85
Repeating—Double Pole	0-5												-86
Repeating—Double Pole	0-1			●	●								-92
Repeating—Double Pole	0-5			●	●								-98
Repeating—Double Pole	+,−			●	●								-97
Repeating—Single Pole	+,−	●	●	●	●	●			●	●		●	-80
Repeating—Single Pole	−,+	●	●	●	●	●			●	●		●	-94
Repeating—Single Pole	0-1	●	●	●	●	●			●	●		●	-95
Repeating—Single Pole	0-5	●	●	●	●	●			●	●		●	-96
Repeating—Single Pole with extended PCB	+,−			●	●					●			-81
Repeating—Single Pole with extended PCB	0-1			●	●					●			-82
Repeating—Single Pole with extended PCB	0-5			●	●					●			-83
2 out of 5 Code	0-9			●	●								-68
9's Complement of BCD	0-9												-62
9's Complement of BCD with Diode Provisions	0-9												-91
9's Complement of BCD + Complement	0-9												-14
1 of 12 Code	0-11			●	●								-20
1 of 12 Code	0-9 A-B			●	●								-61
1 of 12 Code Make Before Break	0-11												-99
4 Bit Binary	0-11			●	●					●‡			-60
4 Bit Binary + Odd Parity	0-11												-76
Grey Code	0-15			●	●								-64
Hexidecimal (HEX)	0-15			●	●	●			●	●			-03
Hexidecimal (HEX)	0-9 A-F			●	●	●			●	●			-13
HEX + Complement, 1 Common	0-15			●	●								-08
HEX + Complement, 1 Common	0-9 A-F			●	●								-88
HEX + Complement, 1 Common with decimal point on case	0-15			●	●								-28
HEX + Complement, 2 Commons with decimal point on case	0-15												-29
HEX + Complement with separate Commons	0-15												-09
HEX + Complement with separate Commons	0-9 A-F												-89
HEX with decimal point on case	0-15			●	●	●			●	●			-23
HEX with Diode Provisions	0-15			●	●					●			-53
HEX with Diode Provisions	0-9 A-F			●	●					●			-63
HEX with separate C to not true bits	0-15												-16
HEX with separate C to not true bits	0-9 A-F												-18
1 of 16 Code Make Before Break	0-15												-98

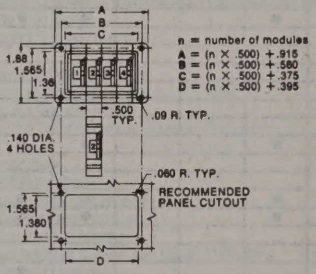
RRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

CHERRY Thumbwheel, Leverwheel, Pushwhe

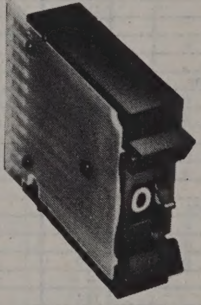
MECHANICAL CHARACTERISTICS		INDUSTRIAL				STANDARD					MINIATUR	
		T10	L10	T11	L11	T64	T65	T71	T72	T75	T20	L20
ACTION	Thumbwheel	●		●		●	●	●	●	●	●	
	Leverwheel		●		●							●
	Pushwheel											
NUMBER OF POSITIONS	8	●‡	●‡	●‡	●‡	●	●	●	●	●	●	●‡
	10	●	●	●	●	●	●	●	●	●	●	●
	12	●‡		●‡		●	●		●	●	●‡	●
	16	●		●		●	●		●	●	●	●
	Stops Available	●	●	●	●	●	●	●	●	●	●	●
APPROXIMATE HEIGHT	1.88	●	●	●	●							
	1.20					●	●	●	●	●		
	1.15										●	●
	.945											
	.590											
MOUNTING TYPE	Front/Screw			●	●							
	Front/Snap In						●		●	●		
	Front/Integral Bezel							●				
	Front/Attached to Cust. PCB					●						
	Rear/Screw	●	●								●	●
	Rear/Attached to Cust. PCB											
FINISH	(A) Gloss	●	●	●	●	●	●	●	●	●	●	●
	(M) Matte	●	●	●	●	●	●	●	●	●	●	●
TERMINATION	F Pin Termination*	●	●	●	●	●	●	●	●	●	●	●
	J Pin Termination*	●	●	●	●	●	●	●	●	●	●	●
MISCELLANEOUS	Dustproof											
	Lighted									●	●	
	Wide Window	●							●		●	

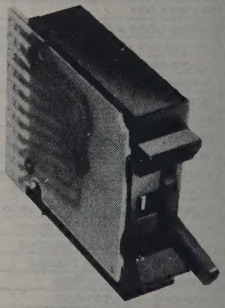
*Not Available In All Codes. Consult Factory ‡With Stops

SERIES T10 & L10 — BACK MOUNT

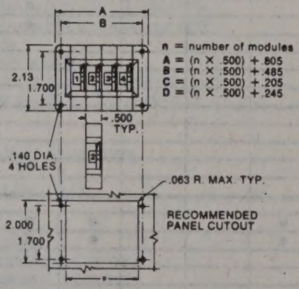

A
B
C
1.88
1.565
1.36
.500 TYP.
.09 R. TYP.
.140 DIA. 4 HOLES
.060 R. TYP.
RECOMMENDED PANEL CUTOUT
1.565
1.380
D
n = number of modules
A = (n X .500) +.915
B = (n X .500) +.580
C = (n X .500) +.375
D = (n X .500) +.395

T10 Thumbwheel available in 8, 10, 12 and 16 positions. L10 Leverwheel available in 8 and 10 positions. Both offered in a wide variety of output codes. T10 Thumbwheel can be furnished with extended PC board to provide mounting of other components. Stops may be inserted at factory to control dial rotation.

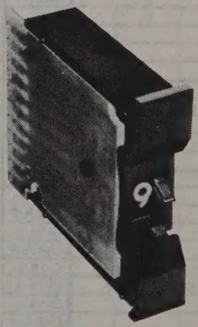

T10 THUMBWHEEL

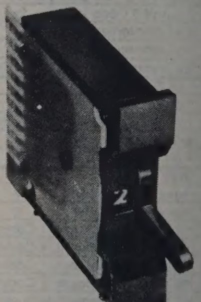

L10 LEVERWHEEL

SERIES T11 & L11 — FRONT MOUNT


A
B
2.13
1.700
.500 TYP.
.140 DIA 4 HOLES
.063 R. MAX. TYP.
RECOMMENDED PANEL CUTOUT
2.000
1.700
n = number of modules
A = (n X .500) + .805
B = (n X .500) +.485
C = (n X .500) +.205
D = (n X .500) +.245

T11 Thumbwheel available in 8, 10, 12 and 16 positions. L11 Leverwheel available in 8 and 10 positions. Both offered in a wide variety of output codes. T11 Thumbwheel can be furnished with extended PC board to provide mounting of other components. Stops may be inserted at factory to control dial rotation.


T11 THUMBWHEEL


L11 LEVERWHEEL

CHERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1

For More Information. Circle No. 459

HERRY

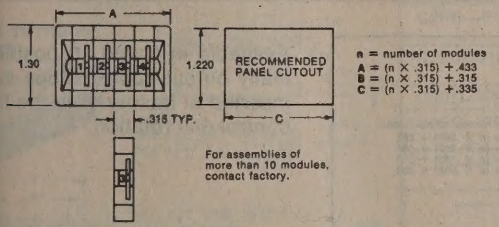
Thumbwheel, Leverwheel, Pushwheel

MECHANICAL CHARACTERISTICS

		MINIATURE				SUBMINIATURE						SUB-SUBMINIATURE	
		T35	T38	T62	T63	T50	T51	T52	T54	T56	T57	T55	SUFFIX NO.
TION	Thumbwheel	●	●	●	●	●	●	●	●				
	Leverwheel												
	Pushwheel									●	●	●	
MBER OF POSITIONS	8	●‡	●‡	●	●	●‡			●‡	●‡		●‡	
	10	●	●	●	●	●	●	●	●	●	●	●	
	12			●	●					●			
	16			●	●	●			●	●			
	Stops Available	●	●	●	●	●			●	●		●	
PROXIMATE HEIGHT	1.88												
	1.20												
	1.15	●	●	●	●								
	.945					●	●	●	●	●	●		
	.590											●	
UNTING TYPE	Front/Screw												
	Front/Snap In									●		●	
	Front/Integral Bezel												
	Front/Attached to Cust. PCB												
	Rear/Screw	●	●		●	●	●	●			●		
	Rear/Attached to Cust. PCB			●					●				
IISH	(A) Gloss	●	●										
	(M) Matte	●	●	●	●	●	●	●	●	●	●	●	
RMINATION	F Pin Termination*	●	●	●	●	●	●	●	●	●	●	●	
	J Pin Termination*	●	●	●	●	●	●	●	●	●	●	●	
SCELLANEOUS	Dustproof		●										
	Lighted									●	●	●	
	Wide Window												

t Available In All Codes. Consult Factory ‡With Stops

RIES T65 — FRONT, SNAP-IN MOUNT

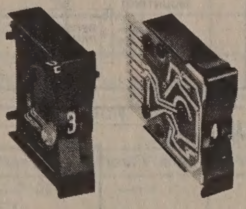

A
1.30
1
2
3
4
.315 TYP.
1.220
RECOMMENDED PANEL CUTOUT
C
n = number of modules
A = (n X .315) +.433
B = (n X .315) +.315
C = (n X .315) +.335
For assemblies of more than 10 modules, contact factory.
3

ilable in 8, 10, 12 and 16 positions and a wide variety of
ut codes. Can be furnished with extended PC board to pro-
mounting of other components. Stops may be inserted at
ory or in the field to control dial rotation.

SERIES T64

Also available as Circuit Board Mount

Wheel and detent spring are mounted in case so as to elevate the contact wiper set. This permits direct mounting on PC board without modifying the board to recess into switch housing. Typically, the circuit board plugs into a chassis and the thumbwheel switch is mounted to permit presetting to circuit functions. Available in 8, 10, 12 and 16 positions. Dimensions are the same as Series T65.

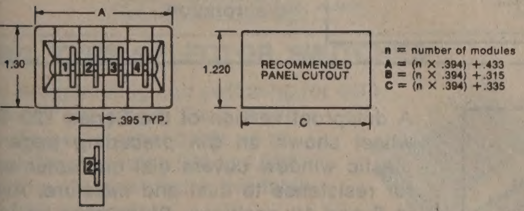


SWITCH CHARACTERISTICS:

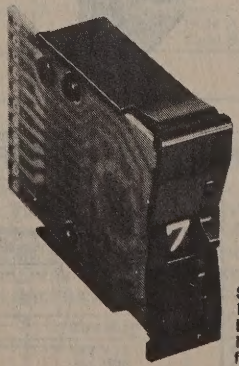
Dielectric Strength .... 500 VAC
Temperature .... −40°C to +70°C

Note: Applies to all thumbwheel switches

RIES T75 — FRONT, SNAP-IN MOUNT


A
1.30
1
2
3
4
.395 TYP.
1.220
RECOMMENDED PANEL CUTOUT
C
n = number of modules
A = (n X .394) +.433
B = (n X .394) +.315
C = (n X .394) +.335
2

ilable in 8, 10, 12 and 16 positions and a wide variety of out-
codes. Can be furnished with extended PC board to provide
nting of other components. Stops may be inserted at fac-
in the field to control dial rotation.

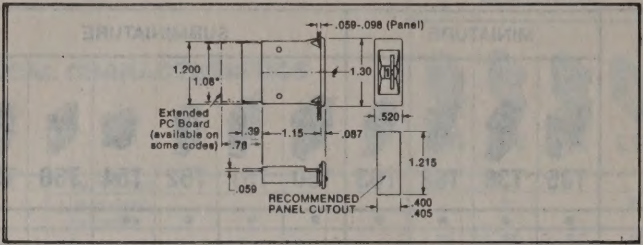


Series T75 — Front Snap-In Mount is also available as Lighted Thumbwheel. Indicated by third digit of suffix. For example T75-01 "L".

ERRY ELECTRICAL PRODUCTS CORP., 3600 Sunset Ave., Waukegan, IL 60087 • 312/578-3500 • TWX 910/235-1572

CHERRY Thumbwheel, Leverwheel, Pushwhe

SERIES T71 — INTEGRAL BEZEL, FRONT, SNAP-IN MOUNT

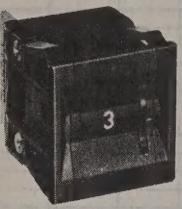

.059-.098 (Panel)
1.200
1.08"
1.30
Extended
PC Board
(available on
some codes)
.39
.78
1.15
.087
.520
1.215
.059
RECOMMENDED
PANEL CUTOUT
.400
.405

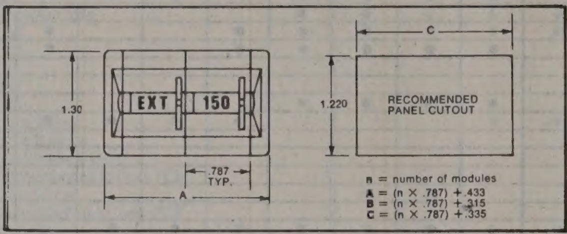
Standard code is 10 positions decimal.
available on special order in T65 and
standard codes except for 12 and 16 posi

SWITCH CHARACTERISTICS:

Dielectric Strength .... 500 VAC
Temperature .... −40°C to +70°C
Note: Applies to all thumbwheel switches

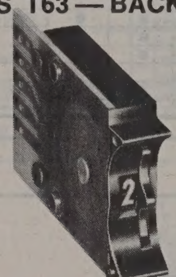
SERIES T72 — WIDE WINDOW FUNCTION SWITCH, FRONT, SNAP-IN MOUNT




C
1.30
EXT
150
1.220
RECOMMENDED
PANEL CUTOUT
.787
TYP.
A
n = number of modules
A = (n × .787) +.433
B = (n × .787) +.315
C = (n × .787) +.335

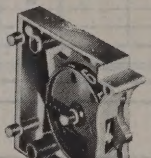
A unique variation of the Series T75, modi
to provide a legend area more than three ti
wider than normal. Offered in a wide variet
standard legends at no extra charge.
standard legends also available. May be u
as a single unit or ganged together with
number of Series T65, T72 or T75 modules

SERIES T63 — BACK MOUNT



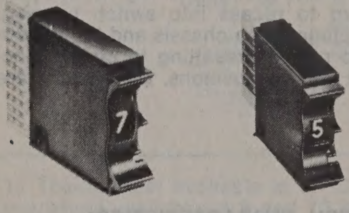
Available in 8, 10, 12 and 16 positions with a wide variety of output codes. Stops may be inserted at factory or in the field to control dial rotation.

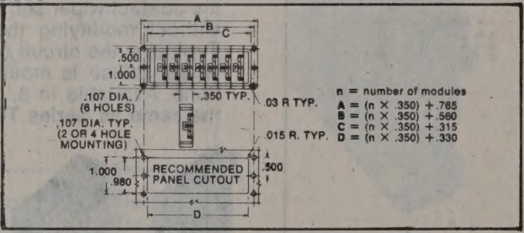
SERIES T62 — CIRCUIT BOARD MOUNT



Wheel and detent spring are mounte
case so as to elevate the contact wiper
This permits direct mounting on PC b
without modifying the board to recess
switch housing. Typically, the circut b
plugs into a chassis and the thumbw
switch is mounted to permit presettin
circuit functions. Available in 8, 10, 12
16 positions. Dimensions are the sam
Series T63.

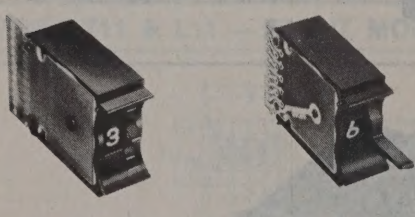
SERIES T35 & T38 — BACK MOUNT

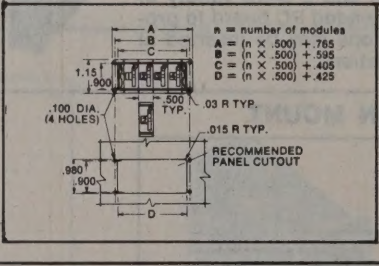



A
B
C
.500
1.000
.107 DIA.
(6 HOLES)
.350 TYP.
.03 R TYP.
.107 DIA. TYP.
(2 OR 4 HOLE
MOUNTING)
.015 R. TYP.
1.000
.980
RECOMMENDED
PANEL CUTOUT
.500
D
n = number of modules
A = (n × .350) +.765
B = (n × .350) +.560
C = (n × .350) +.315
D = (n × .350) +.330

Available in 8 and 10 position
many output codes. Stops ma
inserted at factory or in the fie
control dial rotation.

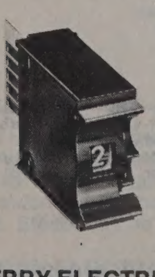
SERIES T20 & L20 — BACK MOUNT

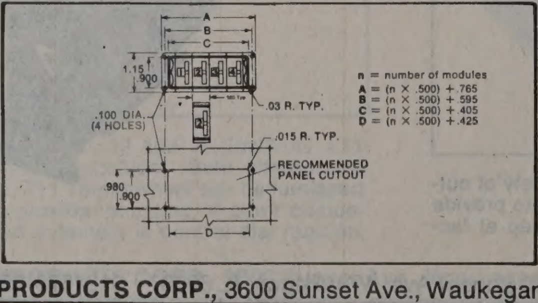



A
B
C
1.15
.900
n = number of modules
A = (n × .500) +.765
B = (n × .500) +.595
C = (n × .500) +.405
D = (n × .500) +.425
.100 DIA.
(4 HOLES)
.500
TYP.
.03 R TYP.
.015 R TYP.
RECOMMENDED
PANEL CUTOUT
.980
.900
D

T20 Thumbwheel and L20 Le
wheel available in 8, 10, 12
16 positions with widest rang
output codes. Can be furnis
with extended PC board to
vide mounting of other co
nents. Stops may be inserte
factory or in the field to co
dial rotation.

SERIES T24 — BACK MOUNT DUSTPROOF




A
B
C
1.15
.900
n = number of modules
A = (n × .500) +.765
B = (n × .500) +.595
C = (n × .500) +.405
D = (n × .500) +.425
.100 DIA.
(4 HOLES)
.03 R. TYP.
.015 R. TYP.
RECOMMENDED
PANEL CUTOUT
.980
.900
D

A dustproof version of the Series T20 Thu
wheel shown on the preceding page. C
plastic window covers dial character ope
for resistance to dust and moisture. Avail
in 8 and 10 positions. Stops may be inse
at factory or in the field to control dial rota

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For More Information. Circle No. 459

CHERRY Thumbwheel, Leverwheel, Pushwheel

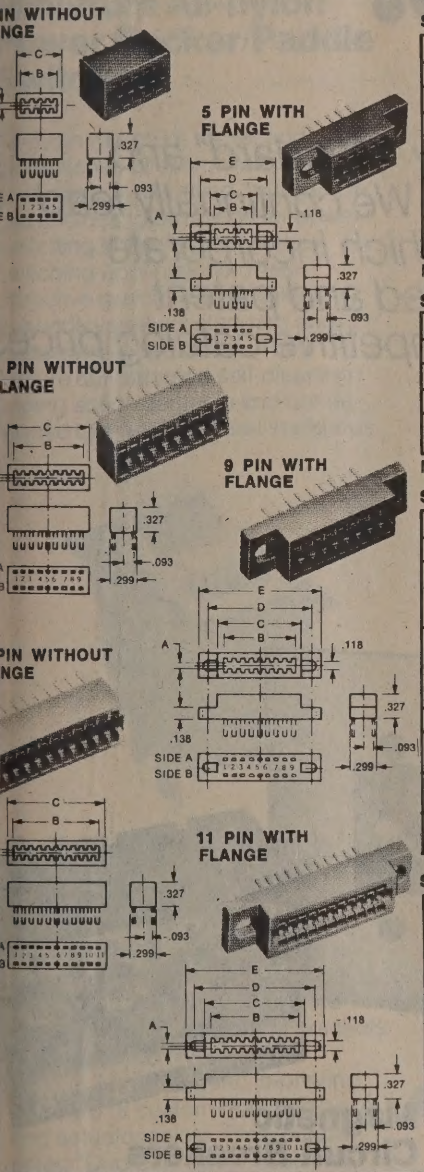
UMBWHEEL CONNECTORS

CIFICATIONS

spacing on connectors is either .079″
.100″, in a choice of 9 or 11 pin
figuration. Available with or without
unting flanges. Flanges have elon-
ed mounting holes (.122″ x .178″) to
ept No. 4-40 or No. 4-48 machine
ews.

y material: Molded Noryl

s: Gold flashed beryllium copper



	With and Without Flange					With Flange Only		With and Without Flange
COLOR	SWITCH SERIES	NO. OF PINS	A	B	C	D	E	PC BOARD THICKNESS
RED	T56 T56	9 11	.051 .051	.886 .886	.945 .945	1.181 1.181	1.417 1.417	.039 .039
BEIGE	T50 T50	9 11	.051 .051	.965 .965	1.024 1.024	1.260 1.260	1.496 1.496	.039 .039
GREEN	T20, 65, 75 L20	11	.071	1.146	1.205	1.441	1.677	.059
BLACK	T55	5	.051	.563	.630	.866	1.102	.039

SERIES T50 (Beige) 9 pins on .100″ centers, 11 pins on .079″ centers

TERMINATION				Number of Pins	For Use With Switch Numbers:
Solder Pins		Solder Lugs			
Without Flange	With Flange	Without Flange	With Flange		
C2BO—P101	C2BF—P103	C2BO—N101	C2BF—N103	Side A, 9 Pins	T50-02, 03, 04, 94, 95, 96
C2BO—P802	C2BF—P804	C2BO—N802	C2BF—N804	Side A, 11 Pins	T50-01
——	C2BF—P105	——	——	Side A, 9 Pins; Side B, 9 Pins.	
——	C2BF—P806	——	——	Side A, 11 Pins; Side B, 11 Pins.	

NOTE: No connector is available to fit the T51-02.

SERIES T55 (Black) All pins on .100″ centers, 5 pins per row

TERMINATION				Number of Pins	For Use With Switch Numbers:
Solder Pins		Solder Lugs			
Without Flange	With Flange	Without Flange	With Flange		
C2KO—P107	C2KF—P109	C2KO—N107	C2KF—1N09	Side A, 5 Pins	See Note
C2KF—P108	C2KF—P110	——	——	Side A, 5 Pins; Side B, 5 Pins.	See Note

NOTE: T55 connectors fit all codes except decimal.

SERIES T56 (Red) 9 pins on .100″ centers, 11 pins on .079″ centers

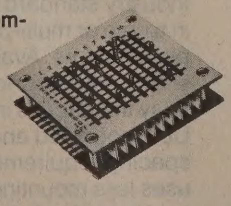
TERMINATION				Number of Pins	For Use With Switch Numbers:
Solder Pins		Solder Lugs			
Without Flange	With Flange	Without Flange	With Flange		
C2RO—P111	C2RF—P116	——	C2RF—N116	Side A, Pins 1, 3, 5, 7, 9.	T56-02, 03
C2RO—P112	C2RF—P117	——	——	Side A, Pins 1, 3, 4, 5, 6, 7, 9.	T56 02L, 03L, 12
C2RO—P113	C2RF—P118	C2RO—N113	C2RF—N118	Side A, 9 Pins	T56-02, 02L, 03, 03L, 04, 12
C2RO—P814	C2RF—P819	C2RO—N814	C2RF—N819	Side A, 11 Pins	T56-01
C2RO—P815	C2RF—P820	——	——	Side A, 11 Pins; Side B, Pins 5, 7.	T56-01L
——	C2RF—P121	——	——	Side A, 9 Pins; Side B, 9 Pins.	T56-02
——	C2RF—P822	——	——	Side A, 11 Pins; Side B, 11 Pins.	T56-01

SERIES T20, L20, T65, T75 (Green) All pins on .100″ centers, 11 pins per row maximum

TERMINATION				Number of Pins	For Use With Switch Numbers:
Solder Pins		Solder Lugs			
Without Flange	With Flange	Without Flange	With Flange		
C2GO—P123	C2GF—P126	——	——	Side A, Pins 4, 5, 6, 7, 8.	T20C-02 L20C-02 T65C-02 T75C-02
C2GO—P124	C2GF—P127	C2GO—N124	C2GF—N127	Side A, 11 Pins	T65C-01 T75C-01
C2GO—P125	C2GF—P128	——	——	Side A, 11 Pins; Side B, 11 Pins.	

TRIX TYPE SELECTOR SWITCHES

nual programming and switching for com-
x control equipment. Each of two
ndard types is expandable up to
 modules, providing 500 to 1,000
sspoints. Custom design available
o 2,784 crosspoints.



ctrical Capacity:

Make and break 48 volts DC at 0.50 Amp, 125 Volts AC at
.15 Amp.

Current carrying only (no make and break) 2 Amp. AC or DC.

Insertion Resistances:

50 milliohms plus 6 milliohms per inch of printed circuit.

Note: Overall width of basic 10 x 10 and 20 x 10 Selector Switch is 3½ inches. For each 10 sliders added to the basic unit add 3 inches to overall width. A 20 slider unit measures 6½ inches wide; a 30 slider unit measures 9½ inches wide; a 40 slider unit measures 12½ inches wide and a 50 slider unit measures 15½ inches wide.

Part No.	Circuitry	Part No.	Circuitry
C10-01A	20 x 10	C10-20A	10 x 10
C10-02A	20 x 20	C10-42A	10 x 20
C10-03A	20 x 30	C10-43A	10 x 30
C10-04A	20 x 40	C10-44A	10 x 40
C10-05A	20 x 50	C10-45A	10 x 50

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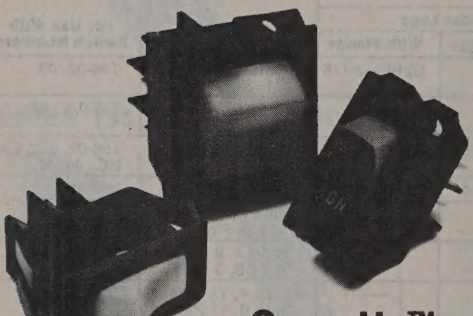

Curvette™ Rocker Switches

Our new compound curve rocker switch offers more performance and protection for the lowest cost than you'll find anywhere. Outside, Curvette's smooth compound curve bezel and glare-free matte finish blend into the panel. Inside, Curvette's switching mechanism is the toughest we've ever designed. It handles detrimental high inrush current surges without expensive silver alloy butt contacts. It's been tested successfully up to 75 amps inrush. And in most applications, Curvette's new switching mechanism also stops arcing before it starts — without expensive arc-suppressing fibre. Curvette withstands 50,000 actuations, minimum, at maximum load in high ambient temperatures. Curvette's slightly smaller size and patent pending mounting ear design let it fit snugly into any opening from .48" x 1.072" to .55" x 1.125". Curvette is UL listed and CSA approved for 16AMP 125VAC and 10AMP 250VAC; VDE approvable for 12(6) AMP 250VAC. Curvette is available in one-color, two-color and lighted (AC or DC) versions. Curvette VisiRocker™ has a second color molded in for low cost "on" indication. Also available with custom legends and in double-pole configurations.

ON
OFF
OFF
OFF
OFF

Magnetic Circuit Breakers

Industry standard magnetic circuit breakers are availa
in single or multi-pole configurations, with single or mul
ple actuators. Available with instantaneous, ultra short,
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relay trip circuits in popular ratings up to 50 amp. They
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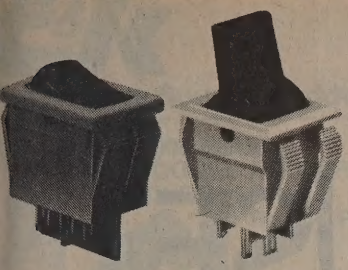
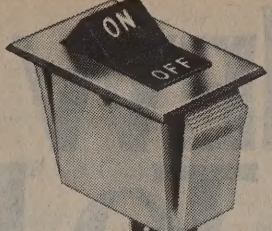
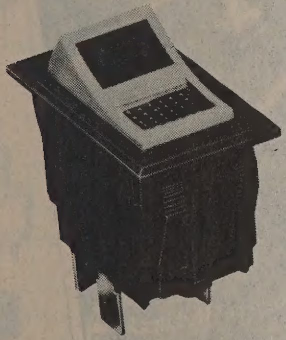
breakers also fit larger, "standard" frame size opening
Special caps available in eight attractive colors. Well-suited for new designs or as direct replacements for competitive products.





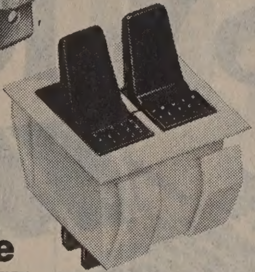
Miniature All-nylon Power Rocker/Paddle Switches

All-nylon miniature rocker and paddle switches offer high reliability, low cost, snap-in mounting, multiple circuit choices, plus ratings for power switching or low level dry circuit switching applications. These attractive switches are available in a wide variety of standard and custom-matched colors. They feature our patented self-cleaning wiping action contacts and are designed to meet European standards.



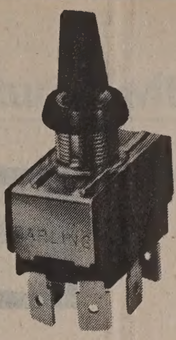
Full Size Tippette® Rocker Switches

Tippette rocker switches are available in an almost endless variety of circuits, current ratings, actuator and bezel styles, mounting brackets and termination types. Other options include legend imprinting, standard or custom-matched bezel and actuator colors. Plus, our patented "Drip Dry" option is an inexpensive way of protecting switch from dirt, moisture and other contaminants. Lighted versions feature single or multiple indicator lights — available with voltages from 6VDC to 240VAC. Will be available in European-approved versions, consult factory.



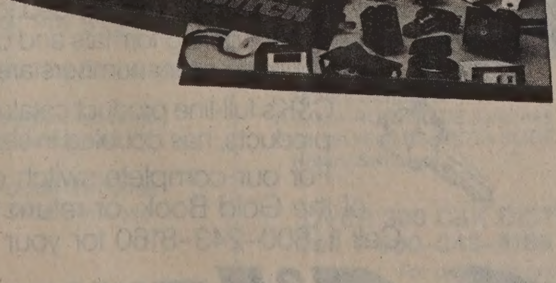
Mini Tippette Switches

All-nylon low cost insulated switches are tested at full load for 100,000+ cycles. Single or double pole versions offered. All feature convenient snap-in mounting, paddle or rocker actuation. Choose from various current ratings, circuit designs, termination types, colors (standard or custom matches) and legend imprinting. Lighted versions with lamp voltages from 6VDC to 240VAC. Will be available in European-approved versions, consult factory.



Full Size Toggle Switches

These toggle switches are available in one through four poles in ratings up to 20 amps. Single and double pole switches are available with a variety of circuit, termination and actuator variations including an insulated all-nylon model. New lighted versions utilize a translucent actuator which displays three colors to indicate switch positions. Add a neoprene bushing seal that protects against dust and moisture and you have the right switch combination for marine and automotive applications. Will be available in European-approved versions, consult factory.



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Take a look—
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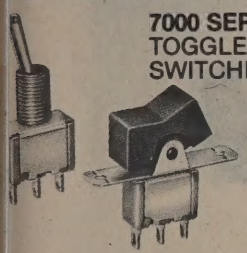
Miniature Switches



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Reliable Proven Design

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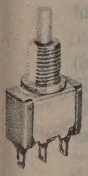
SEALED TOGGLE, ANTI-STATIC ROCKER & LEVER HANDLE SWITCHES

Wave Solderable

W SERIES
.025 WIRE-WRAP TOGGLE SWITCHES

Terminal Spacing for WIRE-WRAP Boards



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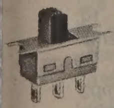
SNAP-ACTING MOMENTARY PUSHBUTTON SWITCHES

Light Crisp Feel

8060 SERIES
ALTERNATE ACTION & MOMENTARY PUSHBUTTON SWITCHES

Higher Current



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MINIATURE SLIDE SWITCHES

SP & DP With Proven Design

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TINY SWITCHES

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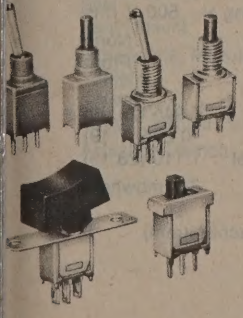
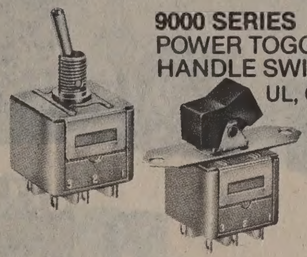
- T Series Tiny Toggle Switches
- TP Series Tiny Pushbutton Switches
- T Series Tiny Rocker Switches
- TS Series Tiny Slide Switches





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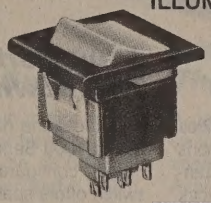

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8600 SERIES
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MP SERIES
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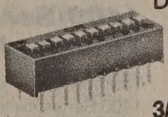
Clean Modern Appearance

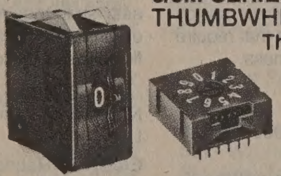
SS SERIES
SOLID STATE PUSHBUTTON SWITCHES

Bounce Free



BD SERIES
DIP SWITCHES

Wave Solderable



3/3M SERIES
THUMBWHEEL SWITCHES

Thousands of Varieties

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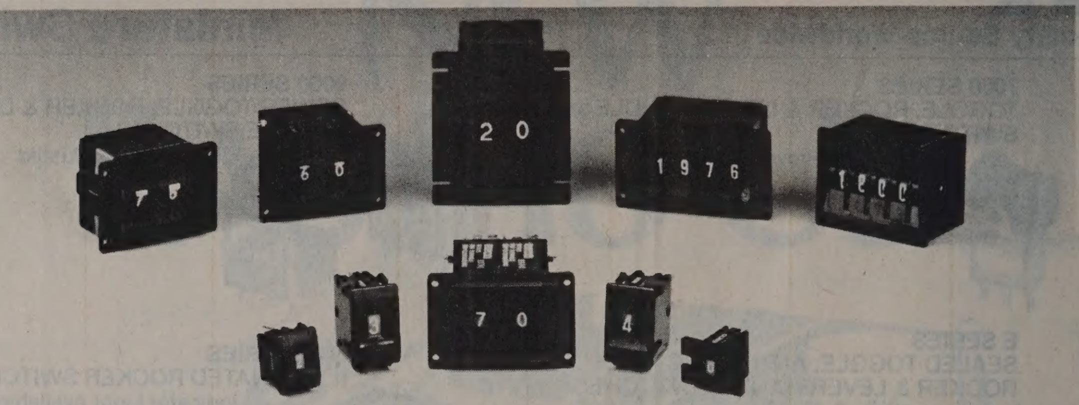
- Y Series Switchlocks
- A Series Switchlocks
- A Series Rotary Switches
- H Series Power ROTA-SLIDE® Rotary Switches
- R Series ROTA-SLIDE Switches
- F Series Miniature ROTA-SLIDE Rotary Switches
- V Series Power & Line Voltage Select Slide Switches
- S Series Slide Switches
- L Series Miniature Slide Switches
- C Series Power Rocker Switches
- J Series Rocker Switches
- K Series Pushbutton Switches

OVER 300 C&K DISTRIBUTOR LOCATIONS
Call 1-800-243-8160 for nearest distributor.

For complete product specifications,
refer to Vol. 3 C&K of the Gold Book,
or return the C&K postcard in Vol. 4.

C&K **C&K COMPONENTS, INC.** 15 Riverdale Ave., Newton, MA 02158-1082 Tel: (617) 964-6400, Telex: 92-2544, TWX: 710-335-1163

EECO® THUMBWHEEL SWITCHES



1000 Series Thumbwheel Switch

The .236 wide 1000 Series switch provides reliability and compact size for applications where space is limited. Available in standard thumbwheel adjust. or in safety-lock Push-Set and Pen-Set.

Number of Positions	10
Life	300,000 Detents
Electrical Rating	
Non-Switching Load	0.500 Amps
Switching Load	0.100 Amps
Contact Resistance	0.200 Ohms
Dielectric Withstanding V.	500 VDC
Seal	Dust
Panel Mount	Rear
Dimensions, Module	
Height	0.551 (14.0)
Width	0.236 (5.99)
Depth, Behind Panel	0.865 (21.97)
Actuation Method	
Thumbwheel/Push/Pen-Set	Std.

1100 Series Thumbwheel Switch

With the same narrow .236 width design as the 1000 Series switch, but with front mount configuration, the 1100 Series switch offers space saving dimensions in an attractive black matte finish.

Number of Positions	10
Life	300,000 Detents
Electrical Rating	
Non-Switching Load	0.500 Amps
Switching Load	0.100 Amps
Contact Resistance	0.200 Ohms
Dielectric Withstanding V.	500 VDC
Seal	Dust
Panel Mount	Front
Dimensions, Module	
Height	0.708 (17.98)
Width	0.236 (5.99)
Depth, Behind Panel	0.905 (22.99)
Actuation Method	
Thumbwheel/Push/Pen/Lock-Set	Std.

1200 Series Thumbwheel Switch

This .300 wide single pole decimal or binary coded switch offers long life and reliability in a snap-together Push-Set panel switch. With small size and easily read characters, the 1200 Series switch provides 10 positions.

Number of Positions	10
Life	300,000 Detents
Electrical Rating	
Non-Switching Load	0.500 Amps
Switching Load	0.100 Amps
Contact Resistance	0.200 Ohms
Dielectric Withstanding V.	500 VDC
Seal	Dust
Panel Mount	Front
Dimensions, Module	
Height	0.708 (17.98)
Width	0.300 (7.62)
Length	0.905 (22.99)
Actuation Method	Push-Set

1300 Series Thumbwheel Switch

With .300 width, snap-together assembly, front snap-in mounting and large characters, this 10- or 16-position switch is the perfect choice for users that require high reliability and compactness.

Number of Positions	10 and 16
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	1.000 Amps
Switching Load	0.100 Amps
Contact Resistance	0.200 Ohms
Dielectric Withstanding V.	500 VDC
Seal	Dust
Panel Mount	Front
Dimensions, Module	
Height	0.945 (24.00)
Width	0.300 (7.62)
Depth, Behind Panel	1.338 (33.99)
Actuation Method	Push-Set

1400 Series Thumbwheel Switch

Thumbwheel, Push-Set or Lock-Set, the 1400 Series switch with its high reliability, easy snap-together assembly and variety of binary or decimal codes gives design flexibility to the user.

Number of Positions	10 and 16
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	1.000 Amps
Switching Load	0.100 Amps
Contact Resistance	0.200 Ohms
Dielectric Withstanding V.	500 VDC
Seal	Dust
Panel Mount	Front
Dimensions, Module	
Height	0.945 (24.00)
Width	0.315 (8.00)
Depth, Behind Panel	1.338 (33.99)
Actuation Method	
Thumbwheel/Push/Lock-Set	Std.

1600 Series Thumbwheel Switch

Low cost and small size, combined with front snap-in mounting make this 10-position thumbwheel actuated switch ideal for applications where panel space is limited. Snap-together modules eliminate tools.

Number of Positions	10
Life	100,000 Detents
Electrical Rating	
Non-Switching Load	1.000 Amps
Switching Load	0.100 Amps
Contact Resistance	0.150 Ohms
Dielectric Withstanding V.	500 V rms
Seal	None
Panel Mount	Front
Dimensions, Module	
Height	0.945 (24.00)
Width	0.295 (7.49)
Depth, Behind Panel	1.110 (28.19)
Actuation Method	Thumbwheel

Dimensions in inches (mm)

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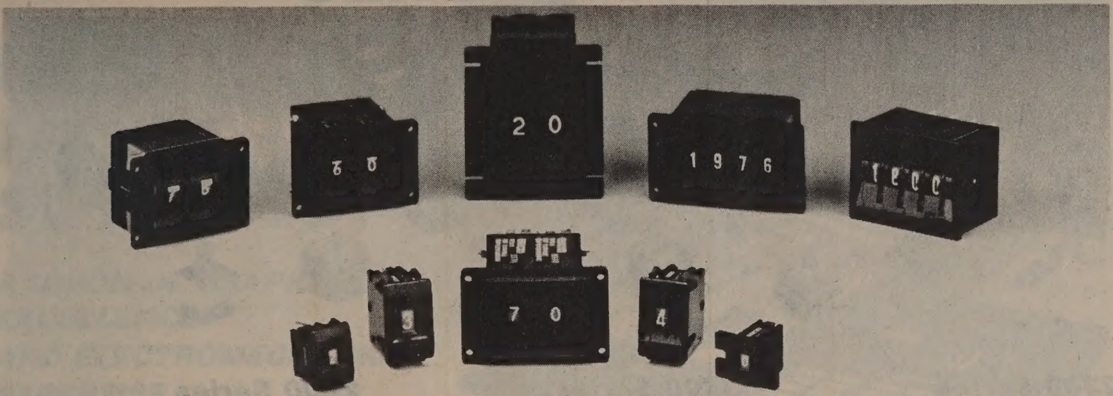
EECO® THUMBWHEEL SWITCHES



1776/1976 Series Thumbwheel Switch

Revolutionary in design, the 1776 Series .500 wide thumbwheel switch, and the slimmer (.350) 1976 Series switch, offer optional notched terminals for mounting directly to motherboards.

Number of Positions	8, 10, 12, and 16
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	1000 V rms
Seal	Dust
Panel Mount	Rear
Dimensions, Module	
Height	1.200 (30.48)
Width	0.500 (12.70), 0.350 (8.89)
Depth, Behind Panel	1.508 (38.30)
Actuation Method	Thumbwheel

1800 Series Thumbwheel Switch

A reliable, low cost snap-in mount switch available in gray, beige or black in gloss or molded matte finish. The 1800 Series switch has PCB termination and is a slim .315 wide.

Number of Positions	10
Life	500,000 Detents
Electrical Rating	
Non-Switching Load	1.000 Amps
Switching Load	0.100 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	1000 V rms
Seal	None
Panel Mount	Front
Dimensions, Module	
Height	1.240 (31.50)
Width	0.315 (8.00)
Depth, Behind Panel	1.417 (35.99)
Actuation Method	Thumbwheel

2000 Series Thumbwheel Switch

A general purpose, large industrial-type switch, the 2000 Series offers over 50 codes in 8-, 10-, 12-, and 16-positions. Available with an unsealed and sealed option, plus extra large legend.

Number of Positions	8, 10, 12, and 16
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	1,000 V rms
Seal	Optional
Panel Mount	Rear
Dimensions, Module	
Height	2.100 (53.34)
Width	0.500 (12.70)
Depth, Behind Panel	2.030 (51.56)
Actuation Method	Thumbwheel

6000 Series Thumbwheel Switch

Designed to Military standards and field-proven, the 6000 Series switch is sealed to protect the contact area from dust, moisture and salt spray. Offered in 8-, 10-, and 12-positions, and with 3 types of term.

Number of Positions	8, 10, and 12
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	1,000 V rms
Seal	Environmental
Panel Mount	Rear
Dimensions, Module	
Height	1.150 (29.21)
Width	0.500 (12.70)
Depth, Behind Panel	1.560 (39.62)
Actuation Method	Thumbwheel

7000 Series Military Thumbwheel Switch

Qualified to the rigid standards of MIL-S-22710/15, this Military-grade switch offers a completely sealed contact area, impervious to dust, high humidity and salt spray. Can be used safely in explosive environments.

Number of Positions	8, 10, and 12
Life	1,000,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	1,000 V rms
Seal	Environmental
Panel Mount	Rear
Dimensions, Module	
Height	1.150 (28.07)
Width	0.500 (12.70)
Depth, Behind Panel	1.570 (39.88)
Actuation Method	Thumbwheel

Thumbpot™ Digital Voltage Divider

This unit is available in .500 or .350 wide models and electrically divides the input voltage into precise, incremental voltage output values. The major feature of the unit is exacting repeatability.

Number of Positions	10
Life	1,000,000 Detents
Electrical Rating	
Std. Res. Range	100-100K Ohms
Std. Res. Tolerance	+1%
Dielectric Withstanding V.	500 V rms
Ins. Res. (@ 500 VDC)	1,000 Megohms
Seal	Dust
Panel Mount	Rear
Dimensions, Module	
Height	1.200 (30.48)
Width	0.500 (12.70), 0.350 (8.89)
Depth, Behind Panel	1.250 (31.75)
Actuation Method	Thumbwheel

Dimensions in inches (mm)

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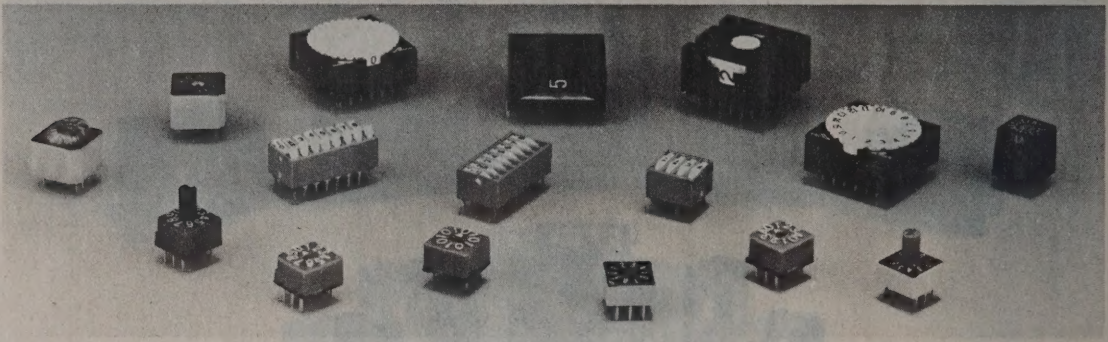
For More Information. Circle No. 462

EECO® PCB SWITCHES



2300 Series MICRO-DIP®

Advanced in concept, the 2300 Series switch is a space-saving yet economical method of equipment programming. Ideal for address encoding or presetting of PROM's and data entry devices.

Number of Positions	10 and 16
Life	10,000 Detents
Electrical Rating	
Non-Switching Load	1.000 Amps
Switching Load	0.100 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	250 V rms
Dimensions	
Height	0.239 - 0.394 (6.07 - 10.01)
Width	0.376 - 0.450 (9.55 - 11.43)
Length	0.396 - 0.450 (10.06 - 11.43)
Actuation Method	
Thumbwheel	Available
Screwdriver	Standard
Shaft	Available
Binary Coded Output	Standard

3300 Series MICRO-DIP®

A low-profile, fully-sealed version of the original 2300 Series MICRO-DIP switch, this switch has all of its features, plus full sealing to withstand automated soldering and cleaning processes.

Number of Positions	10 and 16
Life	10,000 Detents
Electrical Rating	
Non-Switching Load	1.000 Amps
Switching Load	0.100 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	250 V rms
Full Environmental Seal	Standard
Dimensions	
Height	0.190 (4.83)
Width	0.380 (9.65)
Length	0.380 (9.65)
Actuation Method	
Screwdriver	Standard
Shaft	Available
Binary Coded Output	Standard

2400 Series MINI-DIP®

With exclusive gold-on-gold cleaning/wiping action contacts, this series of switches assures low contact resistance while the unique locking rod design prevents accidental actuation.

Number of Positions	2 to 10
Life	2,000 Detents
Electrical Rating	
Non-Switching Load	1.000 Amps
Switching Load	0.125 Amps
Contact Resistance	0.050 Ohms
Dielectric Withstanding V.	500 V rms
Full Environmental Seal	Optional
Dimensions	
Height	0.375 (9.52)
Width	0.385 (9.78)
Length	0.200 - 1.000 (5.08 - 25.4)
Actuation Method	Rocker
Standard Options	
Special Marking	Yes
Seal	Yes

2100 Series STRIPSWITCH®

The most economical method of handsetting coded values. Requires a minimum of space, no mounting hardware, and can be "ganged" up to four stations in a strip. Two legend locations provide readability.

Number of Positions	10 and 16
Life	250,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	500 V rms
Dimensions	
Height	0.430 (10.92)
Width	0.775 (19.68)
Length	0.800 (20.32)
Actuation Method	
Thumbwheel	Standard
Screwdriver	Standard
Binary Coded Output	Standard

2200 Series STRIPSWITCH®

This switch offers all of the features of the proven 2100 Series STRIPSWITCH in a low-profile, fully-sealed unit. The easy-to-read thumbwheel has a built-in screwdriver slot.

Number of Positions	10 and 16
Life	100,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	500 V rms
Full Environmental Seal	Standard
Dimensions	
Height	0.360 (9.14)
Width	0.790 (20.07)
Length	0.790 (20.07)
Actuation Method	
Thumbwheel	Standard
Screwdriver	Standard
Binary Coded Output	Standard

2600 Series STRIPSWITCH®

This is a 10 position low profile switch with a standard bottom seal to prevent solder wicking and flux migration. Horizontally or vertically mounted, with thumbwheel and screwdriver slots.

Number of Positions	10
Life	250,000 Detents
Electrical Rating	
Non-Switching Load	3.000 Amps
Switching Load	0.125 Amps
Contact Resistance	0.100 Ohms
Dielectric Withstanding V.	500 V rms
Dimensions	
Height	0.343 (8.71)
Width	0.780 (19.81)
Length	0.800 (20.32)
Actuation Method	
Thumbwheel	Standard
Screwdriver	Standard
Binary Coded Output	Standard

Dimensions in inches (mm)

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EECO®

MEMBRANE SWITCHES

A UNION OF GRAPHICS EXCELLENCE AND ELECTROMECHANICAL EXPERTISE.

The Membrane Switch Operations of EECO Incorporated provides high quality switches to customers requiring absolute reliability combined with faultless graphics.

EECO membrane switches integrate SPST, momentary, normally open switches into control panels which include exceptional graphic features. Circuitry is screen-printed on polyester substrates and conductors carry low voltage DC logic signals. Construction methods provide totally-sealed panels capable of withstanding harsh environmental conditions. Mechanical designs minimize the effect of normal handling during the assembly process and use of the finest available materials ensures quality.

Typical applications include:

- Medical products and instrumentation.
- Depth-finders and radar systems for marine use.
- Heat and humidity intensive products such as handheld military radios.
- Office products.
- Point-of-Sale terminals.

Vertical Integration

EECO ensures quality and efficiency by exercising careful control over processes and materials. EECO in-house capabilities include:

- Computer Assisted Design to ensure documentation quality.
- Design engineering and art layout.
- Photographic reproduction.
- One of the finest technical graphics capabilities in the country.
- Circuit printing and a comprehensive testing program for the electronic component portion of all EECO membrane switches.
- A graphic ink laboratory for production and matching of high quality inks.
- Fabrication of steel rule dies.
- Production of stainless steel and polyester mesh screens in humidity-controlled environment.
- Die cutting.
- Assembly.

Features

- Embossed graphics provide tactile location and enhance the user interface.
- Selective texturing adds chemical resistance and allows a transparent readout area in a matte background without a die-cut opening.
- Connectors are installed and tested to met specific circuit configurations.
- Standard aluminum or plastic support panels can be provided with mounting hardware.
- PCB's with components and connectors are available for integration of LED backlighting.
- Graphic interchangeability permits cosmetic changes to control panels for private labeling.
- Backlit switch functions are available.
- "Deadfront" legends allow selective display of instructions.
- Lenses for LED, Vacuum Fluorescent, Liquid Crystal, and CRT displays are available.
- Polyester or stainless steel domes provide tactile feedback which adds mechanical resistance and travel.
- ESD/EMI shielding provided with aluminum or copper foils, or a variety of cost-effective printed conductive materials.

Quality & Reliability

The EECO quality system is organized to provide reliable membrane switch products that you can count on—every time!

- All aspects of a proposed design are reviewed prior to production.
- Training programs for the entire manufacturing force assure quality at every phase of production.
- All component materials are selected, qualified and inspected with quality standards prior to release to manufacturing.
- Die cutting, color matching, printing and assemblies are all first-article inspected before continued manufacture.
- Continuous monitoring of operations assures adherence to strict quality standards.
- Circuits and connectors are fully electrically inspected before final assembly.
- Conductors are fully tested for electrical conformance, proper substrate adhesion, hardness and proper curing.
- Each switch function is thoroughly tested for design compliance, continuity and electrical specifications.
- Final inspection is 100%, plus a simulated customers' incoming inspection program sampling.
- A thoroughly documented Quality Assurance Program assures that only top quality products are shipped.

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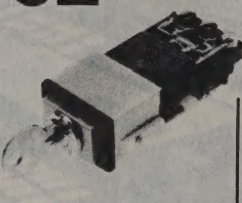
EAO SWITCHES

The World's Finest Switching Products

SERIES 01

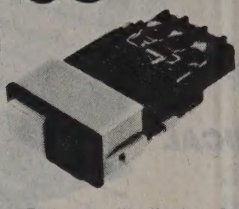
- Round, Square, and Rectangular bezel-front panel mount
- All types mount in a round hole
- 1-4 poles
- Momentary or maintained action
- Maintained action is position indicating
- 2 piece lens cap. Can be separated for insertion of film
- 3 Switching elements—Snap, Low Level, Electronic
- 9 Lens colors
- Front panel replacement of lamps
- Lamps do not travel when the switch is actuated

SERIES 02



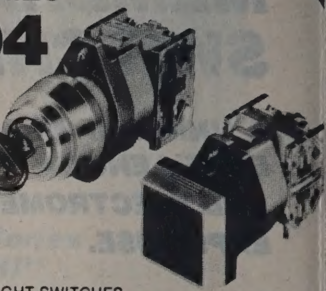
- Double pole, Double throw Momentary or Maintained action on both 380 Volt 10 Amp contacts
- Rectangular lens cap—9 colors
- Key Lock available

SERIES 03



- Full or split display—2 lamp
- Double pole, single or 2 button action
- Momentary, Maintained or combination
- Independent or Interlocked
- Key Switches available

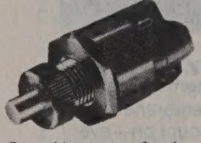
SERIES 04



OILTIGHT SWITCHES

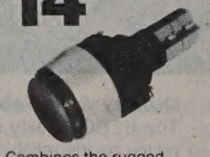
- Round or Square panel front
- Snap together modular design
- Up to 8 pole switching
- Lighted and unlighted pushbuttons
- Mounts in 890″ round hole
- Lever, Key-Lock, Emergency Stop actuators

SERIES 11



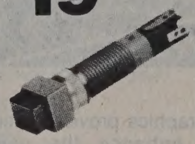
- Round lens cap—6 colors
- Mount from rear of panel
- 1-3 pole switching elements
- Momentary or maintained action
- Lamps replaceable from front
- LED available

SERIES 14



- Combines the rugged design of the 04 oiltight panel seal and the choice of switching elements
  - 5 Amps 250 volt
  - Low level or electronic elements
- Specifically designed for machine tool applications where low level or computer switching is required.
- High-Security Key Lock available

SERIES 19

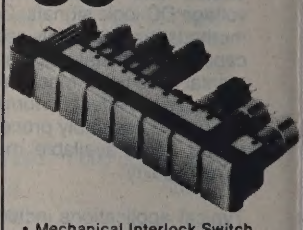


- Miniature lighted pushbuttons & indicators
- 9 mm (.354″) centers.
- Round or square bezel
- Low level switching: µV up to 60V; µA up to 100 mA
- Momentary or maintained action (position indicating)

SERIES 21

- Non illuminated version of the Series 11 with 6 different colored actuator button.
- Switching Elements
  - 5 Amp 240 volt 1 to 3 poles
  - Low level switch
  - Electronic switch Hall effect
- Momentary and maintained (position indicating) action

SERIES 30

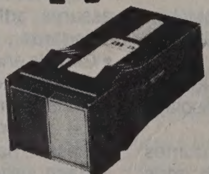


- Mechanical Interlock Switch
- 2—12 Switch units
- 5 different interlock combinations
- Slide Mechanism—All metal construction
- 3 Switching elements—Snap, Low Level, Electronic

SERIES 31/31LL

- Square or Rectangular bezel
- Flat or Concave lens
- 1–4 pole snap acting switch, Low Level or Electronic
- Lamp T-1 ¾ groove base
- Key Lock—round, square, rectangular with 3 levels of security: Low-Cost, Standard and High-Security

SERIES 41

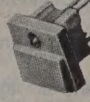


- 2 lamp switch
- Full or split screen
- Same panel dimensions as 31 Series
- Soft mount—from front of panel
- Switching elements same as 31 Series

SERIES 51

- Combines style of Series 31 with oil and water tight features of Series 14.
- Integral 'O' ring seal; one-piece actuator; conforms to IP65 requirements
- 1-4 pole, snap-acting contacts, low level or electronic switching.
- Round, square and rectangular panel fronts; choice of 8 lens colors.

SERIES 98



- Oil/Watertight seal; built to IP67 standards
- 3 sizes; non-illuminated or illuminated (1 or 2 LED)
- Momentary or maintained action, SPDT, (Form C)
- Rated at 50 VAC/72 VDC
- Gold plated contacts; over 5 million operations

SERIES 99

LIGHTED KEYBOARD SWITCH

- Momentary and maintained action
- Gold contacts
- Long life—5 million operation minimum
- Low level switching —dry circuit
- Low constance resistance— 10 milli-ohms
- Low contact bounce, < 100µ sec

EAO Switch. You can feel the difference.

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For More Information. Circle No. 463

THUMBWHEEL SWITCHES

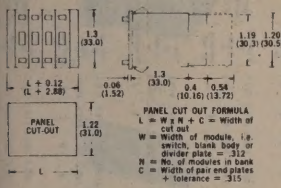
IMLEC

MODEL II IMLEC INDEXER PUSHBUTTON FRONT MOUNT

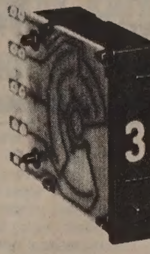
The Imlec Indexer is a bi-directional push indexing front mount switch, 5⁄16″ in width. Identical in size to our popular MF switches. With snap together banking and snap-in panel mounting. Pushbuttons above and below the legend allow the user to add or subtract from the count.

These 10 or 16-position switches are available in all popular codes.

DIMENSIONS IN INCHES (IN MILLIMETERS)



PANEL CUT OUT FORMULA
L = W x N + C = Width of cut out
W = Width of module, i.e. switch, blank body or divider plate = .312
N = No. of modules in bank
C = Width of pair end plates + tolerance = .315

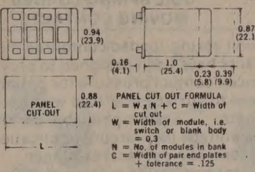


MODEL MI MINI INDEXER PUSHBUTTON FRONT MOUNT

The Mini Indexer is a bi-directional push indexing front mount switch. 0.30″ in width. Similar to our Imlec Indexer but smaller in size. Features snap together banking and snap-in panel mounting. Pushbuttons above and below the legend allow the user to add or subtract from the count.

Available in most popular 10-position codes.

DIMENSIONS IN INCHES (IN MILLIMETERS)



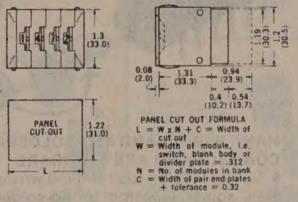
PANEL CUT OUT FORMULA
L = W x N + C = Width of cut out
W = Width of module, i.e. switch or blank body = 0.3
N = No. of modules in bank
C = Width of pair end plates + tolerance = .125

MODEL MF MINIATURE FRONT MOUNT

The MF is our most popular, low cost, 5⁄16″ wide Thumbwheel Switch. Slim, attractive, snap-in panel mounting requires no panel mounting hardware.

Available in all popular 10 and 16-position codes. Matte black finish on high impact moldings, with white legend on black wheel standard.

DIMENSIONS IN INCHES (IN MILLIMETERS)



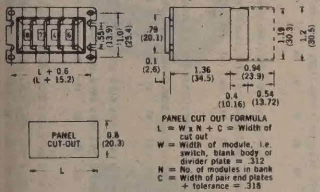
PANEL CUT OUT FORMULA
L = W x N + C = Width of cut out
W = Width of module, i.e. switch, blank body or divider plate = .312
N = No. of modules in bank
C = Width of pair end plates + tolerance = 0.32

MODEL TR THIN REAR MOUNT

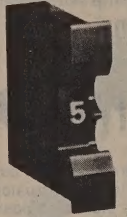
For applications that require a lot of switch in a small space, these 5⁄16″ wide TR switches are ideal. Rear mount counterpart to our popular MF front mount switches.

Available in most 10-position codes including Decimal, BCD, BCD plus Complement and Complement only.

DIMENSIONS IN INCHES (IN MILLIMETERS)



PANEL CUT OUT FORMULA
L = W x N + C = Width of cut out
W = Width of module, i.e. switch, blank body or divider plate = .312
N = No. of modules in bank
C = Width of pair end plates + tolerance = .318

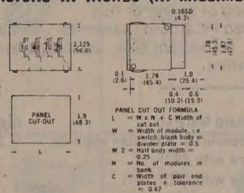


MODEL IF INTERMEDIATE FRONT MOUNT

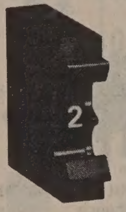
A rugged front mount switch with large digits, ½″ wide module. Snap-in front mounting hardware. Available in most popular 10 and 16-position codes.

Matte black finish with white legends on black wheel standard. Gloss fnish, other wheel colors and legends available.

DIMENSIONS IN INCHES (IN MILLIMETERS)



PANEL CUT OUT FORMULA
L = W x N + C Width of cut out
W = Width of module, i.e. switch, blank body or divider plate = 0.5
W 2 = Half body width = 0.25
N = No. of modules in bank
C = Width of pair end plates + tolerance = 0.47

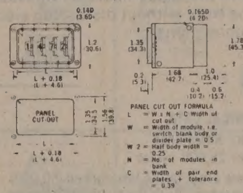


MODEL IR INTERMEDIATE REAR MOUNT

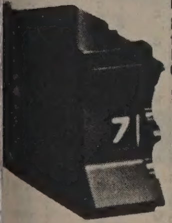
Rugged rear mount counterpart to our IF model, with large readable digits, ½″ wide module. Available in most popular 10 and 16-position codes.

Matte black finish with white legends on black wheel standard. Gray bodies, gloss finish, other wheel colors and legends available.

DIMENSIONS IN INCHES (IN MILLIMETERS)



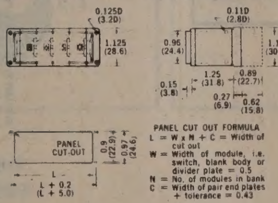
PANEL CUT OUT FORMULA
L = W x N + C Width of cut out
W = Width of module, i.e. switch, blank body or divider plate = 0.5
W 2 = Half body width = 0.25
N = No. of modules in bank
C = Width of pair end plates + tolerance = 0.39



MODEL MR MINIATURE REAR MOUNT

Popular rear mount switch, ½″ wide module but lower profile than IR model. Available in matte black in most popular 10-position codes including Decimal, BCD, and BCD plus Complements.

DIMENSIONS IN INCHES (IN MILLIMETERS)



PANEL CUT OUT FORMULA
L = W x N + C = Width of cut out
W = Width of module, i.e. switch, blank body or divider plate = 0.5
N = No. of modules in bank
C = Width of pair end plates + tolerance = 0.43

SPECIFICATIONS ALL MODELS

Contact Current: Contacts rated 2 amps @ 115 VAC or 28 VDC non-switching; 0.5 amps @ 28 VAC or DC switching. Minimum recommended switching current 10 microamps @ 20 millivolts.

Voltage: 200 volts max DC (within power rating) or RMS.

Power: 24 watts max per switch with 12 watts max per energized output.

Insulation Resistance: 1000 megohms between adjacent contacts at 25°C and 20% relative humidity.

Contact Resistance: 0.1 ohms initial and 0.2 ohms after life test at 25°C.

Dielectric Strength: 500 VAC.

Moldings: High impact acetate body in matte black, gloss black or gray finish; wheels are polycarbonate in black with white legends standard, white with black legends for lighted versions, other colors available.

Contact Material: Stator has 0.0001″ hard gold over 1 oz. copper on glass fibre as MIL-P-13949GF. Rotor has silver/gold alloy on beryllium copper.

Life: 1,000,000 detents minimum either direction.

Stops: Stops to limit switch to any position.

Panel Thickness: 1⁄16″ to 3⁄32″.

Operating Temperature: −20°C to 70°C. Storage temperature: −40°C to 70°C.

Shock: 100 G's, 6 MS.

Vibration: 15 G's to 70-2000 Hz.

Humidity: 96 HRS, 95% relative.

Options and Accessories Available: Extended Boards for diode suppression; Termination Pins; Stopping; Blank Bodies, Half Bodies; End Plates Divider Plates; Connectors; External LED Lighting; Sealing, etc.

HOW TO ORDER

CODE NO.	DESCRIPTION	II	MI	MF	TR	MR	IF	IR
-12	10 pos. Decimal	II-12	MI-12	MF-12	TR-12	MR-12	IF-12	IR-12
-12A	10 pos. Decimal Ext. Board	II-12A	MI-12A	MF-12A	TR-12A	—	IF-12A	IR-12A
-13	10 pos. Decimal 2 pole	II-13	—	MF-13	TR-13	MR-13	IF-13	IR-13
-18	10 pos. BCD Complement Only	II-18	MI-18	MF-18	TR-18	—	—	—
-18A	10 pos. BCD Complement Only Ext. Board	II-18A	MI-18A	MF-18A	TR-18A	—	—	—
-21	10 pos. BCD	II-21	MI-21	MF-21	TR-21	MR-21	IF-21	IR-21
-21A	10 pos. BCD Ext. Board	II-21A	MI-21A	MF-21A	TR-21A	MR-21A	IF-21A	IR-21A
-22	10 pos. BCD and Complement	II-22	—	MF-22	TR-22	MR-22	IF-22	IR-22
-22A	10 pos. BCD and Complement Ext. Board	II-22A	—	MF-22A	TR-22A	MR-22A	IF-22A	IR-22A
-55	16 pos. Decimal 0-15 or 0-F	II-55	—	MF-55	—	—	IF-55	IR-55
-56	16 pos. BCD 0-15 or 0-F	II-56	—	MF-56	--	—	IF-56	IR-56
-57	16 pos. BCD and Comp. 0-15 or 0-F	II-57	—	MF-57	—	—	IF-57	IR-57
-57A	16 pos. BCD and Comp. 0-15 or 0-F Ext. Board	II-57A	—	MF-57A	—	—	IF-57A	IR-57A
-EP	End Plates, Pair	II-EP	MI-EP	MB-EP	TR-EP	MR-EP	IF-EP	IR-EP
-BB	Blank Body	II-BB	MI-BB	MF-BB	TR-BB	MR-BB	IF-BB	IR-BB
-DP	Divider Plate	—	—	MF-DP	TR-DP	MR-DP	IF-DP	IR-DP
-BBH	Blank Body with Decimal Point	II-BBH	MI-BBH	MF-BBH	TR-BBH	MR-BBH	IF-BBH	IR-BBH
-CN	Connector 10 position only	MCN-10	—	MCN-10	MCN-10	—	ICN-10	ICN-10
-HB	Half Body	—	—	—	—	—	IF-HB	IR-HB
IH	Banking Hardwade (insert no. of modules)	—	—	—	—	IH-( )	IH-( )	IH-( )
MFH	Banking Hardwade (insert no. of modules)	—	—	MFH-( )	MFH-( )	—	—	—

INTER-MARKET INC. 1946 Lehigh Avenue / Glenview, Illinois 60025 / (312) 729-5330 / TWX-910-651-1997

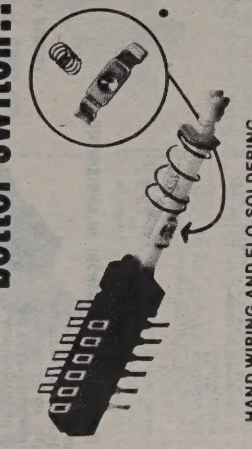
For More Information. Circle No. 464

MODULAR PUSH BUTTON SWITCHES

"Creative Switchmakers" **for Home Entertainment Products and Test Equipment**

If it's a better switch you need . . . better switch to Schadow!

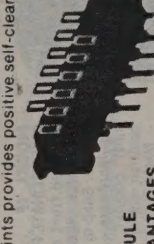
better switch...here's why...



HAND WIRING AND FLO-SOLDERING CONNECTIONS ARE STANDARD
- Solder lugs on top for hand wiring
- PC spikes at bottom for flo-soldering

INDIVIDUAL COIL SPRING LOADED MOVING CONTACTS
- The coil spring-loaded contoured moving contacts have been designed to provide balanced contact pressure for optimum surface to surface interface with the fixed contacts . . . assuring reliable performance in low voltage (dry circuit) applications
- Long term low contact resistance
- Constant coil spring tension at the contact points provides positive self-cleaning action

SUPERIOR MODULAR CONSTRUCTION
- Ease of maintenance . . . switch plunger with sliding contacts is removable from the front without disturbing electrical connections



MODULE ADVANTAGES
- Enclosed housing protects inner contact area from dust and foreign intrusions
- Fixed terminals are "staked" in position, providing an extra seal to help prevent wicking of solder or flux
- Molded PC Board Standoffs, front and back, on bottom side, assure parallel mounting

TECHNICAL DATA

Contact Resistance .4-6 mOhms
after 25,000 cycles . . . . .6-20 mOhms
Lifetime Expectation Interlocked (50,000)
Momentary, Push Push (100,000) cycles
Material of Construction
Fixed contact. Brass/Silver Plated . . . . .0002"
Moving contact . . . . . . .Bimetal Brass/Silver .0004"
Plunger Material. . . .Polycarbonate V-0 rated or Delrin
Contacts . . . . .Non-shorting
Housing Material. . . . . .Polycarbonate V-0 rated or Glass Reinforced Nylon

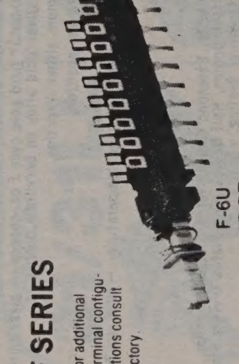
Terminal Board Material . . . . .High Grade Paper Phenolic or V-0 rated material. . . . . .Series F
Key pressure with 2PDT .28 oz.
Key pressure with 4PDT .32 oz.
Key pressure with 6PDT .35 oz.
Key pressure with 8PDT .42 oz.
Key pressure with 10PDT . . . . .46 oz.
Key pressure with Power Switch . . . . .42 oz.

NOTE: Lighter key pressures available, contact factory for details.

NOTE: For switching applications requiring flame retardant materials, contact factory.

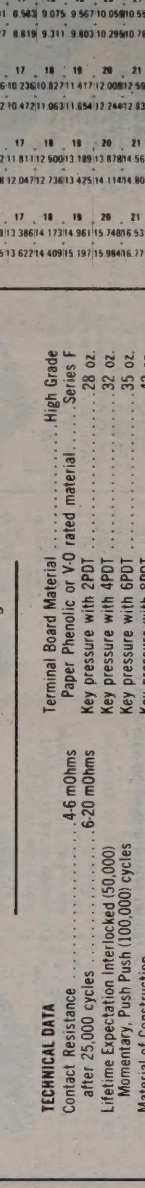
F SERIES

For additional terminal configurations consult factory.


F-6U
6P DT

MODULE DIMENSIONS

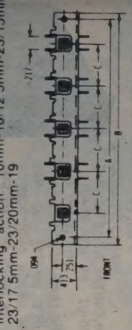
	X	Y
2PDT	.827	1.670
4PDT	1.300	2.143
6PDT	1.772	2.615
8PDT	2.244	3.087
10PDT	2.716	3.559
16PDT		



All dimensions in inches

CHASSIS DIMENSIONS FOR SERIES F

NOTE: Maximum stations to be grouped in one interlocking action. 10mm-10/12.5mm-23/15mm-23/17.5mm-23/20mm-19



C Dim 10mm (.394)	No. of Stations	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
	A MTG	1.181	1.575	1.969	2.362	2.756	3.150	3.543	3.937	4.331	4.724	5.118	5.512	5.906	6.299	6.693	7.087	7.480	7.874	8.268	8.661	9.005	9.449	9.843	10.236	10.630	11.024	11.417	11.811	12.205	12.598	12.992	13.386	13.780	14.173	14.567	14.961	15.354	15.748	16.142	16.535	16.929	17.323
	B O ALL	1.417	1.811	2.205	2.598	2.992	3.386	3.780	4.173	4.567	4.961	5.354	5.748	6.142	6.535	6.929	7.323	7.717	8.110	8.504	8.898	9.291	9.685	10.079	10.472	10.866	11.260	11.654	12.047	12.441	12.835	13.228	13.622	14.016	14.409	14.803	15.197	15.591	15.984	16.378	16.772	17.165	17.559

C Dim 12.5mm (.492)	No. of Stations	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
	A MTG	1.201	1.693	2.185	2.677	3.169	3.661	4.154	4.646	5.138	5.630	6.122	6.614	7.106	7.598	8.091	8.583	9.075	9.567	10.059	10.551	11.043	11.535	12.028	12.520	13.012	13.504	13.996	14.488	14.980	15.472	15.965	16.457	16.949
	B O ALL	1.437	1.929	2.421	2.913	3.406	3.898	4.390	4.882	5.374	5.866	6.358	6.850	7.343	7.835	8.327	8.819	9.311	9.803	10.295	10.787	11.280	11.772	12.264	12.756	13.248	13.740	14.232	14.724	15.217	15.709	16.201	16.693	17.185

C Dim 15mm (.590)	No. of Stations	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	A MTG	1.378	1.969	2.560	3.150	3.740	4.331	4.921	5.512	6.102	6.693	7.283	7.874	8.465	9.055	9.646	10.236	10.827	11.417	12.008	12.598	13.189	13.780	14.370	14.961	15.551	16.142	16.732	17.323
	B O ALL	1.614	2.205	2.795	3.386	3.976	4.567	5.157	5.748	6.339	6.929	7.520	8.110	8.701	9.291	9.882	10.472	11.063	11.654	12.244	12.835	13.425	14.016	14.606	15.197	15.787	16.378	16.968	17.559

C Dim 17.5mm (.689)	No. of Stations	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	A MTG	1.476	2.165	2.854	3.543	4.232	4.921	5.610	6.299	6.988	7.677	8.366	9.055	9.744	10.433	11.122	11.811	12.500	13.189	13.878	14.567	15.256	15.945	16.634	17.323
	B O ALL	1.713	2.402	3.091	3.780	4.468	5.157	5.846	6.535	7.224	7.913	8.602	9.291	9.980	10.669	11.358	12.047	12.736	13.425	14.114	14.803	15.492	16.181	16.870	17.559

C Dim 20mm (.787)	No. of Stations	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	A MTG	1.575	2.362	3.150	3.937	4.724	5.512	6.299	7.807	7.874	8.661	9.449	10.236	11.024	11.811	12.598	13.386	14.173	14.961	15.748	16.535	17.323
	B O ALL	1.811	2.598	3.386	4.173	4.961	5.748	6.535	7.323	8.110	8.898	9.685	10.472	11.260	12.047	12.835	13.622	14.409	15.197	15.984	16.772	17.559

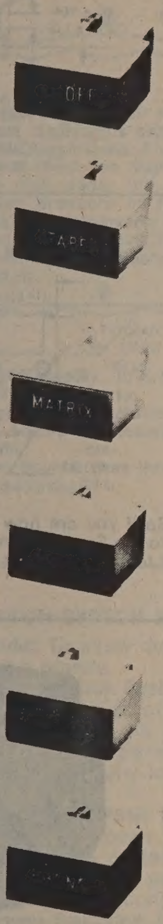
ITT ITT Schadow inc

Dept. GB, 8081 Wallace Road, Eden Prairie, MN 55344 • (612) 934-4400
TWX 910-576-2469 • TELEX: 29-0556
Manufacturing facilities in
Minneapolis, Minnesota: Einbeck, W. Germany; W. Berlin, CUCQ, Dole, France and Singap
In Canada: ITT Components, 4001 Chesswood Drive, Downsview, Ontario M3J 2R8
(416) 630-7971 • TELEX: 06-22703

For More Information. Circle No. 465

NEED GRAPHICS?

Several examples are shown below. Your specific requirements quoted on request. (Graphics pictured on FA 100 push buttons)



right on the button . . .

standard buttons for Series F and G Switches

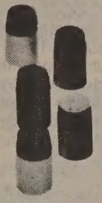
Rectangular buttons also can be snapped on vertically to provide more selection of larger buttons on smaller chassis spacing. Standard colors shown . . . other colors to match or contrast with your equipment available on special order.

Rectangular buttons also can be snapped on vertically to provide more selection of larger buttons on smaller chassis spacing. Standard colors shown . . . other colors to match or contrast with your equipment available on special order.

FG
Diameter: .346"
Length: .413"
Standard Minimum Spacing: 10mm
Colors: Black, White, Grey, Red, Green, Chrome

F-200
Diameter: .394"
Length: .433"
Standard Minimum Spacing: 12.5mm
Colors: Chrome/Black, Black/Black

FZ
Diameter: .394"
Length: .642"
Standard Minimum Spacing: 12.5mm
Colors: Black/Black, White/Black, White/Red, Red/Black, Red/Grey

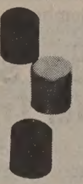


F1.12 - H-3
F1.15 - H-3
F1.21 - H-3
Diameters: .433", .433", .433"
Lengths: .472", .591", .827"
Cap Depth: .472"
Standard Minimum Spacing: 12.5mm
Colors: Black/Metal Cap

F1.12 - H-4
F1.15 - H-4
F1.21 - H-4
Diameters: .394", .394", .394"
Lengths: .472", .591", .827"
Cap Depth: .079"
Standard Minimum Spacing: 12.5mm
Colors: Black/Metal Cap

F1.12 - H-5
F1.15 - H-5
F1.21 - H-5
Diameters: .480", .480", .480"
Lengths: .571", .689", .925"
Cap Depth: .571"
Standard Minimum Spacing: 12.5mm
Colors: Black/Chrome

FGK
Diameter: .473"
Length: .492"
Standard Minimum Spacing: 12.5mm
Colors: Red, White, Black, Grey, Green



FSC
Width: .386"
Height: .217"
Length: .441"
Standard Minimum Spacing: 10mm
Colors: White, Black, Grey

FSD
Width: .484"
Height: .276"
Length: .413"
Standard Minimum Spacing: 12.5mm
Colors: Black, White, Grey

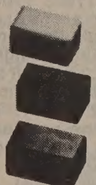
FU12
Width: .470"
Height: .216"
Length: .440"
Standard Minimum Spacing: 12.5mm
Colors: Black, White, Grey, Red

FSB
Width: .579"
Height: .291"
Length: .433"
Standard Minimum Spacing: 15mm
Colors: Black, White, Grey, Red, Chrome

FE
Width: .681"
Height: .236"
Length: .472"
Standard Minimum Spacing: 17.5mm
Colors: Black, White, Grey,

FSA
Width: .677"
Height: .315"
Length: .512"
Standard Minimum Spacing: 17.5mm
Colors: Black, White, Grey
Inserts: Silver or Gold

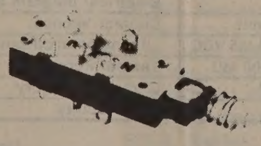
FA
Width: .772"
Height: .394"
Length: .453"
Standard Minimum Spacing: 20mm
Colors: Black, White, Grey,

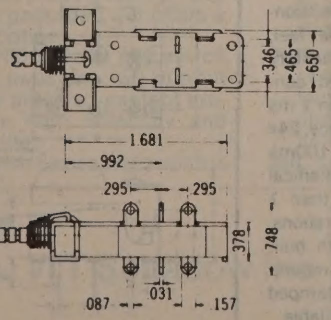


04-7060-00
Width: .487"
Height: .487"
Length: .590"
Cap Depth: .480"
Standard Minimum Spacing: 12.5mm
Colors: Spun-Finish Chrome

N30 TV-5 rated power switches

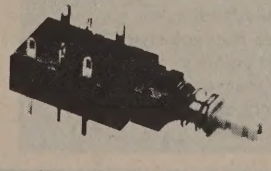
(Also available with 2PDT low voltage auxiliary contacts) UL, CSA, VDE Approved.

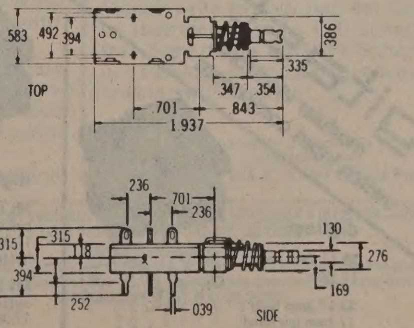




Series NE 15/F line switches

(Also available with 2PDT low voltage auxiliary contacts) UL, CSA, VDE Approved, 4 AMP 250 VAC.





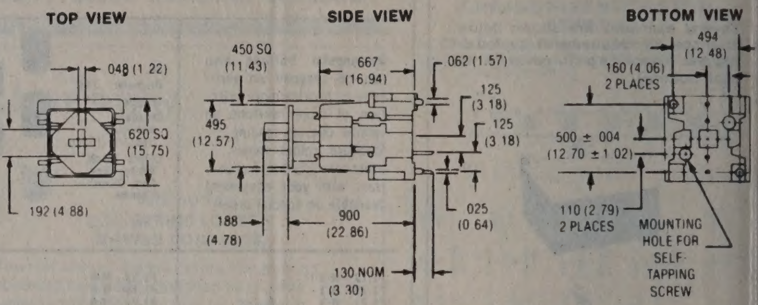
ITT Schadow inc

DC50 Series Key Switches (Full Travel)

The DC50 Series exceptional reliability and outstanding performance is achieved through ITT Schadow's patented diaphragm process which sandwiches two gold-plated contacts between Mylar* and stainless steel to permanently protect them from damage and environmental contamination.

- Modular construction
- Tease-proof action
- Tactile feedback
- Contact bounce less than 2 milliseconds
- Membrane contact

(0° KEYSTEM EXAMPLE)

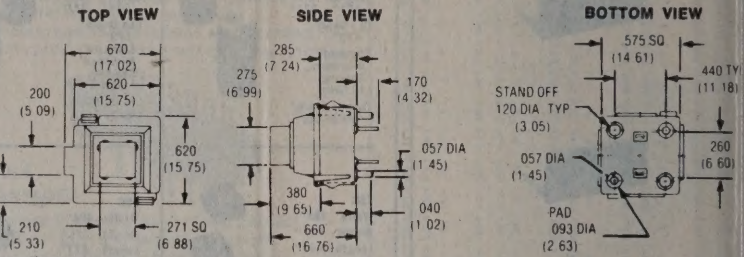

TOP VIEW
048 (1 22)
620 SQ
(15 75)
192 (4 88)
SIDE VIEW
450 SQ
(11 43)
667
(16.94)
062 (1.57)
125
(3 18)
125
(3 18)
495
(12 57)
188
(4 78)
900
(22 86)
025
(0 64)
130 NOM
(3 30)
BOTTOM VIEW
494
(12 48)
160 (4 06)
2 PLACES
500 ± 004
(12 70 ± 1 02)
110 (2 79)
2 PLACES
MOUNTING
HOLE FOR
SELF-
TAPPING
SCREW

DC60 Series Key Switches (Full Travel)

The ITT Schadow DC60 Series Key Switches are value engineered to achieve the highest possible performance at a much lower cost than conventional mechanical switches.

- Choice of 3 low profile
- Trifurcated gold-inlayed contacts
- Snap fit sub panel mounting
- Tactile feedback
- Variety of actuation forces
- Momentary or push push action
- 61-01 complies with European D.I.N. specifications
- Modular construction

(DC61-01 EXAMPLE)


TOP VIEW
670
(17 02)
620
(15 75)
200
(5 09)
620
(15 75)
210
(5 33)
271 SQ
(6 88)
SIDE VIEW
285
(7 24)
275
(6 99)
170
(4 32)
057 DIA
(1 45)
380
(9 65)
040
(1 02)
660
(16 76)
BOTTOM VIEW
575 SQ
(14 61)
440 TY
(11 18)
STAND OFF
120 DIA TYP
(3 05)
057 DIA
(1 45)
260
(6 60)
PAD
093 DIA
(2 63)

D.I.N. Compliance
ITT Schadow's DC61-01 and DC61-02 Full Travel Key Switches are among the lowest profile module Key Switches ever built. This low profile conforms to strict European health and safety regulations by complying to their D.I.N. standard. So if you are now selling o ever plan to sell to the European market, you owe it to yourself to take a look at these low profile switches.

D6 Series Key Switches

The D6 is a single pole, single throw normally open key switch specially designed for digital electronic control. Its small size enables keyboard design with minimum center spacing of .500 (12.70mm). The commoned terminals offer the possibility of X. Y coding by using a single sided printed Circuit Board.
Built-in buttons (square or round) are available in several colors and have been designed to fit directly onto front panels. The total travel of .031 (0.80mm) combined with the snap effect provide the user with a smooth, gentle yet positive tactile feedback.

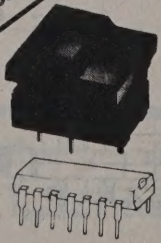
- Tactile feedback
- Three package styles
- Eight colors
- Commoned terminals
- Small size .500 (12.70mm)
- Low cost

ELECTRICAL DATA

Electrical diagram SPST NO		Electrical diagram SPST NO	
Contact resistance	≤20 mΩ	Contact bounce	3 ms
Breaking capacity	10 mA/35 VDC	Life (nominal current and voltage)	500,000 Cycles
Insulation resistance	100,000 MΩ	Temperature range	−20°C to +65°C
Dielectric strength	500 V	Climatic category	21 days
Inter-terminal capacity	1 pF	Solderability	235°C during 5 seconds

---

digitast
modular electronic
switch input component



digitast

SR 12.3mm wide x 17.1mm

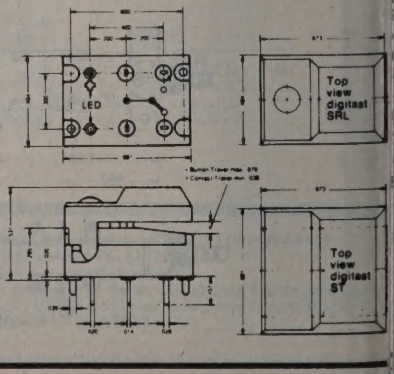
ST 17.3mm wide x 17.1mm (pictured)

digitast

SRL (LED factory or customer installed) 12.3mm wide x 17.1mm (pictured)

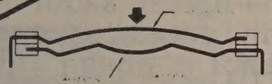
STL (LED factory or customer installed) 17.3mm wide x 17.1mm

Digitast for use with DIP packages, consistent tactile feel, SPDT momentary spring loaded contact, less than 1 ms contact bounce, 24v 10ma or 60v 100ma ratings. Mechanical life greater than 1 million operations. Available with built in LED. PCB mounting. Hot stamped graphics available.

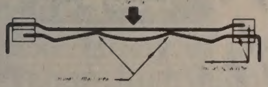

LED
Top view digitast SRL
Top view digitast ST

For More Information. Circle No. 465

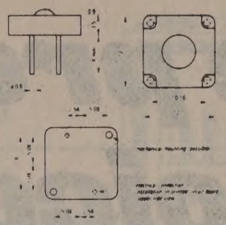
low cost
3 point contact
highest integrity
disc switch
modular electronic components

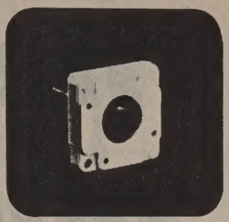


The Disc switch is built around two contact diaphragms separated by an insulating material. The profile of each of these two diaphragms is such that, under the action of applied pressure on the upper dome, it is momentarily collapsed, making instant positive, 3 point contact with the lower diaphragm.

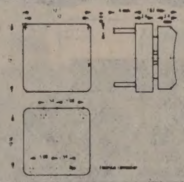


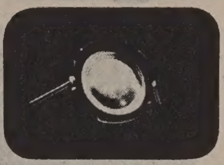
- High Reliability...10 X 10⁶
- Self Cleaning
- Broad Range of Switching Power...from a few milliwatts to 30 watts.
- Low Bounce (less than 100 microseconds)



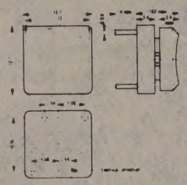


MD Disc module: Extra-flat momentary contact module. Shorter stroke configuration installable directly on printed circuit board. Enables you to design your own keyboard adapted to your own specific needs.





ED Push button switch assembly with a momentary action contact and incorporating the unique design disc switch. The switch is designed for direct insertion into printed circuit boards. Two principal advantages of the MDP switch are the short stroke (only 0.5 mm) and the crisp tactile feel.



MDP Push button switch assembly with a momentary action contact and incorporating the unique design disc switch. The switch is designed for direct insertion into printed circuit boards. Two principal advantages of the MDP switch are the short stroke (only 0.5mm) and the crisp tactile feel. Contact arrangement: single, normally open contact with momentary action. TERMINALS: tinned terminals — 0.8mm dia. x 4mm long. SOLDERING: Since the disc switch is completely sealed, it can be flow soldered. PUSH BUTTONS AND KEYS: dimensions (mm) 12.7 x 12.7 x 3.4 (7.62 with key). STANDARD COLORS: red, blue, light grey, dark grey.

USH BUTTON SWITCH SERIES

ption Guide: To allow quick option selection at a glance.

T Series Light Touch Push Buttons: The Light Touch Series of push button switches offers all the reliability and versatility of the F Series switch system with dramatically lower actuation forces.

Series Miniature Push Button: The F Series miniature push button switch forms a versatile system of modules designed for reliable performance in low voltage (dry circuit) applications.

Series Power Switches: F Series power switches form an integral or stand alone option to our standard F Series. All mechanical functions performed by the F Series are available in the power switch offering with the exception of lockout.

Series Options:

- Panel Mount, ZF and FPM
- Lampless status indicators
- Illuminated buttons
- Non-illuminated buttons

EY SWITCH SERIES (Low Travel)

igitast Series: The Digitast Series key switch is specially designed for use with dual in-line packages, yet offers a wide variety of options.

EK Series: The REK Series key switch is designed for switching low current loads utilizing a patented contact system resulting in high reliability and long operating life.

isc Series: The Disc Series key switch is built around two contact diaphragms separated by an insulating material designed for instant contact with the advantage of being a self-cleaning contact with tactile feed back.

D6 Series: The D6 Series key switch is a single pole, single throw key switch designed for digital electronic control allowing keyboard design with a minimum center spacing of .500 (12.70).

KEY SWITCH SERIES (Full Travel)

DC50 Series: The DC50 Series exceptional reliability and outstanding performance is achieved through ITT Schadow's patented diaphragm process which sandwiches two gold-plated contacts between mylar and stainless steel to permanently protect them from damage and environmental contamination.

DC60 Series: The DC60 Series key switches are value engineered to achieve the highest possible performance at a much lower cost than conventional mechanical switches.

ROTARY SWITCH SERIES (Closed Deck)

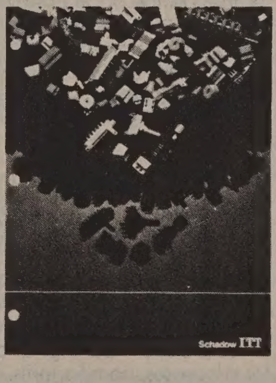
RT-A Series: The RT-A Series rotary switch is a PC or panel mounted switch with the shaft perpendicular to the PC Board for mounting with components such as displays and indicators.

RBP-12 Series: The RBP-12 Series rotary switch is designed with index and contacts contained within a single molded plastic case with many contact variations available.

MIL Series: The MIL Series rotary switch is a totally sealed miniature rotary that can be custom built to fit almost any packaging requirement.

ROTARY SWITCH SERIES (Open Deck)

MA/MAY/MAO/MO Series — SZ/SZY/SZO/SZV Series: The MA and SZ Series low current rotary switches can be ordered with multiple contact styles in silver, silver plated or gold.



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ng; master keying, grand-
aster keying . . . with hun-
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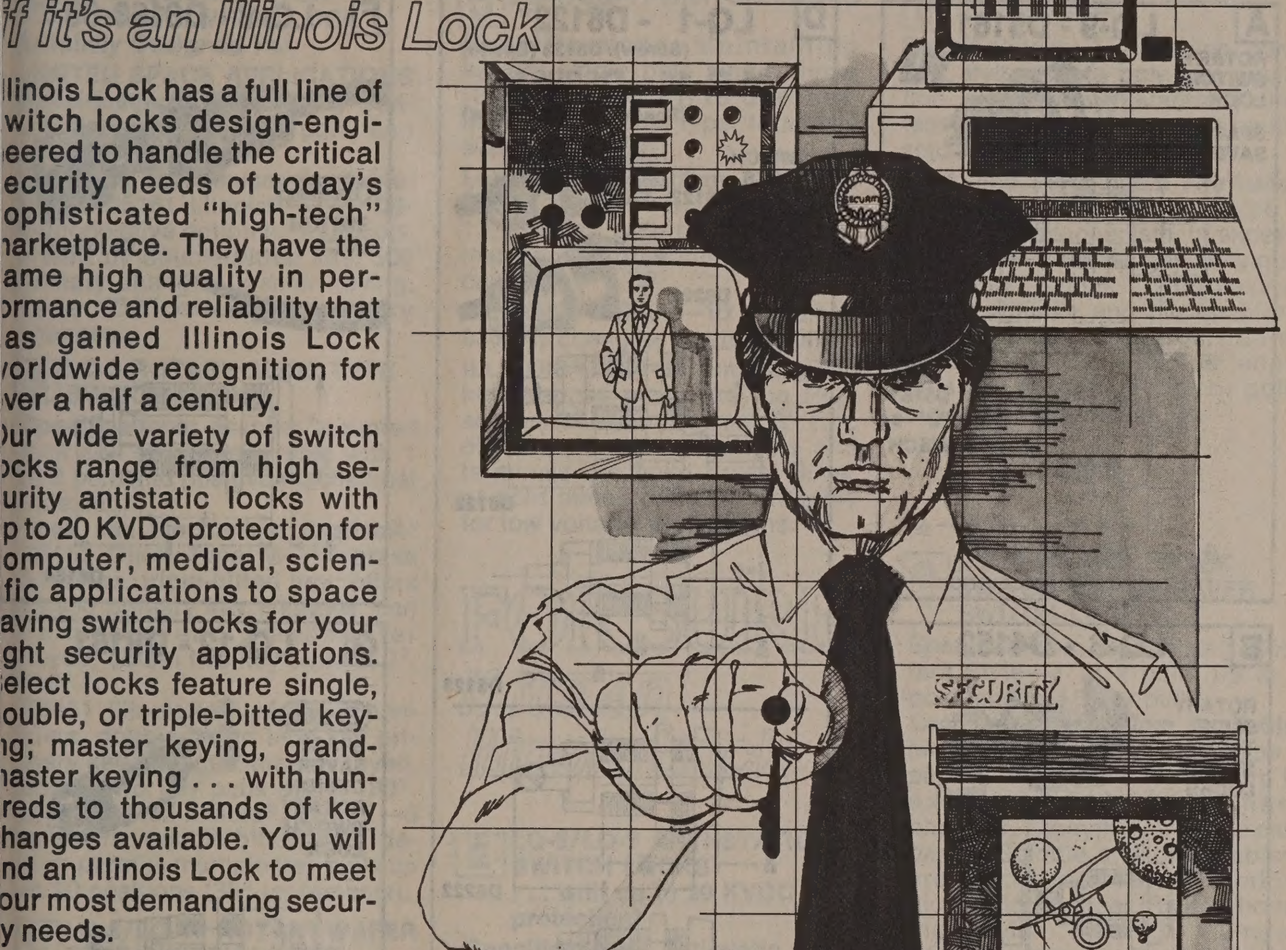

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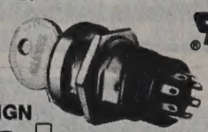
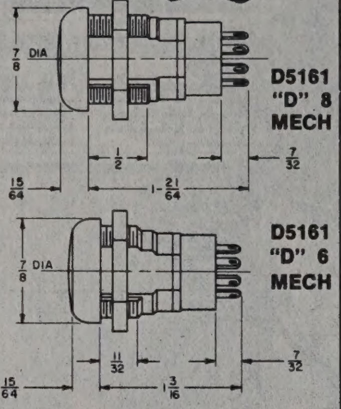
A LQ-9 - D5161

ROTARY SWITCH LOCK

SPACE SAVER DESIGN

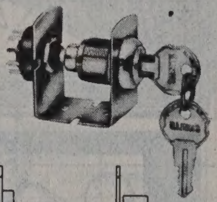


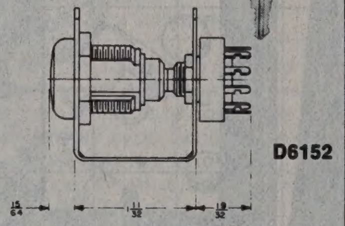

7/8 DIA
D5161
"D" 8
MECH
1/2
7/32
15/64
1-21/64
D5161
"D" 6
MECH
11/32
7/32
15/64
1-3/16

UL COMPONENT RECOGNITION

B LQ-3 - D4152

ROTARY SLIDE TYPE SWITCH LOCKS

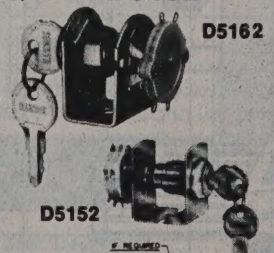


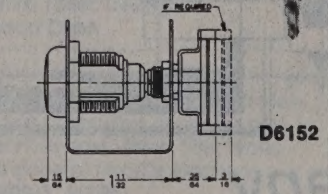

D6152
15/64
1-11/32
19/32

UL LISTED ROTARY SWITCH

C LQ-10 - D5162
LQ-6 - D5152

ROTARY WAFER TYPE SWITCH LOCKS

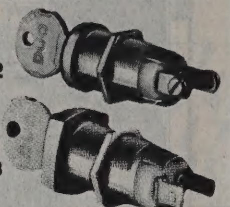

D5162
D5152

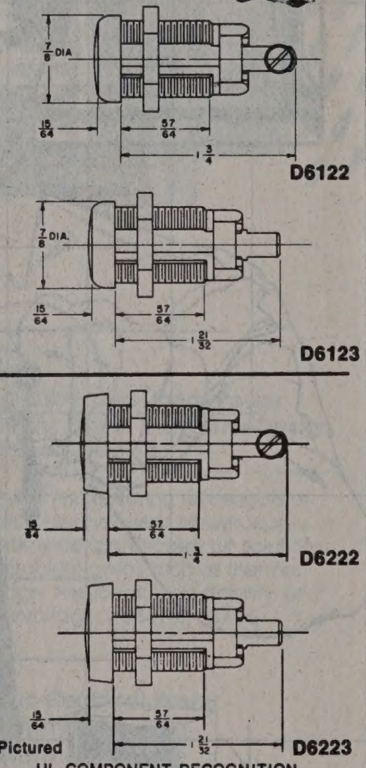

IF REQUIRED
D6152
15/64
1-11/32
25/64
3/16

UL LISTED WAFER SWITCH

D LQ-1 - D6122* (Screw)/D6123 (Spade)
LQ-11 - D6223* (Spade)/D6222 (Screw)

SWITCH LOCKS


D6122
D6223

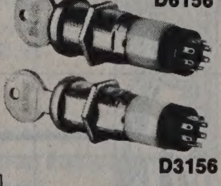

7/8 DIA
15/64
57/64
1-3/4
D6122
7/8 DIA.
15/64
57/64
1-21/32
D6123
15/64
57/64
1-3/4
D6222
15/64
57/64
1-21/32
D6223

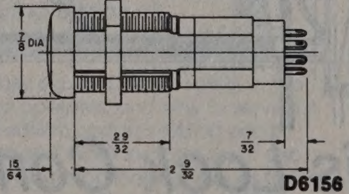
*Pictured

UL COMPONENT RECOGNITION

E LQ-5 - D6156
LQ-7 - D3156

ANTI-STATIC ROTARY SWITCH LOCKS


D6156
D3156


7/8 DIA
29/32
7/32
15/64
2-9/32
D6156

UL COMPONENT RECOGNITION

F LQ-8 - D8163-03

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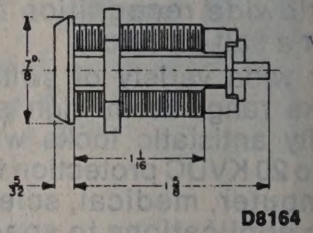
SWITCH LOCK


7/8 D.
1-1/16
5/32
1-3/8
D8164

G LQ-12 - D8161

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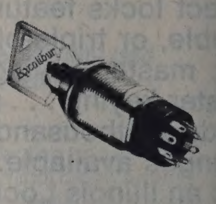
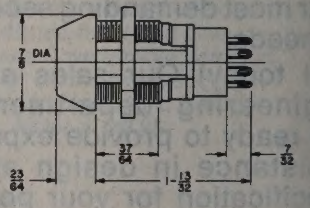
SPACE SAVER DESIGN ROTARY SWITCH LOCK



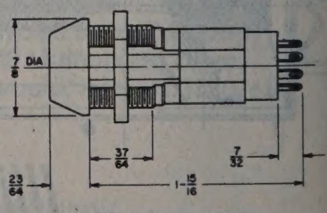

7/8 DIA
37/64
7/32
23/64
1-13/32

UL LISTED ROTARY SWITCH

H LQ-13 - D8156

Excalibur™

ANTI-STATIC SWITCH LOCK


7/8 DIA
37/64
7/32
23/64
1-5/16

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Specifications: Maintaining Contact Style—one or two pole, and up to 5 positions.

Lock and Mechanism Available: Model D5161 Illinois® type "D8-eight positive action tumblers operated by double-bitted key; 500 primary changes, master keying. Type "D6" offers 60 primary changes.

B LQ-3 ROTARY SLIDE-TYPE SWITCH LOCKS

Specifications: Bracket mounted lock and switch, available with 1 or 2 pole and positive mechanical indexing.

Lock and Mechanism Available: D6152 Duo® Type M—14 brass tumblers, triple-bitted key; offers 13,950 primary key changes, can be master and grandmaster keyed, obtain two key pulls at 0°, 180°.

D5151 Illinois®, Type D—8 tumblers, double-bitted key; 250 primary key changes, master keyed, obtain two key pulls at 0°, 180°. Model D4152 Illinois®, Type E—8 tumblers, double-bitted key; design permits multiple key pulls up to 10 positions (36° increments).

C LQ-6/LQ-10 ROTARY WAFER TYPE SWITCH LOCKS

Specifications: Bracket mounted lock and switch. UL listed wafer switch, available with multiple poles and stacked decks. Positive detent at each index position. Spring return feature available.

Lock and Mechanism Available: LQ-10 - D5162-110 Illinois® "D8" eight tumblers, double-bitted key; 250 primary changes; D5162-100 Illinois® "D6"—6 tumblers, double-bitted key, 60 primary changes.

LQ-6 - D6152 Duo®, Type M—14 brass tumblers, triple-bitted key; 13,950 primary changes, master and grandmaster keyed, obtain 4 key pulls at 0°, 90°, 180°, 270°. D5152 Illinois® Type D—8 tumblers, double-bitted key; 250 primary changes, master keyed; obtain 4 key pulls at 0°, 90°, 180°, 270°. D4152 Illinois®, Type E—8 tumblers; double-bitted key; design permits key pulls up to 8 positions (45° increments).

D LQ-1/LQ-11 SWITCH LOCKS

Specifications: Maintaining switch; single pole single throw (SPST), 90° turn to operate. Screw or spade type terminals available.

Lock and Mechanism Available: DUO® "M"—14 brass tumblers, 13,950 key changes available, master and grandmaster keying capability.

ILLINOIS® "D10"—10 tumblers, 930 key changes, master keying.

ILLINOIS® "D8"—8 tumblers, 250 key changes, master keying. Plug and barrel are of "Zamak 3" zinc die cast material. Contacts and terminals are solid brass. Silver or gold plated contacts available for low voltage applications.

FOR SURE
if it's an
Illinois Lock

E LQ-5/LQ-7 ANTI-STATIC SWITCH LOCKS

. . . with up to 20 KVDC protection!

Specifications: Anti-static available in two styles: Momentary Contact Style—1 or 2 pole, 2 position, 45° key turn to operate, spring return; Maintaining Contact Style—1 or 2 pole, up to 5 positions. Available shortly with maintaining and momentary contact incorporated within one key switch.

Lock and Mechanism Available: LQ5 HIGH SECURITY—D6157/D6156 DUO® "B"—14 brass tumblers, triple-bitted key; 13,950 primary changes, master and grandmaster keyed. D5157/D5156 in "D10" with 10 tumblers, double bitted key, 950 changes; "D8" has 8 tumblers, double-bitted key, 250 primary changes, master keyed.

LQ7 features D4156/D4157 Illinois® Type "E"—8 tumblers, double bitted key, 250 primary key changes. D3156/D3157 Illinois® Type "G"—5 tumblers, single-bitted key, 659 primary key changes, master keyed.

F LQ-8 Excalibur™

Specifications: Maintaining contact style, single pole two position. Available with standard wire leads: 6" long, 16 gauge or with solder terminals.

Lock and Mechanism Available: D8163/D8164 "Excalibur" Type 7 pin tubular mechanism, in excess of 750,000 primary key changes available. "Zamak 3" zinc die cast barrel. Spindle and pin tumblers are solid brass, keys bright nickel-plated steel. Contacts and terminals are copper. Silver or gold plated contacts available.

G LQ-12 Excalibur™ "CLICK-SWITCH" SPACE SAVER SWITCH LOCK

Specifications: Maintaining Contact Style—1 or 2 pole, up to 5 positions and 5 key pulls.

Lock and Mechanism Available: Model D8161 "Excalibur" Type 7 pin tubular mechanism, offers in excess of 750,000 primary changes. "Zamak 3" zinc die cast barrel. Spindle and pin tumblers are solid brass, keys are bright nickel-plated steel. Switch housing is nylon "Zytel 101" UL rated 94V-2; terminals are solderable faston type, silver-plated copper alloy. Available with gold-plated contacts.

H LQ-13 Excalibur™ ANTI-STATIC SWITCH LOCK

Up to 20 KVDC protection!

Specifications: Anti-static Maintaining Contact Style—1 or 2 pole, up to 5 positions and 5 key pulls.

Lock and Mechanism Available: Model D8156 "Excalibur" Type 7 pin tubular mechanism, offers in excess of 750,000 primary changes.

"Zamak 3" zinc die cast barrel. Spindle and pin tumblers are solid brass, keys are bright nickel-plated steel. Switch housing is nylon "Zytel 101" UL rated 94V-2; terminals are solderable faston type, silver-plated copper alloy. Available with gold-plated contacts.

301 W. Hintz Road • Wheeling, IL 60090 • 1-312-537-1800

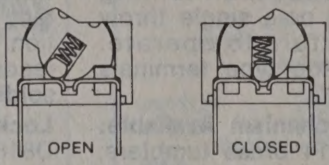
WRITE OR CALL FOR YOUR FULL LINE LECTRO-QUIP® CATALOG NOW!

Grayhill INC

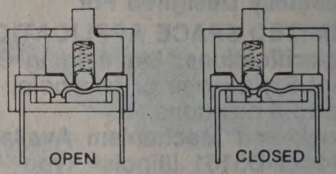
DIP Switches Features

Another Difference from the Different DIP Switch Company . . .

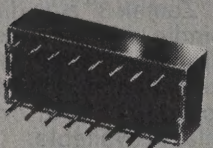
Exclusive Contact System



- Now available in Rockers *AND* Slide Actuators



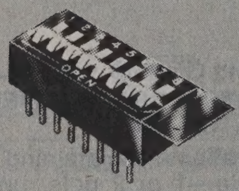
Unique spring-loaded ball contact system provides high contact pressure for reliable contact and shock and vibration immunity. It also provides exceptional mechanical and electrical life.



Complete Seal

After being wave soldered, your printed circuit boards can be vapor, spray or immersion cleaned without damaging switch contacts.

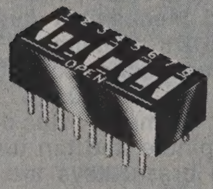
- Epoxy Potted Bottom Is Standard
- Top Seal Available At Minimum Additional Price



A top tape seal is a standard feature that can be added to all Series 76 and Series 78 GRAYHILL DIP switches with the exception of toggle actuators. Adding the letter S as a suffix to the part number orders the top tape seal.

Military Qualification

Another difference from the different DIP Switch Company . . . Grayhill SPST Rocker DIP Switches are qualified to MIL-S-83504/01 and MIL-S-83504/02



And More . . .

Grayhill can print your own part number or wording on the switch. We can also provide position location markings, rigid protective covers, and cards of tape seal. Contact Grayhill.

Specifications—Series 76 and 78, Standard and Military

For Series 79 Specifications, see the Linear Action DIP Switch pages.

Ratings

	Series 76	Series 78	Series 78SS
Mechanical Life: (Operations Per Position)	50,000	35,000	10,000
Make and Break Current Rating (Operations):			
At 50 mA, 30 Vdc	35,000	25,000	7,500
At 125 mA, 30 Vdc	25,000	15,000	No Rating

Contact Resistance: 100 milliohms maximum after life (30 milliohms initially), measured at 10 mA dc and 50 mV (open circuit).

Insulation Resistance: (at 100 Vdc); Between adjacent closed contacts: 1,000 megohms minimum after life, (5,000 megohms initially). Across open switch contacts: 1,000 megohms minimum after life, (5,000 megohms initially).

Dielectric Strength: Between adjacent closed contacts: 500 Vac after life (750 Vac initially). Across open switch contacts: 500 Vac after life (750 Vac initially).

Current Carry Rating: With a maximum contact temperature rise of 20°C: Series 76—5 Amps; Series 78—4 Amps.

Environmental

Refer to MIL-STD-202F Per MIL-S-83504.

Vibration: 10 to 2,000 Hz at 15g (or 0.060" double amplitude); no damage and no contact openings exceeding 10 microseconds. (Method 204, Test Condition B)

Shock: 50g, 11 mS half sine; no damage and no openings exceeding 10 microseconds. (Method 213, Test Condition A)

Moisture Resistance: 240 hours with temperature cycling and polarization; pass insulation resistance and dielectric strength. (Method 106)

Thermal Shock: For 5 cycles (1 cycle: -55°C, +25°C, +85°C, +25°C); no failures; passes contact resistance.

Thermal Aging: 1,000 hours at 85°C; no failures.

Machine Soldering

The sealed recessed rocker switches have been tested to EIA Standard RS-448-2, "Environment Effects of Machine Soldering," with the results listed below. Similar performance can be expected from sealed switches with other means of actuation.

Fluxing: Passes test with flux touching the switch body.

Cleaning: Passes immersion test (and is therefore also suitable for spray and vapor/spray cleaning).

Soldering: Passes two, four and six seconds soldering time.

Cleaning Solution: 1-1-1 trichlorethane, Freon (TF or TE), isopropyl alcohol and water/detergent.

Materials and Finishes

— For Part Numbers Beginning 78SS —

Shorting Bar (Ball), Base Contacts, and Terminals: Copper Alloy, Silver plated .00003" minimum over Nickel.

— For All Other Series 76 and 78 Switches —

Shorting Bar (Ball): Brass, Gold plated .00001" minimum over Nickel plate.

Base Contacts: Copper Alloy, Gold plated .00001" minimum over Nickel plate.

Terminals: Copper Alloy, Tin plated .00005" minimum over Nickel plate. Gold plate over Nickel also available.

— For All Series 76 and 78 Switches —

Switch Cover, Rocker and Base: Polyester UL94 VO type.

Potting Material: Epoxy.

Protective Cover: Polycarbonate.

Top Seal: Polyester film.

Optional Contact Plating: Gold thicknesses of .00003" and .0001" are also available. Contact GRAYHILL.

Grayhill, Inc. / 561 Hillgrove Ave. / P.O. Box 10373 / La Grange, IL 60525 / (312) 354-1040

Single Pole/Single Throw DIP Switches

Rockers and Toggles—Series 76

Raised and Recessed Rockers

No. of Stations	Length	Part No. Raised	Part No. Recessed	Unit Price
2	0.280	76SB02	76RSB02	$2.90
3	0.380	76SB03	76RSB03	3.00
4	0.480	76SB04	76RSB04	3.10
5	0.580	76SB05	76RSB05	3.20
6	0.680	76SB06	76RSB06	3.30
7	0.780	76SB07	76RSB07	3.35
8	0.880	76SB08	76RSB08	3.45
9	0.980	76SB09	76RSB09	3.55
10	1.080	76SB10	76RSB10	3.60
12	1.280	76SB12	76RSB12	3.80

PIANO-DIP®

No. of Stations	Length	Part No.	Unit Price
4	0.480	76PSB04	$3.65
5	0.580	76PSB05	3.70
6	0.680	76PSB06	3.80
7	0.780	76PSB07	3.90
8	0.880	76PSB08	3.95
9	0.980	76PSB09	4.10
10	1.080	76PSB10	4.25

To order top seal versions, add suffix "S" to part number (not available on TOGGLE-DIP), add $0.20 to unit price, and discount accordingly.

Military Qualified Raised and Recessed Rockers

No. of Stations	Length	Military Raised	Grayhill Number	Military No. Recessed	Grayhill Number	Unit Price
2	0.280	M83504/01-022	76MSB02	M83504/02-022	76MRSB02	$3.20
3	0.380	M83504/01-023	76MSB03	M83504/02-023	76MRSB03	3.30
4	0.480	M83504/01-024	76MSB04	M83504/02-024	76MRSB04	3.40
5	0.580	M83504/01-025	76MSB05	M83504/02-025	76MRSB05	3.50
6	0.680	M83504/01-026	76MSB06	M83504/02-026	76MRSB06	3.60
7	0.780	M83504/01-027	76MSB07	M83504/02-027	76MRSB07	3.65
8	0.880	M83504/01-028	76MSB08	M83504/02-028	76MRSB08	3.75
9	0.980	M83504/01-029	76MSB09	M83504/02-029	76MRSB09	3.85
10	1.080	M83504/01-030	76MSB10	M83504/02-030	76MRSB10	3.90
12	1.280	M83504/01-032	76MSB12	M83504/02-032	76MRSB12	4.10

To order top sealed switch, add suffix "S" to Grayhill part number (or "T" to Military Number); add $0.20 to unit price, and discount accordingly. Contact GRAYHILL for information and prices on switches with the following Military Numbers: M83504/01-002 thru M83504/01-010

Slide Actuated—Series 78

Slides

No. of Stations	Length	Part No. Raised	Part No. Recessed	Unit Price
2	0.280	78B02	78RB02	$2.61
3	0.380	78B03	78RB03	2.70
4	0.480	78B04	78RB04	2.79
5	0.580	78B05	78RB05	2.88
6	0.680	78B06	78RB06	2.97
7	0.780	78B07	78RB07	3.02
8	0.880	78B08	78RB08	3.11
9	0.980	78B09	78RB09	3.20
10	1.080	78B10	78RB10	3.24

Silver Contact Slide Switches

No. of Stations	Description	Ordering Information	
4	SPST only; Raised Slides	78SS04	$2.35
8		78SS08	2.65
5, 6, 7, 9 or 10	Special order in minimum lots of 50,000 per part number. Contact GRAYHILL.		

To order top sealed switch, add suffix "S" to Grayhill part number; add $0.18 to unit price, and discount accordingly.

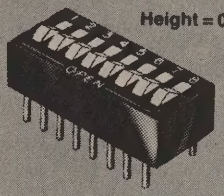
Dimensions & Discounts

Switch length is indicated in chart; width is 0.380 inches; maximum height above board is shown with pictures.

Discount Schedule

	76PSB	Others
1-9	Unit Price	Unit Price
10-24	Less 8%	Less 8%
25-49	Less 16%	Less 21%
50-99	Less 21%	Less 40%
100-499	Less 30%	Less 50%
500-999	Less 40%	Less 57%
1000 Up	Contact Your Local Distributor or Grayhill	

Prices and Discounts subject to change without notice.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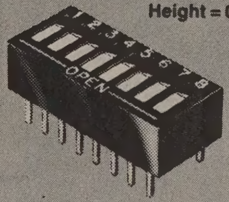
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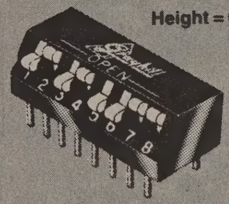
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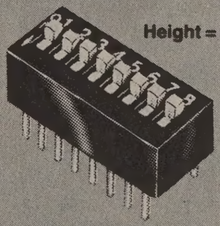
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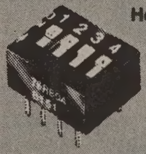
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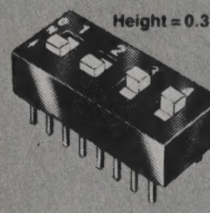
Available Locally Through Your Grayhill Distributor

Grayhill INC

Multiple Pole and Multiple Throw DIP Switches



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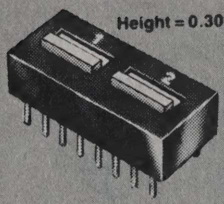


Height = 0.305

Two, Three, and Four Pole/Single Throw

Slide Actuated

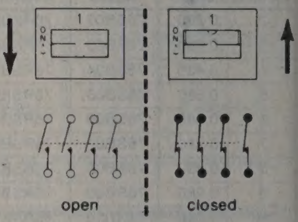
Last 2 digits in part number indicate number of stations in switch.

DPST		3PST		4 PST		
Part No.	Unit Price	Part No.	Unit Price	Part No.	Unit Price	Length
78F01	$3.56	–	–	–	–	0.280
–	–	78G01	3.74	–	–	0.380
78F02	3.78	–	–	78H01	3.78	0.480
78F03	3.96	78G02	3.96	–	–	0.680
78F04	4.19	–	–	78H02	4.19	0.880
–	–	78G03	4.23	–	–	0.980
78F05	4.37	–	–	–	–	1.080

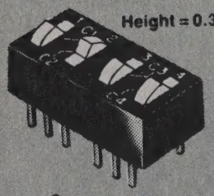
For top seal versions, add the suffix "S" to part number; add $0.20 to unit price and discount accordingly.

Typical Circuit Diagram

● indicates closed contact
○ indicates open contact



Circuitry diagrams shown are for 4PST. Circuitry is achieved in a similar fashion for 2PST and 3PST switches.



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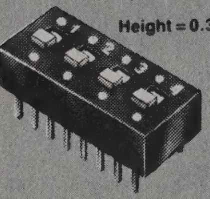

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Single Pole/Double Throw

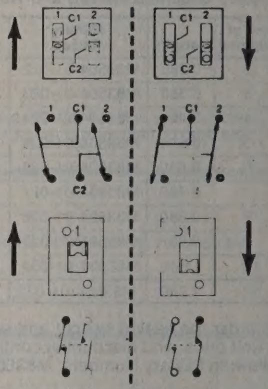
Rockers and Toggles

		DIP-C®		TOGGLE-DIP™	
No. of Stations	Length	Raised Part No.	Recessed Part No.	Toggle Part No.	Unit Price
2	0.380	76SC02	76RSC02	76STC02	$3.70
3	0.580	76SC03	76RSC03	76STC03	3.95
4	0.780	76SC04	76RSC04	76STC04	4.20

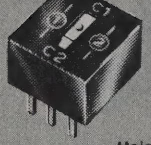
Slide Actuated Switches

No. of Stations	Length	Part No.	Price
1	0.280	78J01	$4.41
2	0.480	78J02	4.59
3	0.680	78J03	4.82
4	0.880	78J04	5.04
5	1.080	78J05	6.30

To order top seal versions add suffix "S" to part number (not available on TOGGLE-DIP), add $0.20 to unit price, and discount accordingly.



See Double Throw Note.



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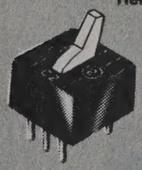

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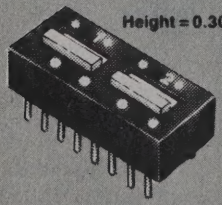

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Double Pole/Double Throw

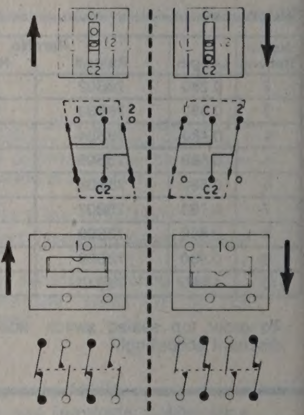
Rockers and Toggles

DOUBLE DIP™				TOGGLE-DIP™	
No. of Stations	Length	Raised Part No.	Recessed Part No.	Part No.	Unit Price
1	0.380	76SD01	76RSD01	76STD01	$3.80
2	0.780	76SD02	76RSD02	76STD02	4.30

Slide Actuated Switches

No. of Stations	Length	Part No.	Price
1	0.480	78K01	$6.48
2	0.880	78K02	7.02

To order top seal versions, add suffix "S" to part number (not available on TOGGLE-DIP), add $0.20 to unit price, and discount accordingly.



See Double Throw Note.

Dimensions

Switch length is indicated in chart: width is 0.380 inches; maximum height above board is shown with picture.

Discount Schedule

	Series 76	Series 78
1-9	Unit Price	Unit Price
10-24	Less 8%	Less 8%
25-49	Less 16%	Less 21%
50-99	Less 21%	Less 40%
100-499	Less 30%	Less 50%
500-999	Less 35%	Less 57%
1000 Up.	Contact Grayhill	

Prices and Discounts Subject to Change Without Notice.

Double Throw Circuitry

All Series 78 double throw switches have alternately opposed circuits which are actually 2 completely separate circuit paths. A single slide actuates both circuits thus providing double throw. True double-throw circuitry is achieved by tying selected terminals on the PC board for a common. The "on" position of each circuit is indicated by a dot on the cover.

Grayhill, Inc. / 561 Hillgrove Ave. / P.O. Box 10373 / La Grange, IL 60525 / (312) 354-1040

Attenuator, Tap, And Coded Switches

The Attenuator DIP Switch

Attenuator Range	Part No. Without Tape Seal	Price
0.1 to 1.5 DB	78J04-A01	$14.50
1.0 to 15 DB	78J04-A02	14.50
1.5 to 22.5 DB	78J04-A03	14.50

To order top seal version, add the letter "S" after the 4 in the part number (example 78J04S-A01); add $0.20 to the unit price and discount accordingly. Use Series 78 discount schedule at left.

Materials and Finishes

Switch Cover, Slide and Base: Polyester (94 VO Type).

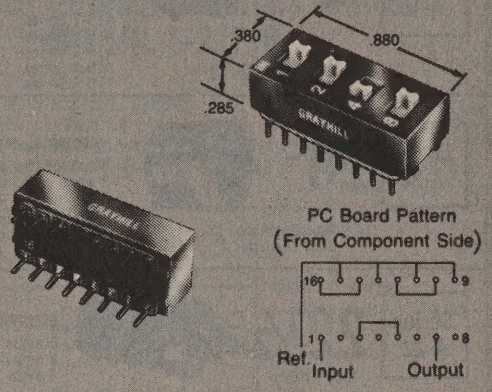
Shorting Bar (Ball): Brass, Gold plated.00001" minimum over Nickel plate.

Base Contacts: Copper Alloy, Gold plated 0.00001" minimum over Nickel plate.

Terminals: Copper Alloy, Tin Plated 0.00005" Minimum over Nickel plate.

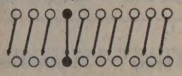
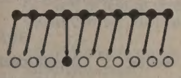
Network Encapsulation: Polymer Plastic.

- 0.1 To 1.5 dB In 0.1 dB Steps
- 1.0 To 15 dB In 1.0 dB Steps
- 1.5 To 22.5 dB In 1.5 dB Steps



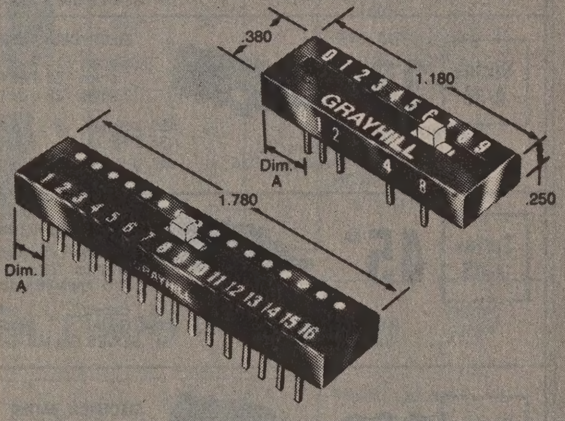
Power Rating: 20 dB Maximum.
Impedance: 600 OHM ± 2%, Unbalanced.
Insertion Loss: 0.02 dB.
Loss In DB: ± 0.015 dB Cummulative.

Linear Action DIP Switches

Circuitry	Description	Dim. A	Part Number	Unit Price
	Circuit Selector 1-of-10	.140	79A10	$4.00
	Circuit Selector 1-of-16	.140	79A16	4.65
BCD	Binary Code 10	.240	79B10	4.00
	Binary Code 16	.390	79B16	4.65
	Single Pole/ Ten Position	.140	79C10	4.00
	Single Pole/ 16 Position	.140	79C16	4.65

To order top seal version, add suffix "S" to part number, add $0.30 to unit price and discount. Use Series 76 discount at left.

- Tap Switches And Coded Outputs
- Positive Detent • Reliable Switching
- 2,000 Cycle Life—60,000 Operations



Specifications for Series 79 Switches

Ratings

Mechanical Life: 4,000 cycles minimum. Note: A cycle is one complete operation, back and forth thru all switch positions.

Make and Break Current Rating: 2,000 cycles at 10 mA, 30 mV dc; 2,000 cycles at 125 mA, 6 Vdc; 2,000 cycles at 50 mA, 30 Vdc.

Contact Resistance: 100 milliohms maximum after life, measured at 10 mA dc and 50 mV (open circuit). Initial values are 60 milliohms maximum for coded switches, and 50 milliohms for other Linear Action Switches.

Insulation Resistance (At 100 Vdc): Between adjacent isolated contacts—1,000 Megohms minimum after life; (5,000 Megohms initially). Across open contacts 1,000 Megohms minimum after life. (5,000 Megohms initially).

Dielectric Strength: Between adjacent isolated contacts: 500 Vac after life. (750 Vac initially). Across open contacts: 500 Vac after life. (750 Vac initially).

Current Carry Rating: 2 Amps with a maximum contact temperature rise of 20°C.

Environmental Refer to MIL-STD-202F Per MIL-S-83504.

Vibration: 10 to 2,000 Hz at 15g (or 0.060" double amplitude); no damage and no contact openings exceeding 10 microseconds. (Method 204, Test Condition B).

Shock: 50g, 11 mS half sine; no damage and no openings exceeding 10 microseconds. (Method 213, Test Condition A).

Materials and Finishes

Switch Cover, Slide, Base: Polyester, UL94 VO rating.

Shorting Arm: Phosphor Bronze, Gold plated .00001 minimum over Nickel plate .00002 minimum.

Base Contacts: Copper Alloy, Gold plated .00001 minimum over Nickel plate .00002 minimum.

Terminals: Copper Alloy, Tin plated .00005 minimum over Nickel plated .00002 minimum.

Potting Material: Epoxy.

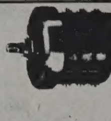
Tape Seal: Polyester film.

Available Locally Through Your Grayhill Distributor

Series "A" Miniature Rotary Selector Switches
QPL MIL-S-3786

• TOTALLY ENCLOSED • EXPLOSION PROOF
• UNITIZED CONSTRUCTION

Series A-15 **15°**

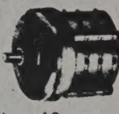


ELECTRICAL RATING:
5 amps 115 v ac Res
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

A15-1 Series	1 pole/deck
A15-2 Series	2 pole/deck
A15-3 Series	3 pole/deck
A15-4 Series	4 pole/deck
A15-6 Series	6 pole/deck

Max. Positions: 24
Body Diameter: 2"

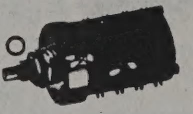
Series A-20 **20°**



ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.
Available only in single pole per deck construction.

Max. Positions: 18
Body Diameter 2"

Series A-22 **22½°**



ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

A22-1 Series	1 pole/deck
A22-2 Series	2 pole/deck
A22-4 Series	4 pole/deck

Max. Positions: 16
Body Diameter: 1.5"

Series A-30 **30°**

ELECTRICAL RATING:
2 amps 115 v ac Res.
1 amp 28 v dc Res.
0.5 amp 28 v dc Ind.

A30-1 Series	1 pole/deck
A30-2 Series	2 pole/deck
A30-3 Series	3 pole/deck
A30-4 Series	4 pole/deck
A30-6 Series	6 pole/deck

"M" SERIES See MIL-S-3786/4

Max. Positions: 12
Body Diameter: 1.036"

Series A-36 **36°**

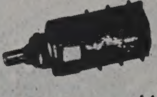
ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2 amps 28 v dc Ind.

A36-1 Series	1 pole/deck
A36-2 Series	2 pole/deck

"M" SERIES See MIL-S-3786/4

Max. Positions: 10
Body Diameter: 1.036"

Series A-45 **45°**



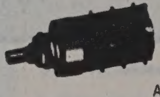
ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

A45-1 Series	1 pole/deck
A45-2 Series	2 pole/deck

"M" SERIES See MIL-S-3786/4

Max Positions: 8
Body Diameter: 1.036"

Series A-60 **60°**

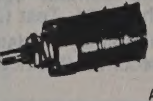


ELECTRICAL RATING
5 amps 115 v ac Rs.
3 amps 28 v dc Res
2 amps 28 v dc Ind.
Available only in single pole per deck construction.

Max. Positions: 6
Body Diameter: 1.036"

"M" SERIES See MIL-S-3786/4

Series A-90 **90°**



ELECTRICAL RATING
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.
Available only in single pole per deck construction

Max. Positions: 4
Body Diameter: 1.036"

"M" SERIES See MIL-S-3786/4

Series Index
AA30 - 30°
AA36 - 36°
AA45 - 45°

Directly interchangeable with "A" Series above.

ADJUSTABLE STOPS

Max. Positions: AA30-12 AA36-10 AA45-8
Body Dia: 1.036" Meets MIL-S-3786

JANCO CORPORATION

Series "B" Micro-Miniature Rotary Selector Switches

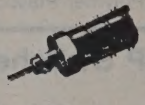
QPL
MIL-S-3786

• TOTALLY ENCLOSED • EXPLOSION PROOF
• UNITIZED CONSTRUCTION

All switches offer maximum protection against radio frequency interference.
Body Diameter: .623"
Electrical Rating Continuous:
8 amps at 28 v dc
Switching Rate:
0 to 0.25 amp resistive
0 to 28 v dc
0 to 0.25 amp resistive
0 to 115 v ac
0 to 0.12 amp inductive
0 to 28 v dc

Torque: 5 to 9" ounces
Contact Resistance:
.005 ohms average
Insulation Resistance:
100,000 megohms minimum at 100 volts
10,000 megohms minimum at 500 volts
Designed and Built to meet the environmental and functional requirements of MIL-S-3786

Series B-30 **30°**

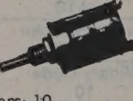


B30-1 Series	1 pole/deck
B30-2 Series	2 pole/deck
B30-3 Series	3 pole/deck

"M" Series
See MIL S-3786/13

Max Positions: 12
Body Diameter: .623"

Series B-36 **36°**

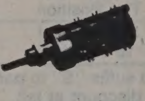


B36-1 Series	1 pole/deck
B36-2 Series	2 pole/deck

"M" Series
See MIL S-3786/13

Max Positions: 10
Body Diameter: .623"

Series B-45 **45°**

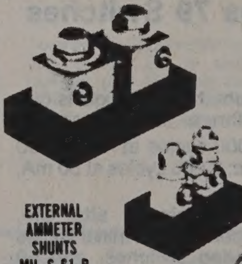


B45-1 Series	1 pole/deck
B45-2 Series	2 pole/deck

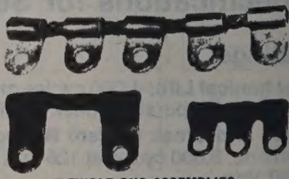
"M" Series
See MIL S-3786/13

Max Positions: 8
Body Diameter: .623"

ELECTRICAL HARDWARE PRODUCTS FOR AIRCRAFT

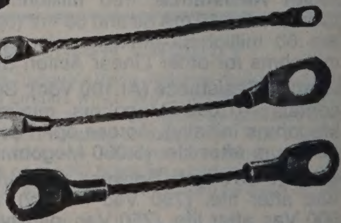


EXTERNAL AMMETER SHUNTS MIL-S-61-B



FLEXIBLE BUS ASSEMBLIES

BUS BARS



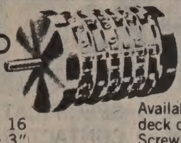
BONDING JUMPERS

JANCO CORPORATION
Box 3038 • Burbank, CA 91504 • 3111 Winona Avenue • (818) 846-1800 • TWX 910-498-2701

Series "C" Rotary Selector Switches

Series C-22

22½°

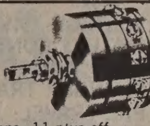


ELECTRICAL RATING:
10 amps 115 vac Res.
10 amps 28 v dc Res.
6 amps 28 v dc Ind.
Available only in single pole per deck construction.
Screw terminals only.

Max. Positions: 16
Body Diameter: 3"

Series C-30

30°

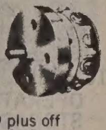


ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
C30-1 Series 1 pole/deck
C30-3 Series 3 pole/deck
Available in 1 and 3 poles per deck construction.
Screw terminals only.

Max. Positions: 11 plus off
Body Diameter: 2.180"

Series C-36

36°



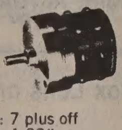
ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
Available only in single pole per deck construction.

Screw terminals only.

Max. Positions: 9 plus off
Body Diameter: 2.375"

Series C-45

45°

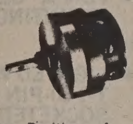


ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
C45-1 Series 1 pole/deck
C45-2 Series 2 pole/deck
Available in 1 and 2 poles per deck construction.
Screw terminals only.

Max. Positions: 7 plus off
Body Diameter: 1.93"

Series C-90

90°



ELECTRICAL RATING:
1 pole construction
15 amps Res. 115
15 amps Res. 28 v dc
10 amps Ind. 28 v dc
2 pole construction
7.5 amps Res. 115 v ac
7.5 amps Res. 28 v dc
5 amps Ind.
Screw terminals only.

C90-1 Series 1 pole/deck Max. Positions: 4
C90-2 Series 2 pole/deck Body Diameter: 2.12"

GENERAL SPECIFICATIONS

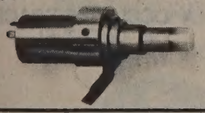
ELECTRICAL RATING:
Carry 10 amps continuous.
Make and Break—see individual switch data.
VOLTAGE DROP:
0.1 volt or less at rated amperage.
Initial Contact Resistance: .003 ohms.
LIFE:
10,000 double cycles make and break rated amperage.
TORQUE:
1 to 3 inch lbs.
SWITCHES DESIGNED AND BUILT IN ACCORDANCE WITH THE FOLLOWING SPECS:
MIL-S 6807 (rotary switches enclose
MIL-S-3786 (rotary switches)
MIL-E-5272 (environmental testing)

All switches offer maximum protection against radio frequency interference.

ON MOST OF THE SWITCHES LISTED THE FOLLOWING FEATURES ARE AVAILABLE.

- O-ring Shaft and Panel Seal
- Combination of Decks
- Bridging contacts
- Momentary positions
- Isolated positions
- Adjustable stops
- Solenoid driven
- Keylock
- Gang switches
- Concentric shaft switches

Typical Unique Applications of Janco Rotary Switches

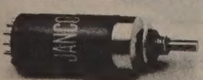


DOUBLE MOMENTARY ACTION

Push button switch designed for grip stick applications. Actuation to first momentary detented position closes first circuit. Second detented position completes second circuit.

FEATURES UNIQUE ON-OFF OPERATION

Actuated by pulling knob out and rotating to "On" positions. While in "on" positions, circuitry cannot be shut off until knob is returned to "off" position and depressed.



MASTER COMMUNICATIONS SWITCH

Provides standard coded outputs and offers unique switching functions by longitudinal shaft movement. Momentary or maintained contact positions actuated by pulling shaft.

JET ENGINE START SWITCH

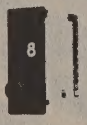
Knob is depressed and contacts are held in by the solenoid. After jet engine reaches desired RPM, system removes power disengaging solenoid. Lighted knob indicated function.

JANCO CORP
BURBANK CAL
PART NO 24

JANCO CORPORATION
SINCE 1947

Series "D" Pushbutton Rotary Switches QPL MIL-S-22710

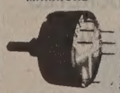
FEATURES: • Totally enclosed, explosion proof. • Printed-circuit construction. • Black or white numbers on black or white background indicate switch positions (black numbers on white background for lighted switches.). • All standard codes available. Available in 8, 10, 12 or 16 positions. • Plastic covered buttons, available in black, red, green, yellow, white or blue.

	Series	Indexing	No. of Positions
	D45U	45°	8
	D36U	36°	10
	D30U	30°	12
	D22B	22½°	16
	D22U		
	D45B	45°	8
	D36B	36°	10
	D30B	30°	12
	DA45U	45°	8
	DA36U	36°	10
	DA30U	30°	12

MAKE AND BREAK
.125 amp res. at 28 v dc and 115 v ac
.05 amp ind. at 28 v dc
PUSH FORCE:
55 oz. max.
CONTACT RESISTANCE:
Initial .100 ohms
After life .160 ohms
LIFE:
50,000 cycles
Cycle consists of 720° rotation
INSULATION RESISTANCE:
5,000 megohms
ALTITUDE:
70,000 ft.
TEMPERATURE RANGE:
−65° C to +85° C
PLUNGER TRAVEL:
.180 approx.
DIELECTRIC STRENGTH:
750 volts RMS
WEIGHT:
½ oz. approx.

Series "E" Rotary Selector Switches

PRINTED CIRCUIT

	Series	Indexing	No. of Positions
 MINIATURE	EA45	45°	8
	EA36	36°	10
	EA30	30°	12
	EA22	22°	16
 **MICRO-MINIATURE**	EB45	45°	8
	EB36	36°	10
	EB30	30°	12
 MINIATURE	EC45	45°	8
	EC36	36°	10
	EC30	30°	12
	EC22	22°	16
	EC18	18°	20
	EC15	15°	24

- * **Totally enclosed, explosion proof.**
- * **Printed circuit construction.**
- * **Make and break:**
  .125 amp Res @ 28 v dc
  .125 amp Res. @ 115 v ac
  .05 amp Ind. @ 28 v dc
- * **All standard codes available.**
- * **Current carrying capacity 3 amps continuous.**
- * **Will meet or exceed the environmental requirements of MIL-S-3786 and MIL-S-22710.**

JANCO CORPORATION
Box 3038 • Burbank, CA 91504 • 3111 Winona Avenue • (818) 846-1800 • TWX 910-498-2701

MEI T-5 SERIES LIGHTED KEYSWITCHES

DESCRIPTION

The T-5 lighted keyboard switch has long life (greater than 10 million cycles), low bounce, gold-plated cross bar contacts usually found in more expensive switches.

Mechanically, the T-5 switch incorporates precision tracking surfaces providing a smooth "feel" throughout its .170 travel. Each switch has two alignment studs and four to six solder points. This makes hand or wave soldered PC board assemblies extremely rugged for the most demanding applications, while keeping the manufacturing costs down by eliminating the need for metal mounting frames.

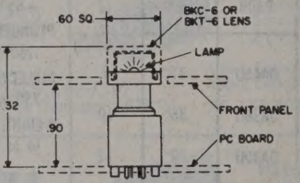
Electrical configurations include normally open, normally closed, double pole normally open, and alternate action. MEI stocks a 5V, 60 milliamp, 100,000 hour bulb for these switches. Lamp terminal spacing is .100 inch, to fit T-1 size lamps which can be changed from the front panel by end users. Lenses are stocked in eight colors.

See PP. 496 & 497 for ADDITIONAL MEI KEYSWITCHES

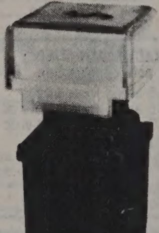
SPECIFICATIONS
CONTACT RATING, DC RESISTIVE: 3
max.
VOLTAGE: 24V max.
INITIAL CONTACT RESISTANCE: 10
mΩ max.
PLUNGER TRAVEL: .170 ±.010 in.
PRE-TRAVEL: .080 ±.030 in.
OPERATING FORCE
SINGLE POLE, MOMENTARY: 3.5 ±0.5 oz.
DOUBLE POLE AND/OR ALT. ACTIO
6.0 ±0.5 oz.
TEMPERATURE
OPERATING: −25°C to +65°C
STORAGE: −40°C to +70°C
CONTACT BOUNCE: 4 ms max.
MIN. ACTUATIONS, @ 5V, 100μ AMP
10 x 10^6

T-5K With Box Lens

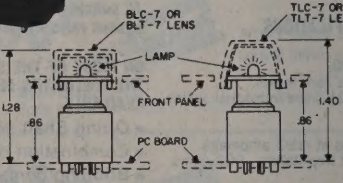
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED
- FOR ⅝" CENTER MOUNTING


60 SQ
BKC-6 OR BKT-6 LENS
LAMP
FRONT PANEL
PC BOARD
1.32
.90

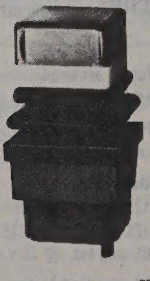
T-5L With Box Lens or Truncated Lens



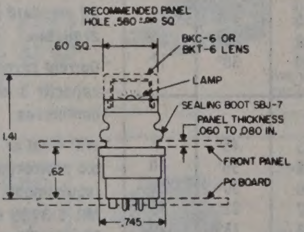
- FOR ¾" CENTER MOUNTING
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED


BLC-7 OR BLT-7 LENS
TLC-7 OR TLT-7 LENS
LAMP
FRONT PANEL
PC BOARD
1.28
.86
1.40
.86

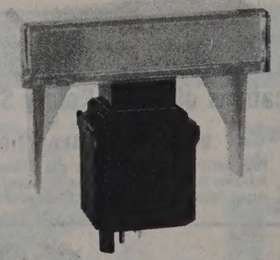
T-5J With Panel Sealing Boot and Box Lens



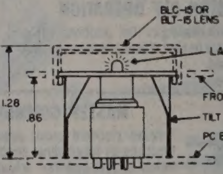
- ENVIRONMENTALLY SEALED ABOVE AND BELOW MOUNTING PANEL
- VINYL BOOT SEALS AGAINST LIQUID AND DUST
- FOR ¾" CENTER MOUNTING
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED


RECOMMENDED PANEL HOLE .580 ±.010 SQ
.60 SQ
BKC-6 OR BKT-6 LENS
LAMP
SEALING BOOT SBJ-7
PANEL THICKNESS .060 TO .080 IN.
FRONT PANEL
PC BOARD
1.41
.62
.745

T-5Y With Double Width Box Lens



- LIGHTED WITH T1 BI-PIN LAMP SOCKETED
- OCCUPIES SPACE OF TWO T-5L W/BOX LENS


BLC-15 OR BLT-15 LENS
LAMP
FRONT PANEL
TILT PREVENTION LEGS
PC BOARD
1.28
.86

MECHANICAL ENTERPRISES INC.

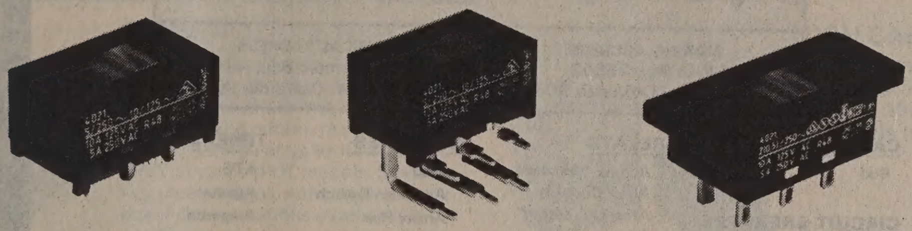
461 CARLISLE DRIVE
SALES - ENGINEERING
HERNDON, VA 22070
(703) 435-9496
TWX 710-832-0942

MANUFACTURING
1321 NW 65th PLACE
FT. LAUDERDALE, FL 33309
(305) 979-1333

For More Information. Circle No. 470

MARQUARDT

INTERNATIONAL APPROVALS

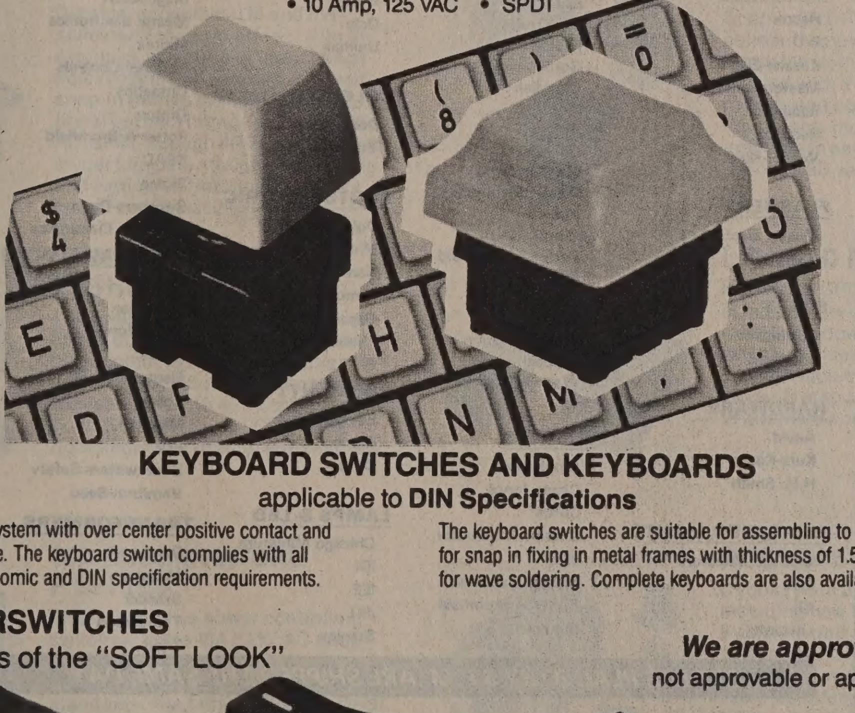


LINE VOLTAGE SELECTOR SWITCHES

Manufactured to meet both international and domestic specifications, the 4021 Series is designed for quick conversion and is available in three arrangements—straight terminals, straight terminals with ears and 90° terminals.

Specifications:

- 5 Amp, 250 VAC
- SPST
- DPDT
- 10 Amp, 125 VAC
- SPDT



KEYBOARD SWITCHES AND KEYBOARDS

applicable to **DIN Specifications**

A snap action system with over center positive contact and extreme long life. The keyboard switch complies with all important ergonomic and DIN specification requirements.

The keyboard switches are suitable for assembling to keyboards, for snap in fixing in metal frames with thickness of 1.5 mm, and for wave soldering. Complete keyboards are also available.

ROCKERSWITCHES

Originators of the "SOFT LOOK"

We are approved!!

not approvable or applicable.

Marquardt Switches, Inc. brings you a **complete family** of rocker, pushbutton and toggle switches, SPST, SPDT, DPST, DPDT, and 3 position, center off and momentary available in the **soft look, matte finish.**

Originally designed for consumer products, these switches will enhance your electronic instrumentation by supplying a look of quality and sophistication to your packaging.

Our 1800. Series is not approvable, or applicable to International Approvals. ***WE ARE APPROVED!*** 6A 250V AC - 10A 250V AC and 16A 250V AC. Available in a variety of colors.

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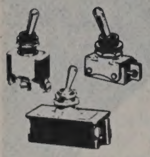
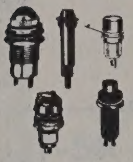
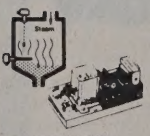
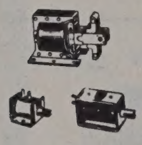

TOGGLES

LAMPS & LEDS

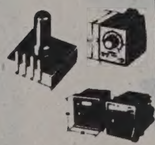

INDICATOR LIGHTS

RELAYS


LIQUID LEVEL CONTROLS


SOLENOIDS

TERMINAL BLOCKS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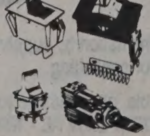
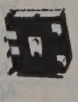
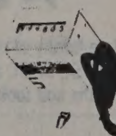
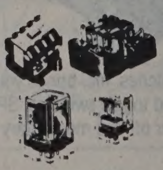
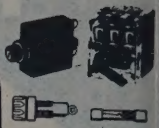

PADDLE SWITCHES

TRANSFORMERS


TIMERS


COUNTERS


RELAYS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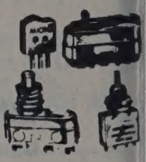
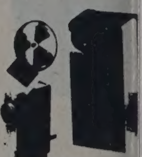

SWITCHES

RELAYS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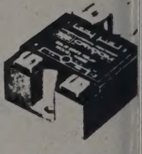
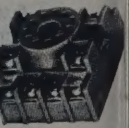
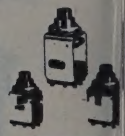
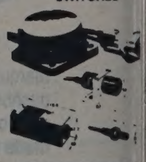

SOLID STATE RELAYS


SOCKETS


PUSHBUTTON SWITCHES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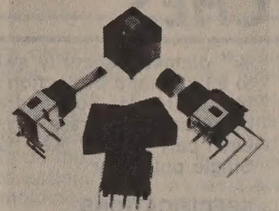
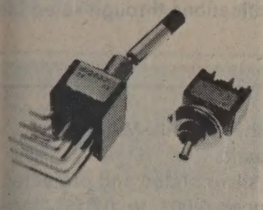


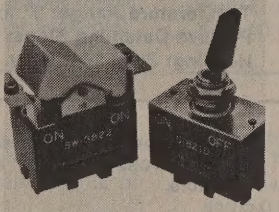
SUPER-SUBMINIATURE PCB WASHABLES

Toggles, paddles, rockers and push-buttons can be assembled to PC boards, wave soldered and cleaned. Straight, vertical and right angle terminals. Special sliding contacts for high-reliability dry circuit operation. Companion slide-actuated switches available.



SUBMINIATURE TOGGLES

Four job-proven series (M, E, D & S) designed to cover a wide variety of applications where maximum performance and minimum size are required. Ratings of up to 10A/125V AC. SPST through 4PDT models. Solder lug, plus straight, right angle and vertical PC terminations in all circuit configurations.

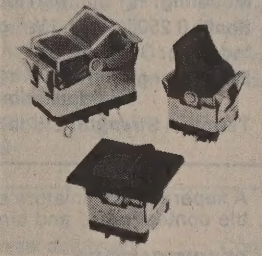


HIGH CAPACITY S SERIES

DPDT and 3PDT toggles and rockers rated at 30A 125/250V AC (resistive load). 30A 30V DC toggles available. Special 50A model toggle is also offered.

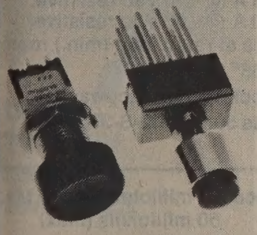
SUBMINIATURE PADDLES AND ROCKERS

Durable, economical M and PW series switches are offered with an extensive selection of interchangeable rockers and paddles. Flat and snap-in frames available with optional bezels. Ratings up to 6A/125V AC. SPDT through 4PDT models with solder lug, plus straight, right angle and vertical PC terminations in all circuit configurations.



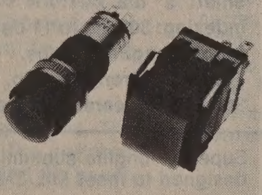
LIGHTED PADDLES AND ROCKERS

Snap-in 5A DPDT MLWs feature independent lamp circuits and are relampable from the front of the panel. Offered with a variety of colored rockers and paddles in all circuit configurations. Incandescent lamps available in several voltages. Also special LED versions.



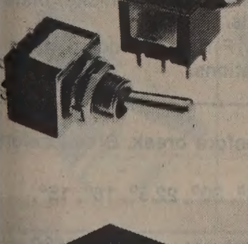
SUBMINIATURE PUSHBUTTONS

Three versatile series (EB, MB and SB) — all offering exceptional durability combined with capabilities up to 6A/125V AC. Several button sizes available. SPST to 4PDT configurations. Solder lug and PC straight, right angle and vertical terminations.



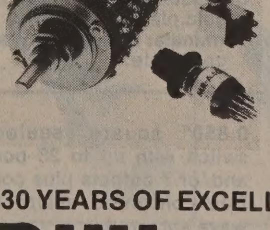
LIGHTED PUSHBUTTONS

KB and LB SPDT and DPDT available in momentary or alternate action (with latch-down feature) in a wide selection of lens styles, types, colors and light sources. Heavy-duty 5A model is also available in momentary or alternate action.



10A SUBMINIATURE P SERIES

Ideally suited as power controlling switches, these 10A/125V AC rated toggles, rockers and paddles conform to the highest international standards. Available in DPST or DPDT configurations. Rockers and paddles offered in a variety of colors. PC or solder lug terminals.



ROTARY SWITCHES

Choose from a variety of rotaries including new MR-A subminiature washable unit available with SP 12-position, DP 6-position and 4P-3 position. Larger rotaries from 6A to 30A also offered. All models have adjustable stops.

SPECIALTY SWITCHES

Choose from thousands of specially designed switches ranging from ruggedly constructed 4-way button or lever actuated joy sticks to unusual superstructures for specialized applications. Just tell us your needs.

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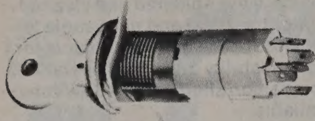
OAK SWITCHES



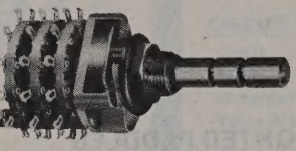
OAK ANTI-STATIC KEYLOCK SECURITY SWITCH

¾″ diameter security switches provide up to 20 kV static protection for sensitive electronic circuitry. Supplied with stainless steel bezel and two brass keys. Keyed alike for each part number. Key pull in all positions. Single pole only.

SPECIFICATIONS

Operating Life: Tested to 10,000 cycles.
Switching: Enclosed; SPST, SPDT, SP3T
Throw: 90°.
Operating Torque: 7 to 16 in. oz.
Temperature Range: 0° to +85°C
Positive Detenting Stops: Integral with lock.
Housing: Zytel 101, Gray.
Switch Terminals: Copper alloy, silver plated.
Contact Material: Copper alloy, silver-plated.
Barrel: Zinc alloy, chromate dipped.
Bezel: Stainless steel.
Keys: Brass (2)
Hex Mtg. Nut: Cadmium plated steel.
Elec. Ratings: 1.0 A @ 28 Vdc
4.0 A @ 120 Vac
2.0 A @ 240 Vac
Contact Resistance: 10 milliohms (nominal).

All switches make before break. UL and CSA listed. Specifications through rated life after break in.

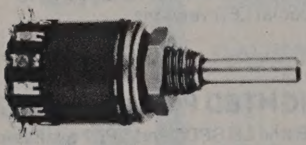


OAK TYPE AM (ACORN) ROTARY SWITCH

1″ diameter with patented Unidex® detent action. Double-wiping and self-cleaning contacts.

SPECIFICATIONS

Size: 1″ dia. (nom.), 1 to 3 sections.
Mounting: ⅜″ dia. with locating key.
Shaft: 0.250″ dia. x 1½″ grooved (breakoff).
Indexing: Dual ball 30°.
Stop Strength: Fixed — 15 in. lbs.
Adjustable — 10 in. lbs.
Terminal Strength: 2½ lb. pull.
Stator: Diallyl phthalate (MIL-M-14).
Rotor: Thermoplastic.
Contacts: Brass, silver plated and protected.
Contact Resistance: 0.003 to 0.015 Ohms between adjacent clips.
Elec. Rating: Break 0.5 A @ 28 Vdc, 0.25 A @ 110 Vac (resistive). Carry 5.0 A.
Life: 10,000 cycles at rated load (min.).
Temperature: −65° to +85°C.
Hardware: Nut, lockwasher, stopwasher.
Finish: Withstands 50 hr. MIL-S-3786 salt spray.



OAK ½″ ROTARY SWITCH

A superior subminiature switch with negligible contact noise and circuit resistance.

SPECIFICATIONS

Size: ½″ (nominal).
Mounting: "D" hole, ¼″ bushing.
Shaft: ⅛″ dia. x ¾″.
Indexing: 30°, up to 11 detents.
Stop Strength: 5 in. lbs.
Terminal Strength: 1 lb. pull.
Stator & Spacers: Diallyl phthalate.
Rotor: Thermoplastic.
Contacts: Silver alloy, gold plated.
Contact Resistance: 10-20 milliohms.
Insulation Resistance: 10 megohms (min.).
Elec. Rating: 0.25 A @ 110 Vac resistive.
0.50 A @ 30 Vdc resistive.
Life: 10,000 cycles at rated load (min.) room
Temperature: −65° to +85°C
Hardware: Nut, lockwasher, stopwasher.
Finish: Withstands 50 hr. MIL-S-3786 salt spray.

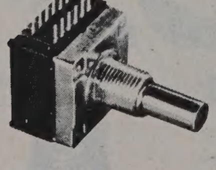
OAK TYPE 500 ½″ ROTARY SWITCH

Superior longlife subminiature switches are designed to meet MIL-S-3786/20. Sealed.

SPECIFICATIONS

Size: ½″ (nom), single pole.
Positions: 4, 6, 8, 10 & 12.
Detent: 90°, 60°, 45°, 36° & 30°.
Base: Diallyl phthalate, MIL-M-14.
Rotor: Phenolic, MIL-M-14.
Contacts: Copper alloy w/silver crown, gold plate.
Terminals: Copper alloy, silver crown, gold plate.
Contact Resistance: 20 milliohms (max) MIL.
50 milliohms (max) non-MIL
Stops: Fixed or adjustable.
Shaft & Panel Seal: Neoprene.
Voltage: 600 Vac breakdown (min).
Current Rating: 6.0 A @ 30 Vdc & 110 Vac. Resistive.
Mechanical: Stainless steel & nickel plate steel detent balls.

Write for Bulletin F-1096 for complete details and specifications.



OAK TYPE 850 PROGRAMMABLE ROTARY SWITCH

0.850″ square, sealed programmable switch with up to 28 positions, 4 sections and/or 7 outputs plus common per section. Dual-concentric shafts available. Can be wave soldered.

SPECIFICATIONS

Rating: 250 mA @ 28 Vdc resistive.
Contact Resistance: 100 milliohms (max).
Voltage Breakdown: 500 V (min) between common and open contact. 1000 V (min) between any contact and housing.
Contacts: Make before break. Break before make.
Detent Angles: 36°, 30°, 22.5°, 18°, 15°, 12.86°.
Operating Temperature: −55° to +85°C.
Stops: Available to limit rotation.
Coding: Hexidecimal, BCD, Grey and others.
Shafts: Steel, zinc plated, chromate treated.

Write for Bulletin F-1093.

OAK SWITCH SYSTEMS INC. P.O. Box 517, Crystal Lake, IL 60014
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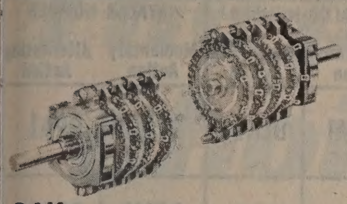
For More Information. Circle No. 474

OAK SWITCHES



OAK MULTIDEX ROTARY SWITCH

Oak Multidex Switches replace older models with a completely new design. Multidex switches are smaller than older models yet provide more contacts (up to 32 and 36 positions). The patented Unidex detent system has one or two balls riding on the star-wheel for smooth and positive action. The detent housing is a one-piece molding. They meet or exceed the requirements of MIL-S-3786, SR32 (latest issue).

Multidex rotors and stators are molded of diallyl phthalate and meet MIL-M-14 requirements. Contacts are silver plated brass (standard) or silver alloys (other available).

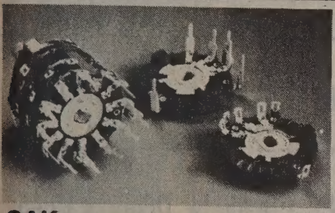
The contacts are self-cleaning, double-wiping types and are coated to resist corrosion.

Terminals are Type "A" clips for easy wire insertion and soldering.

Rated at 0.5 A @ 28 Vdc and 0.25 @ 110 Vac with silver plated contacts. Silver contacts are rated 1.0 @ 28 Vdc and 0.5 A @ 110 Vac. All ratings are for resistive loads.

Temperature ratings are:
MIL: −65° to +85°C.
Commercial: −25° to +85°C.

Both types are made of materials which meet or exceed the requirements of MIL-S-3786 50 hour salt spray test.



OAK TYPE FJ 1.421" DIAMETER ROTARY SWITCH

This series of Oak switches is a product expansion of the standard "F" series. They are designed to meet the requirements of MIL-S-3786/SR03.

The FJ series offers terminal clips which are offset on the rear 15° from those on the front. Each section can accommodate up to 22 clips in 30°, 60° or 90° throw. The FJ series utilizes Oak's durable high pressure double wiping contacts which are self-cleaning and corrosion resistant. Terminals are available for both hard soldering and printed circuit board mounting.

Rotation may be either continuous, with a fixed stop or with an adjustable stop.

FJ switches are rated 1.0 A @ 28 Vdc and 5.0 A @ 110 Vac with silver plated brass contacts. Ratings for silver alloy contacts are: 2 A @ 28 Vdc and 1.0 A @ 110 Vac. Contacts can be make before break or break before make or any combination of these.

All FJ switches are made of the highest quality material to meet or exceed all military and commercial requirements.

OAK TYPE 184 LEVER SWITCHES

Oak Type 184 lever switches are designed for reliable operation over thousands of cycles. The proven Type 184 offers a number of options. They are available as either 2, 3, or 4 position styles and with up to 12 terminals per side so that 12 pole 2 position circuits can be used or up to 8 poles with the 3 position style.

Mounting requires a slot and 2 holes to accept the two #4-40 mounting screws. The face of the switch is tapped. The switches require only 1¾₄" of space behind the panel.

Contacts are silver plated brass and are rated at 0.5 A @ 28 Vdc and 0.25 A @ 110 Vac, resistive. The contacts will carry 5 Amps continuously.

The life of this series is rated at 10,000 cycles under standard conditions as a minimum.

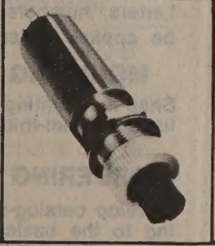
The switches are supplied with a standard knob. Other designs are possible.

Write for complete details or contact your nearest Oak distributor or sales office.

OAK OPTOLITE™ PUSHBUTTON SWITCHES

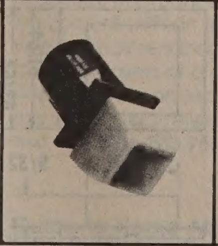
FRICTION CAP PRESSLITES

Momentary & Alternate Action



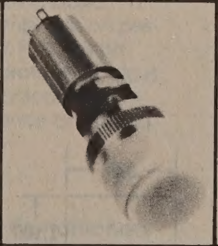
LOW PROFILE PRESSLITES

Momentary & Alternate Action



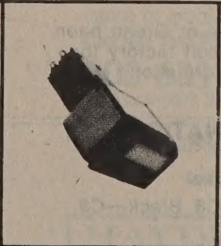
SNAP-IN PRESSLITES

Momentary Action Only



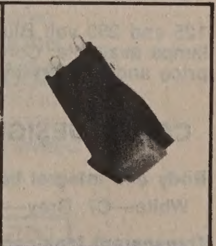
WATERTIGHT & EMI SUPPRESSED PRESSLITES

Momentary & Alternate Action



SPLIT LEGEND

Momentary & Alternate Action

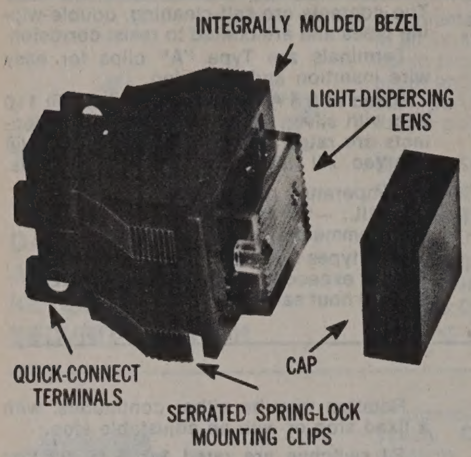


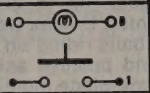
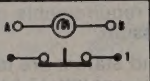
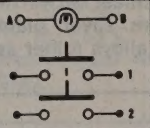
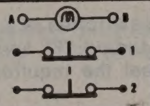
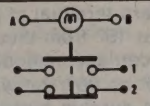
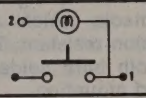
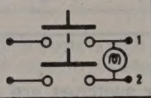
MACROFLEX

Momentary & Alternate Action

OAK SWITCH SYSTEMS INC. P.O. Box 517, Crystal Lake, IL 60014
(815) 459-5000 • TWX 910-634-3353 • TLX 72-2447

OSLO • PUSHBUTTON SWITCHES



			TYPE DL LIGHTED		TYPE DP NON-LIGHTED	
			CATALOG NUMBER		CATALOG NUMBER	
Circuit Number	Circuit Diagram	Switching	Momentary Action	Alternating Action	Momentary Action	Alternating Action
1		single-pole single-throw normally open	DLM1	DLA1	DPM1	DPA1
2		single-pole single-throw normally closed	DLM2	DLA2	DPM2	DPA2
3		double-pole single-throw normally open	DLM3	DLA3	DPM3	DPA3
4		double-pole single-throw normally closed	DLM4	DLA4	DPM4	DPA4
5		double-pole cir. #1 normally open cir. #2 normally closed	DLM5	DLA5	DPM5	DPA5
6		single-pole single-throw normally open	DLM6	DLA6		
7		double-pole single-throw normally open	DLM7	DLA7		

Above types do not include lamp-circuit.

ELECTRICAL FEATURES

Load rating: 10 amperes 125/250 volts ac.
Contacts: fine silver, double-break, break-before-make
Circuits: single-pole and double-pole
Dielectric strength: 2000 volts ac rms.
Life: 25,000 operations at maximum rating

MECHANICAL FEATURES

One-piece molded-nylon body has integral, serrated, spring-lock clips.
Bezel molded integral with body.
Metal bezel available.
Molded-in light-dispersing lens.
Interchangeable lens-caps in wide choice of colors.
Positive mechanical indication of switch-contact position.
100,000 mechanical operations.

TERMINALS

Style A—1/4-inch quick-connect
Style B—3/16-inch quick-connect
Style C—Solder-lug, for #12 wire

STANDARD LAMPS

Integral with switch;
Internally connected per diagrams above.
6, 12, and 28 volt incandescent lamps standard.
125 and 250 volt neon lamps standard.

SPECIAL ORDER LAMPS

125 and 250 volt Blue or Green neon lamps available. Consult factory for price and delivery information.

COLOR DESIGNATIONS

Body and integral bezel
White—C7, Grey—C8, Black—C9,

Transparent lens-cap
Red—1, Clear—2, Amber—3, Green—4, Blue—5

Opaque pushbutton-cap
White—7, Grey—8, Black—9, Blue—10, Green—11, Red—12

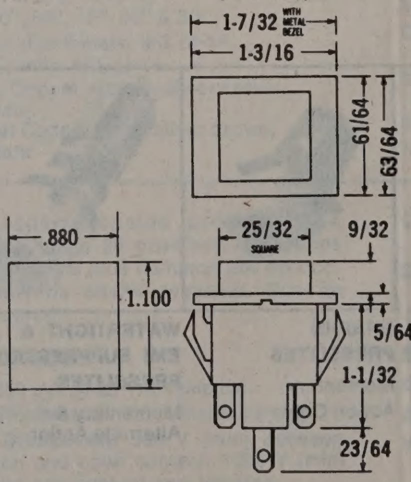
TYPE DG – Lighted Indicators

Type DG Lighted Indicators are identical in size and mounting with Type DL and DP switches and can be grouped easily with them without need fo special mounting provision. A choice of different lens-cap heights i available.

TYPE DGS the low-profile indicator extends the same distance from the panel as the Type DL or DP switch in its ON position (1/16 inch).

TYPE DGT the high-profile indicator ex tends the same distance from the panel as the Type D or DP switch in its OFF posi tion (9/32 inch).

OUTLINE DIMENSIONS (inches)



METAL BEZELS (optional)

Gold-color—F1, Chrome—F2

MARKINGS

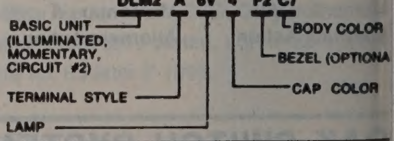
Letters, numbers, and symbols can be applied to lens-caps.

MOUNTING

Snap-in mounting in rectangular hole; fits any panel-thickness 1/32 to 3/16 inc

ORDERING EXAMPLE

Develop catalog-number of unit by adding to the basic Type Number, shown above, the applicable code-letters or numbers in the sequence shown below.



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Software Toolkit for Microcompu
IMPROVING PRODUCTIVITY WITH H LANGUAGES AND OPERATING SYST
Edited by Max Schindler, Selected from Electronic
Active Filter Design
CARSON CHEN
ELECTRO-OPTICAL COMMUNICATIONS DICTIONARY
DENNIS BODSON AND DAN BOTEZ
Switching and Linear power Supply power Converter Design
Abraham I. Pressman
HAYDEN
Basic Electrical Power Equipment
Anthony J. Pansini
HAYDEN
Home Security & Safety
Second Edition
HAYDEN

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Electro-Optical Communications Dictionary
Dennis Bodson and Dan Botez

Complete reference of terms and definitions vital to anyone involved with electro-optical communications. Gives precise meanings and usage for processes, components, and devices. **#0961-5, $22.95**

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Carson Chen

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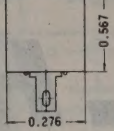
MINIATURE TOGGLE SWITCH SOLDER TERMINALS

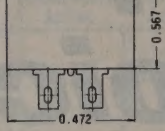
MT7000 SERIES

Soldering work is to be made within 5 seconds when using a 40W soldering iron, and within 3 seconds when using a 60W soldering iron.

Single-pole

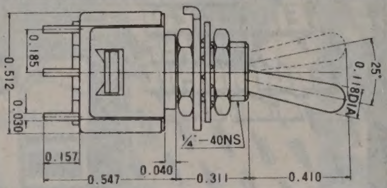
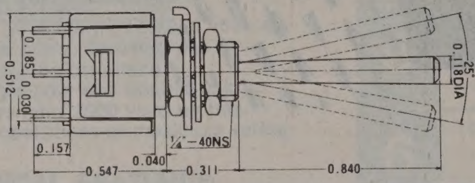
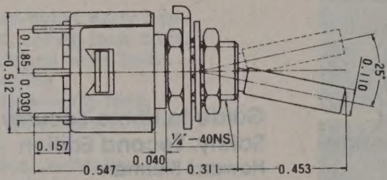
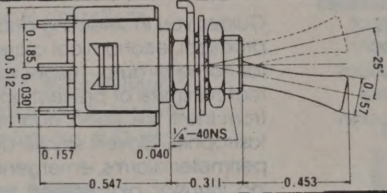
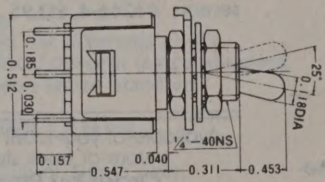
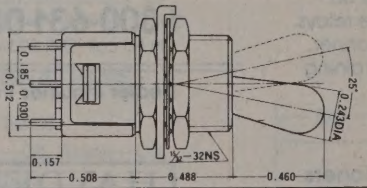
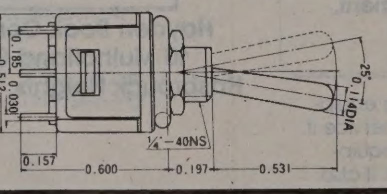


Double-pole



• U.L. APPROVED

The State in the Bracket is Momentary

Type Name	External Shape Dimensions	No. of Poles	ON—ON	ON—OFF—ON	ON—(ON)	(ON)—OFF—(ON)	ON—OFF—(ON
MT Standard Miniature	 0.185 0.512 0.030 0.157 0.547 0.040 0.311 0.410 ¼"—40NS 25° 0.118DIA	1	MT 7101	MT 7103	MT 7108	MT 7105	MT 7107
		2	MT 7201	MT 7203	MT 7208	MT 7205	MT 7207
MTB Long	 0.185 0.512 0.030 0.157 0.547 0.040 0.311 0.840 ¼"—40NS 25° 0.118DIA	1	MTB 7101	MTB 7103	MTB 7108	MTB 7105	MTB 7107
		2	MTB 7201	MTB 7203	MTB 7208	MTB 7205	MTB 7207
MTF Flat Metal	 0.185 0.512 0.030 0.157 0.547 0.040 0.311 0.453 ¼"—40NS 25° 0.110	1	MTF 7101	MTF 7103	MTF 7108	MTF 7105	MTF 7107
		2	MTF 7201	MTF 7203	MTF 7208	MTF 7205	MTF 7207
MTH Flat Plastic	 0.185 0.512 0.030 0.157 0.547 0.040 0.311 0.453 ¼"—40NS 25° 0.157	1	MTH 7101	MTH 7103	MTH 7108	MTH 7105	MTH 7107
		2	MTH 7201	MTH 7203	MTH 7208	MTH 7205	MTH 7207
MTM Short	 0.185 0.512 0.030 0.157 0.547 0.040 0.311 0.453 ¼"—40NS 25° 0.118DIA	1	MTM 7101	MTM 7103	MTM 7108	MTM 7105	MTM 7107
		2	MTM 7201	MTM 7203	MTM 7208	MTM 7205	MTM 7207
MTP Bulldog	 0.185 0.512 0.030 0.157 0.508 0.488 0.460 15/32—32NS 25° 0.243DIA	1	MTP 7101	MTP 7103	MTP 7108	MTP 7105	MTP 7107
		2	MTP 7201	MTP 7203	MTP 7208	MTP 7205	MTP 7207
MTY Water-Proof	 0.185 0.512 0.030 0.157 0.600 0.197 0.531 ¼"—40NS 25° 0.114DIA	1	MTY 7101	MTY 7103	MTY 7108	MTY 7105	MTY 710
		2	MTY 7201	MTY 7203	MTY 7208	MTY 7205	MTY 720

SATORI SWITCH INDUSTRIES

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Tel. (213) 378-947
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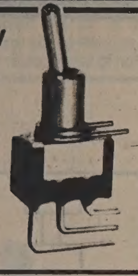
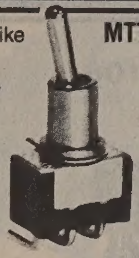
For More Information. Circle No. 480

MINIATURE TOGGLE SWITCH MTV VERTICAL TERMINALS MTZ HORIZONTAL TERMINALS

MTV



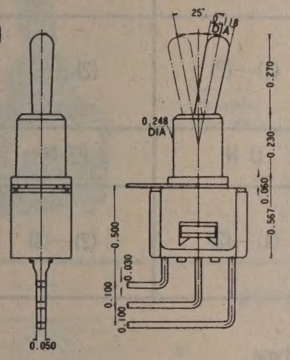
MT7000 SERIES

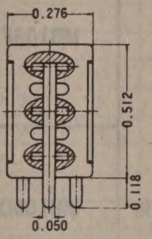


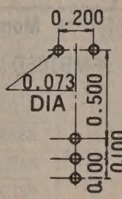
- These types are developed as switches for exclusive use to printed circuit boards, like the terminal switch for printed circuit (P/C)
- We produce gold plated contacts for very small current (50μA 200mA) (Goods to be specially ordered)
- The standard products have no fitting screw parts. (Threadless)
- We accept an order for MTV and MTZ with a triple pole or a quadruple pole as goods to be ordered specially
- UL Approved

MTV (VERTICAL)

M-1


25°
0.118 DIA
0.270
0.248 DIA
0.230
0.060
0.567
0.500
0.030
0.100
0.100
0.050

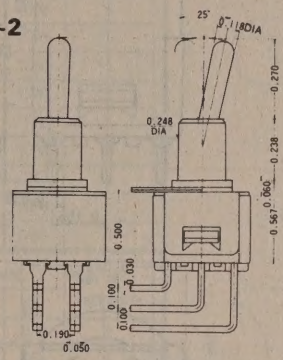

0.276
0.512
0.118
0.050

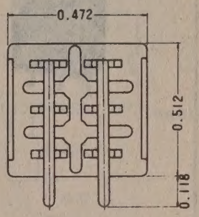

0.200
0.073 DIA
0.500
0.100
0.100

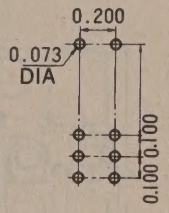
Type Name			
MTV7101	ON	—	ON
MTV7103	ON	OFF	ON
MTV7108	ON	—	(ON)
MTV7105	(ON)	OFF	(ON)
MTV7107	ON	OFF	(ON)

MTV (VERTICAL)

M-2


25°
0.118 DIA
0.270
0.248 DIA
0.238
0.060
0.567
0.500
0.030
0.100
0.100
0.190
0.050

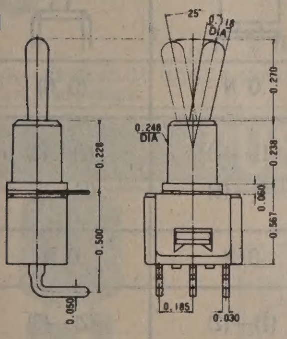

0.472
0.512
0.118

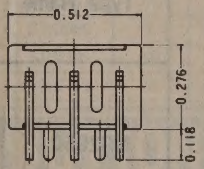

0.200
0.073 DIA
0.100
0.100

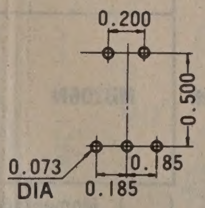
Type Name			
MTV7201	ON	—	ON
MTV7203	ON	OFF	ON
MTV7208	ON	—	(ON)
MTV7205	(ON)	OFF	(ON)
MTV7207	ON	OFF	(ON)

MTZ (HORIZONTAL)

M-1


25°
0.118 DIA
0.270
0.248 DIA
0.228
0.238
0.060
0.567
0.500
0.050
0.185
0.030

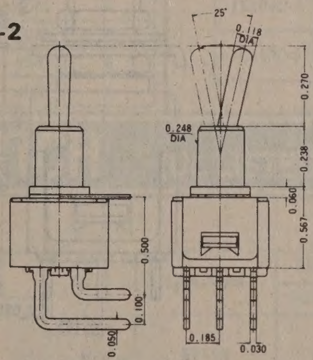

0.512
0.276
0.118

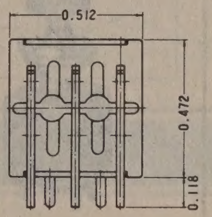

0.200
0.500
0.185
0.073 DIA
0.185

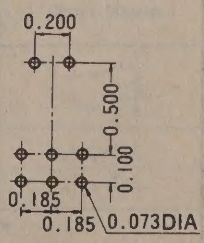
Type Name			
MTZ7101	ON	—	ON
MTZ7103	ON	OFF	ON
MTZ7108	ON	—	(ON)
MTZ7105	(ON)	OFF	(ON)
MTZ7107	ON	OFF	(ON)

MTZ (HORIZONTAL)

M-2


25°
0.118 DIA
0.270
0.248 DIA
0.238
0.060
0.567
0.500
0.100
0.050
0.185
0.030


0.512
0.472
0.118


0.200
0.500
0.100
0.185
0.185
0.073DIA

Type Name			
MTZ7201	ON	—	ON
MTZ7203	ON	OFF	ON
MTZ7208	ON	—	(ON)
MTZ7205	(ON)	OFF	(ON)
MTZ7207	ON	OFF	(ON)

SATORI SWITCH
INDUSTRIES

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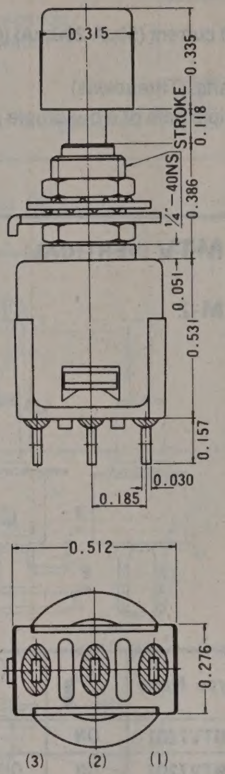
MINIATURE PUSH BUTTON SWITCH (UL LISTED)

● MB106


0.315
0.335
STROKE
0.118
1/4"-40NS
0.386
0.051
0.531
0.157
0.030
0.185
0.512
0.276
(3)
(2)
(1)

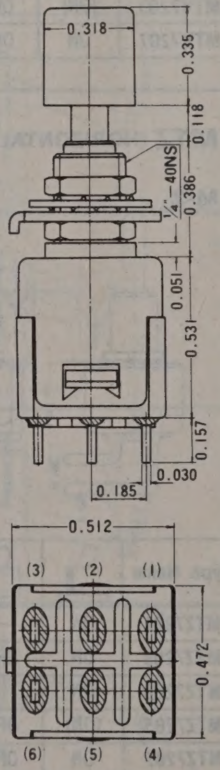
Single-pole Double-throw

Type Name	Push	
MB106F	O N	(O N)
	(1)—(2)	(2)—(3)
※ MB106D	O N	(O N)
	(1)—(2)	(2)—(3)

(　　) Momentary

※MB106D ; Alternating type

● MB206


0.318
0.335
0.118
1/4"-40NS
0.386
0.051
0.531
0.157
0.030
0.185
0.512
(3)
(2)
(1)
0.472
(6)
(5)
(4)

Double-pole Double-throw

Type Name	Push	
MB206R	O N	(O N)
	(1)—(2) (4)—(5)	(2)—(3) (5)—(6)
※ MB206N	O N	O N
	(1)—(2) (4)—(5)	(2)—(3) (5)—(6)

(　　) Momentary

※MB206N ; Alternating type

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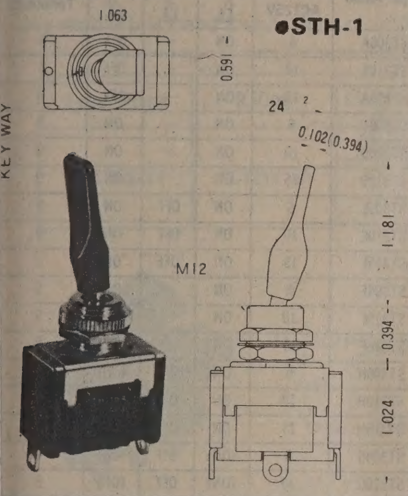
FAX. (213) 375-8

For More Information. Circle No. 480

TOGGLE LEVER SWITCH (UL LISTED)

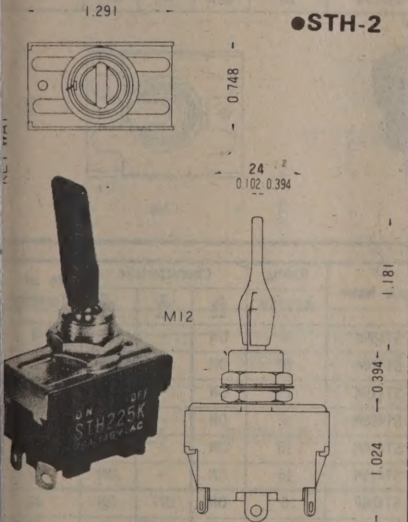
The standard of color for the lever is black, but red, blue, yellow and green can be used. However, please note that replacement of only the lever is not possible.

●STH-1


1.063
0.591
24
2
0.102(0.394)
1.181
M12
0.394
1.024
KEY WAY

Type Name	Rating	Characteristic			No. of Terminals
	AC125V	↖	↑	↗	
STH106A	6	ON	—	OFF	2
STH110A	10	ON	—	OFF	2
STH115A	15	ON	—	OFF	2
STH106D	6	ON	—	ON	3
STH110D	10	ON	—	ON	3
STH115D	15	ON	—	ON	3
STH106E	6	ON	OFF	ON	3
STH110E	10	ON	OFF	ON	3
STH115E	15	ON	OFF	ON	3
STH106F	6	ON	—	(ON)	3
STH110F	10	ON	—	(ON)	3
STH115F	15	ON	—	(ON)	3
STH106H	6	ON	OFF	(ON)	3
STH110H	10	ON	OFF	(ON)	3
STH115H	15	ON	OFF	(ON)	3
STH106G	6	(ON)	OFF	(ON)	3
STH110G	10	(ON)	OFF	(ON)	3
STH115G	15	(ON)	OFF	(ON)	3

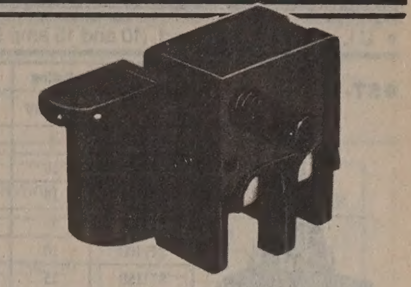
●STH-2

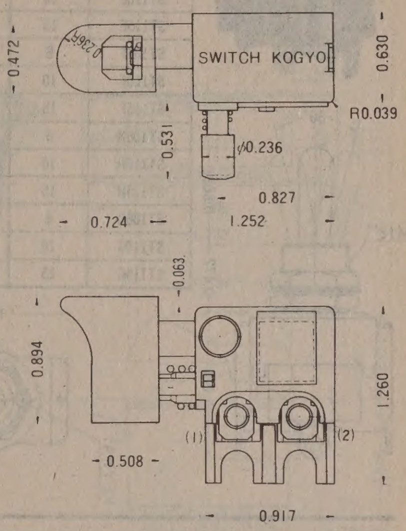

1.291
0.748
24
2
0.102 0.394
1.181
M12
0.394
1.024
ON OFF
STH225K
15A 125V AC
KEY WAY

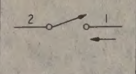
STH series switches are U.L. and C.S.A. approved for the 10 and 15 amp devices.

Type Name	Rating	Characteristic			No. of Terminals
	AC125V	↖	↑	↗	
STH206K	6	ON	—	OFF	4
STH210K	10	ON	—	OFF	4
STH215K	15	ON	—	OFF	4
STH206N	6	ON	—	ON	6
STH210N	10	ON	—	ON	6
STH215N	15	ON	—	ON	6
STH206P	6	ON	OFF	ON	6
STH210P	10	ON	OFF	ON	6
STH215P	15	ON	OFF	ON	6
STH206R	6	ON	—	(ON)	6
STH210R	10	ON	—	(ON)	6
STH215R	15	ON	—	(ON)	6
STH206T	6	ON	OFF	(ON)	6
STH210T	10	ON	OFF	(ON)	6
STH215T	15	ON	OFF	(ON)	6
STH206S	6	(ON)	OFF	(ON)	6
STH210S	10	(ON)	OFF	(ON)	6
STH215S	15	(ON)	OFF	(ON)	6

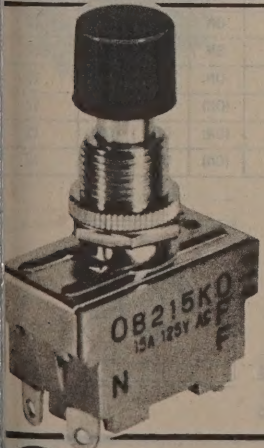
TRIGGER SWITCH

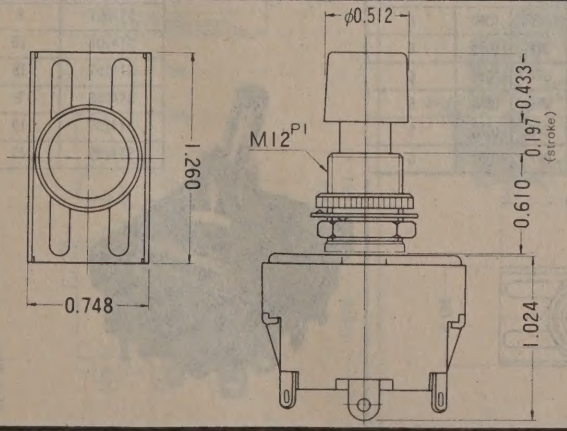


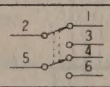
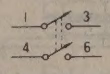

0.472
R0.236
SWITCH KOGYO
0.630
R0.039
0.531
ϕ0.236
0.724
0.827
1.252
0.063
0.894
1.260
(1)
(2)
0.508
0.917

Type Name	Rating	Circuit Diagram
	AC125V	
TG103C-5	3	
TG110C-5	10	

PUSH BUTTON SWITCH (UL LISTED)


OB215KO
15A 125V AC
N
F


ϕ0.512
M12^P1
1.260
0.748
0.433
0.197 (stroke)
0.610
1.024

Type Name	Rating	Circuit Diagram
	AC125V	
B215N	15	
B215K	15	

※B215N, B215K : Alternating type

SATORI SWITCH
INDUSTRIES

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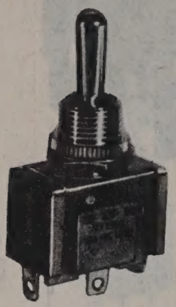
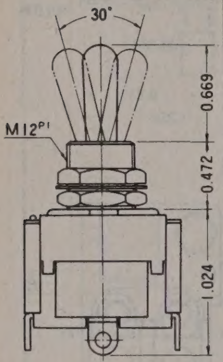
23717 Hawthorne Blvd., Suite 201
Torrance, CA 90505
Tel. (213) 378-9478
Telex. 182536 SATORITRNC
FAX. (213) 375-8565

TOGGLE SWITCH

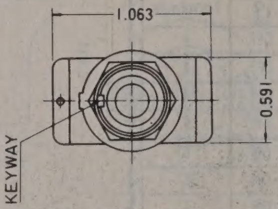
- U.L. and CSA approved. (10 and 15 amp series)

●ST-1

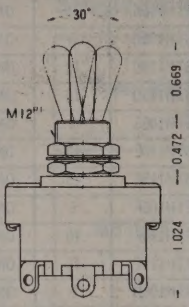


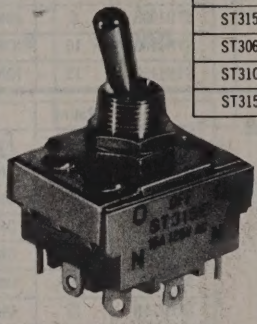


Type Name	Rating	Characteristic			No. of Terminals
	AC125V				
ST106A	6	ON	—	OFF	2
ST110A	10	ON	—	OFF	2
ST115A	15	ON	—	OFF	2
ST106D	6	ON	—	ON	3
ST110D	10	ON	—	ON	3
ST115D	15	ON	—	ON	3
ST106E	6	ON	OFF	ON	3
ST110E	10	ON	OFF	ON	3
ST115E	15	ON	OFF	ON	3
ST106F	6	ON	—	(ON)	3
ST110F	10	ON	—	(ON)	3
ST115F	15	ON	—	(ON)	3
ST106H	6	ON	OFF	(ON)	3
ST110H	10	ON	OFF	(ON)	3
ST115H	15	ON	OFF	(ON)	3
ST106G	6	(ON)	OFF	(ON)	3
ST110G	10	(ON)	OFF	(ON)	3
ST115G	15	(ON)	OFF	(ON)	3

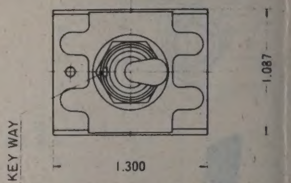


● ST-3

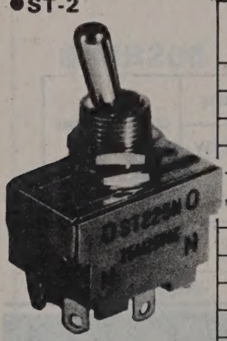


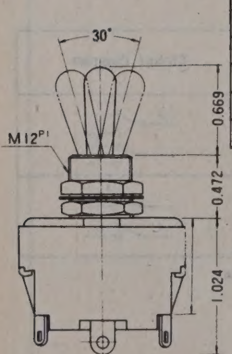


Type Name	Rating	Characteristic			No. of Terminals
	AC125V				
ST306A	6	ON	—	OFF	6
ST310A	10	ON	—	OFF	6
ST315A	15	ON	—	OFF	6
ST306D	6	ON	—	ON	9
ST310D	10	ON	—	ON	9
ST315D	15	ON	—	ON	9
ST306E	6	ON	OFF	ON	9
ST310E	10	ON	OFF	ON	9
ST315E	15	ON	OFF	ON	9
ST306F	6	ON	—	(ON)	9
ST310F	10	ON	—	(ON)	9
ST315F	15	ON	—	(ON)	9
ST306H	6	ON	OFF	(ON)	9
ST310H	10	ON	OFF	(ON)	9
ST315H	15	ON	OFF	(ON)	9
ST306G	6	(ON)	OFF	(ON)	9
ST310G	10	(ON)	OFF	(ON)	9
ST315G	15	(ON)	OFF	(ON)	9

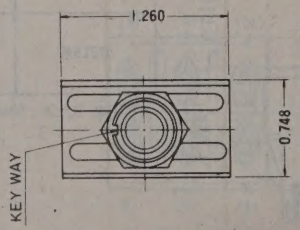


●ST-2

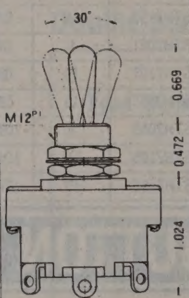




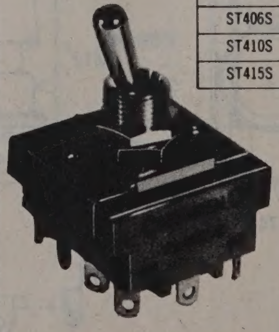
Type Name	Rating	Characteristic			No. of Terminals
	AC125V				
ST206K	6	ON	—	OFF	4
ST210K	10	ON	—	OFF	4
ST215K	15	ON	—	OFF	4
ST206N	6	ON	—	ON	6
ST210N	10	ON	—	ON	6
ST215N	15	ON	—	ON	6
ST206P	6	ON	OFF	ON	6
ST210P	10	ON	OFF	ON	6
ST215P	15	ON	OFF	ON	6
ST206R	6	ON	—	(ON)	6
ST210R	10	ON	—	(ON)	6
ST215R	15	ON	—	(ON)	6
ST206T	6	ON	OFF	(ON)	6
ST210T	10	ON	OFF	(ON)	6
ST215T	15	ON	OFF	(ON)	6
ST206S	6	(ON)	OFF	(ON)	6
ST210S	10	(ON)	OFF	(ON)	6
ST215S	15	(ON)	OFF	(ON)	6

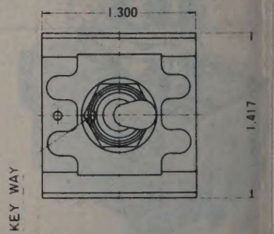


● ST-4



Type Name	Rating	Characteristic			No. of Terminals
	AC125V				
ST406K	6	ON	—	OFF	8
ST410K	10	ON	—	OFF	8
ST415K	15	ON	—	OFF	8
ST406N	6	ON	—	ON	12
ST410N	10	ON	—	ON	12
ST415N	15	ON	—	ON	12
ST406P	6	ON	OFF	ON	12
ST410P	10	ON	OFF	ON	12
ST415P	15	ON	OFF	ON	12
ST406R	6	ON	—	(ON)	12
ST410R	10	ON	—	(ON)	12
ST415R	15	ON	—	(ON)	12
ST406T	6	ON	OFF	(ON)	12
ST410T	10	ON	OFF	(ON)	12
ST415T	15	ON	OFF	(ON)	12
ST406S	6	(ON)	OFF	(ON)	12
ST410S	10	(ON)	OFF	(ON)	12
ST415S	15	(ON)	OFF	(ON)	12





SATORI SWITCH
INDUSTRIES

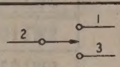
SATORI ELECTRIC (AMERICA) INC.
23717 Hawthorne Blvd., Suite 201
Torrance, CA 90505

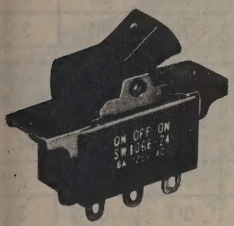
Tel. (213) 378-947
Telex. 182536 SATORITRN
FAX. (213) 375-85

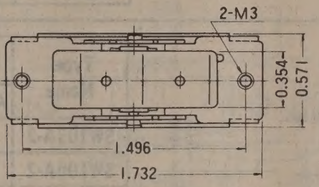
For More Information. Circle No. 480

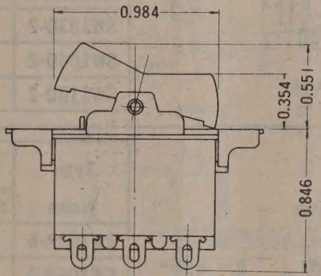
ROCKER SWITCH

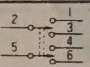
- This is a circuit switch or a power source switch for the general purpose.
- The knob is black and a white mark of ⌀0.059 can be carved.
- As to the rating, production of 3A-15A at 125V AC is possible.
- UL and CSA approved.

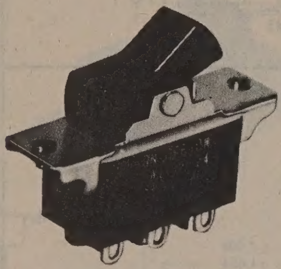
Type Name	Rating	Circuit Diagram	No. of Terminals
		ON—OFF—ON	
SW106E-24	AC125V 6A		3

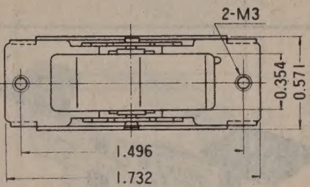

ON OFF ON
SW106E-24
6A 125V AC

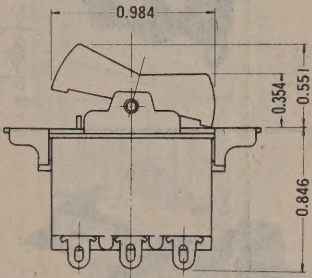

2-M3
0.354
0.571
1.496
1.732

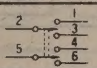

0.984
0.354
0.551
0.846

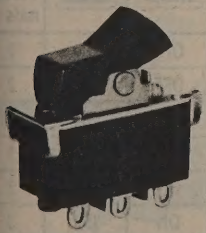
Type Name	Rating	Circuit Diagram	No. of Terminals
		ON—OFF—ON	
SW206P-24	AC125V 6A		6

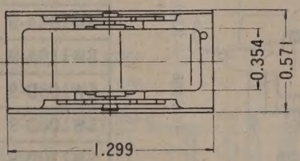


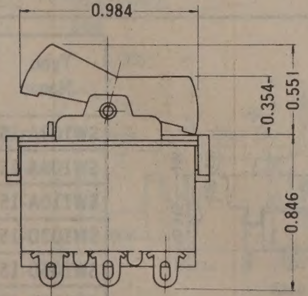

2-M3
0.354
0.571
1.496
1.732

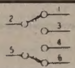

0.984
0.354
0.551
0.846

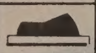
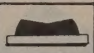
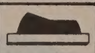
Type Name	Rating	Circuit Diagram	No. of Terminals
		ON—OFF—ON	
SW215P-25	AC125V15A		6

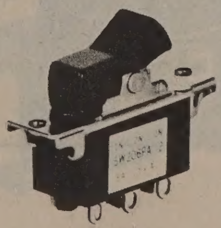


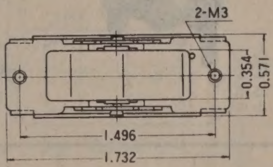

0.354
0.571
1.299

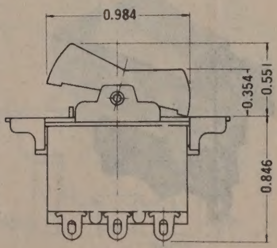

0.984
0.354
0.551
0.846

Type Name	Rating	Circuit Diagram	No. of Terminals
		ON—ON—ON	
SW206PA-2	AC125V 6A		6

Contact Terminal			
1—2 4—5	1—2 5—6	2—2 5—6	Terminal 1-2 or 5-6 keep "ON" position.
			




2-M3
0.354
0.571
1.496
1.732


0.984
0.354
0.551
0.846

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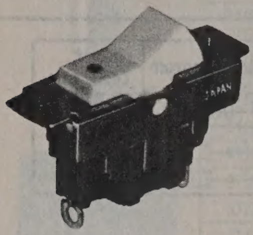
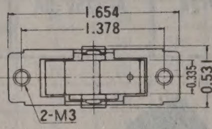
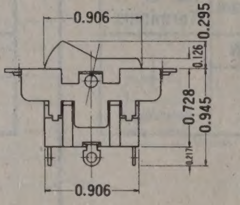
FAX. (213) 375-8565

ROCKER SWITCH

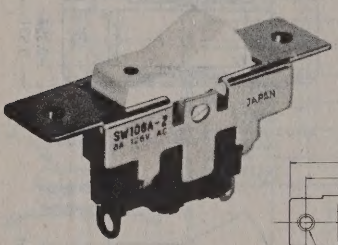
- Single pole, single-throw and Single-pole, double throw.
- UL and CSA approved for 6 and 10 amp series.
- The standard is a white knob with a red mark, or a black knob with a white mark.

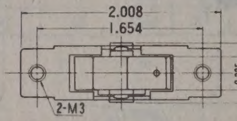


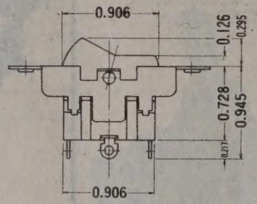

1.654
1.378
2-M3
0.335
0.531


0.906
0.295
0.126
0.728
0.945
0.217
0.906

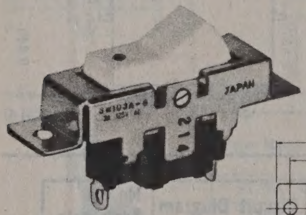
Type Name	Rating AC125V			No. of Terminals
SW103A	3	OFF	ON	2
SW106A	6	OFF	ON	2
SW110A	10	OFF	ON	2
SW103D	3	ON	ON	3
SW106D	6	ON	ON	3
SW110D	10	ON	ON	3

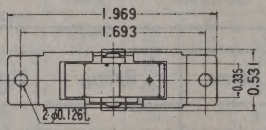

SW106A-2
6A 125V AC
JAPAN

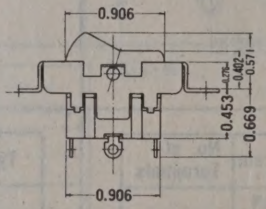

2.008
1.654
2-M3
0.335
0.531


0.906
0.126
0.295
0.728
0.945
0.217
0.906

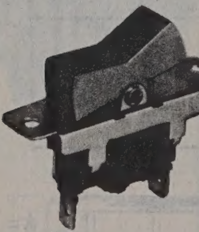
Type Name	Rating AC125V			No. of Terminals
SW103A-2	3	OFF	ON	2
SW106A-2	6	OFF	ON	2
SW110A-2	10	OFF	ON	2
SW103D-2	3	ON	ON	3
SW106D-2	6	ON	ON	3
SW110D-2	10	ON	ON	3

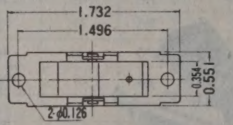

SW103A-6
JAPAN

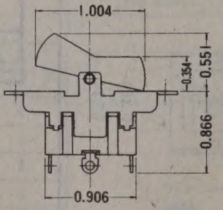

1.969
1.693
2-ϕ0.126
0.335
0.531


0.906
0.276
0.402
0.571
0.453
0.669
0.906

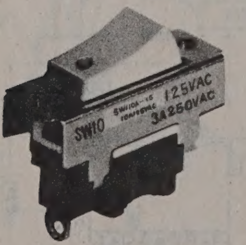
Type Name	Rating AC125V			No. of Terminals
SW103A-6	3	OFF	ON	2
SW106A-6	6	OFF	ON	2
SW110A-6	10	OFF	ON	2
SW103D-6	3	ON	ON	3
SW106D-6	6	ON	ON	3
SW110D-6	10	ON	ON	3

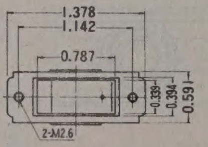


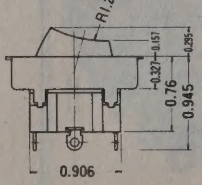

1.732
1.496
2-ϕ0.126
0.354
0.551


1.004
0.354
0.551
0.866
0.906

Type Name	Rating AC125V			No. of Terminals
SW103A-9	3	OFF	ON	2
SW106A-9	6	OFF	ON	2
SW110A-9	10	OFF	ON	2
SW103D-9	3	ON	ON	3
SW106D-9	6	ON	ON	3
SW110D-9	10	ON	ON	3


SW10
125VAC
3A 250VAC


1.378
1.142
0.787
2-M2.6
0.339
0.394
0.591


R1.22
0.157
0.295
0.327
0.76
0.945
0.906

Type Name	Rating AC125V			No. of Terminals
SW103A-15	3	OFF	ON	2
SW106A-15	6	OFF	ON	2
SW110A-15	10	OFF	ON	2
SW103D-15	3	ON	ON	3
SW106D-15	6	ON	ON	3
SW110D-15	10	ON	ON	3

SATORI SWITCH
INDUSTRIES

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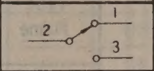
23717 Hawthorne Blvd., Suite 201
Torrance, CA 90505

Tel. (213) 378-947
Telex. 182536 SATORITRN
FAX. (213) 375-856

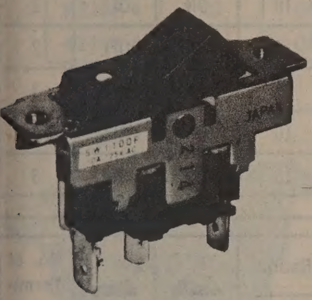
For More Information. Circle No. 480

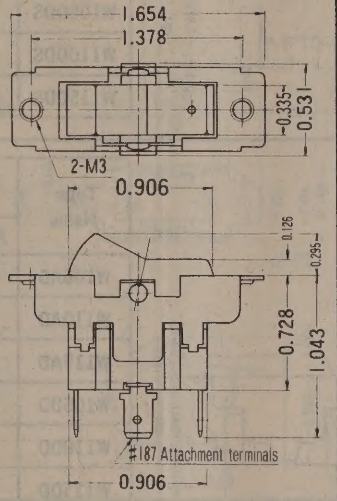
ROCKER SWITCH

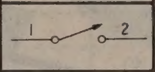
- UL and CSA approved.

Type Name	Rating	Circuit Diagram	No. of Terminals
SW110DF	AC125V10A	ON—ON 	3

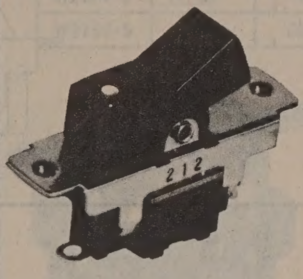
- The knob is black, and a white mark.

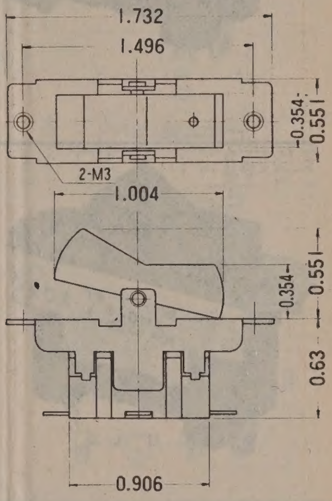


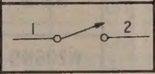

1.654
1.378
0.335
0.531
2-M3
0.906
0.126
0.295
0.728
1.043
#187 Attachment terminals
0.906

Type Name	Rating	Circuit Diagram	No. of Terminals
SW106A-14	AC125V 6A	ON—OFF 	2

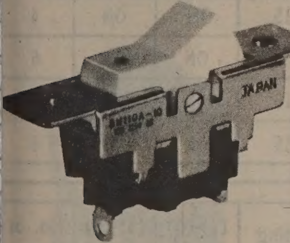
This has a black or gray knob and a white mark.

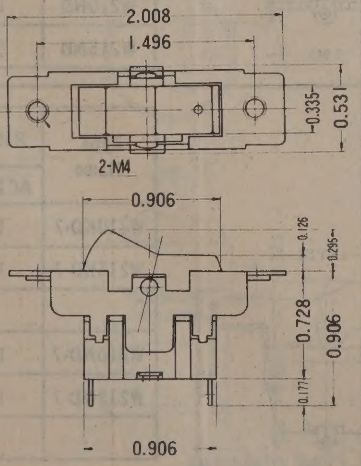


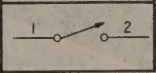

1.732
1.496
0.354
0.551
2-M3
1.004
0.354
0.551
0.63
0.906

Type Name	Rating	Circuit Diagram	No. of Terminals
SW110A-10	AC125V10A	ON—OFF 	2

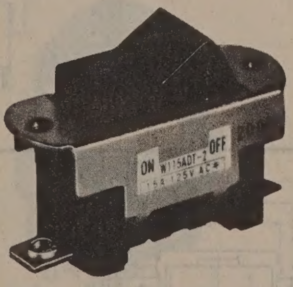
This has a white knob and a red mark.

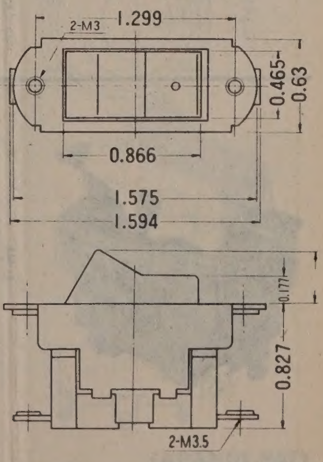



2.008
1.496
0.335
0.531
2-M4
0.906
0.126
0.295
0.728
0.906
0.177
0.906

Type Name	Rating	Circuit Diagram	No. of Terminals
W115ADT-2	AC125V15A	ON—OFF 	2

- This has a black knob and a red mark.
- The construction is dustproof, and M3.5 flat head screw terminals are used.




2-M3
1.299
0.465
0.63
0.866
1.575
1.594
0.177
0.827
2-M3.5

SATORI SWITCH
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23717 Hawthorne Blvd., Suite 201
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Tel. (213) 378-9478
Telex. 182536 SATORITRNC
FAX. (213) 375-8565

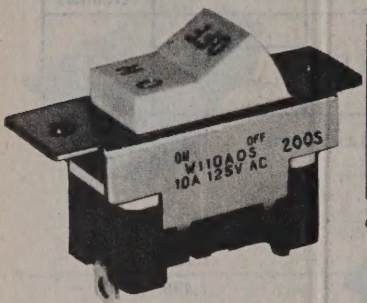
For More Information. Circle No. 480

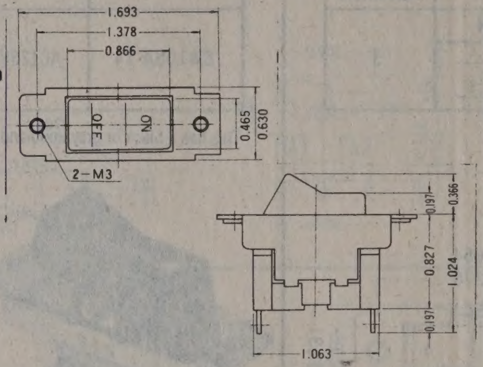
ROCKER SWITCH

DUSTPROOF JAPAN (P.A.T.)

- UL and CSA approved (6 and 10 amp series)
- The standard for knob color is white or black and for a knob mark red or white.

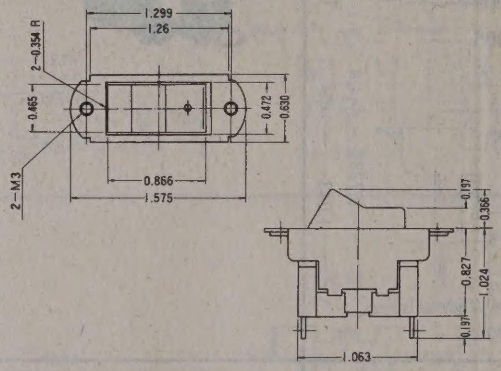
Because of our company's own dustproof construction, long life is guaranteed against entering of dust under normal use, in addition to the dusty condition, and the switch is of use in wide fields.


ON
OFF
W110ADS
200S
10A 125V AC

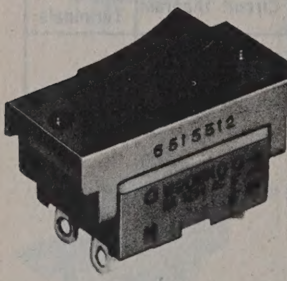

1.693
1.378
0.866
OFF
ON
0.465
0.630
2-M3
0.197
0.366
0.827
1.024
0.197
1.063

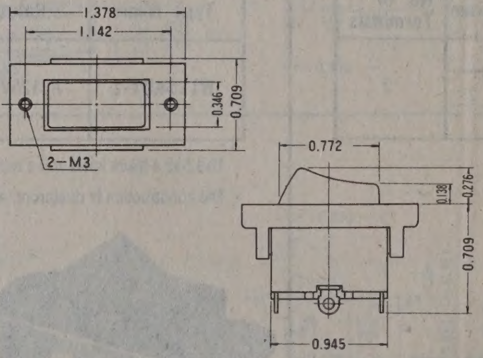
Type Name	Rating			No. of Terminals
	AC125V			
W106ADS	6	ON	OFF	2
W110ADS	10	ON	OFF	2
W115ADS	15	ON	OFF	2
W106DDS	6	ON	OFF	3
W110DDS	10	ON	OFF	3
W115DDS	15	ON	OFF	3

ON
OFF
W110AD
20X
10A 125V AC

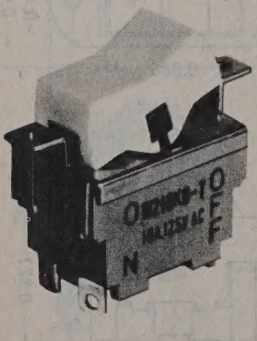

1.299
1.26
2-0.354 R
0.465
0.472
0.630
0.866
1.575
2-M3
0.197
0.366
0.827
1.024
0.197
1.063

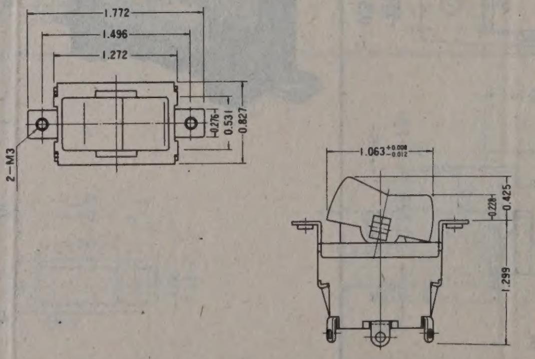
Type Name	Rating			No. of Terminals
	AC125V			
W106AD	6	ON	OFF	2
W110AD	10	ON	OFF	2
W115AD	15	ON	OFF	2
W106DD	6	ON	ON	3
W110DD	10	ON	ON	3
W115DD	15	ON	ON	3




1.378
1.142
0.346
0.709
2-M3
0.772
0.138
0.276
0.709
0.945

Type Name	Rating	(1)-(4)	(3)-(6)	No. of Terminals
	AC125V			
W206KD	6	OFF	ON	4
W210KD	10	OFF	ON	4
W215KD	15	OFF	ON	4
W206ND	6	ON	ON	6
W210ND	10	ON	ON	6
W215ND	15	ON	ON	6


O
N
O
F
F
10A 125V AC


1.772
1.496
1.272
0.276
0.531
0.827
2-M3
1.063
0.228
0.425
1.299

Type Name	Rating	(1)-(4)	(3)-(6)	No. of Terminals
	AC125V			
W210KD-7	10	OFF	ON	4
W215KD-7	15	OFF	ON	4
W210ND-7	10	ON	ON	6
W215ND-7	15	ON	ON	6

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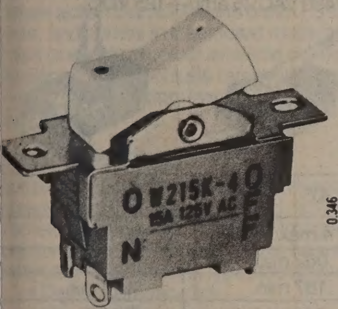
Telex. 182536 SATORITRNC
FAX. (213) 375-8565

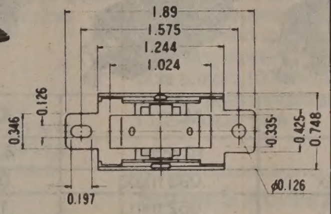
For More Information. Circle No. 480

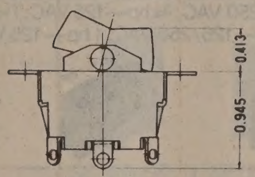
ROCKER SWITCH

- The standard color for a knob is either black or white

Type Name	Rating AC125V				No. of Termi-nals
W210K-4	10	OFF	—	ON	4
W215K-4	15	OFF	—	ON	4
W210N-4	10	ON	—	ON	6
W215N-4	15	ON	—	ON	6
W210P-4	10	ON	OFF	ON	6
W215P-4	15	ON	OFF	ON	6

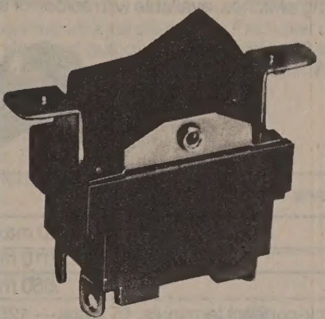

O W215K-4
15A 125V AC
OFF
N

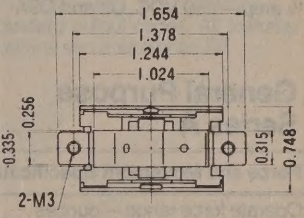

1.89
1.575
1.244
1.024
0.126
0.346
0.335
0.425
0.748
0.197
ϕ0.126

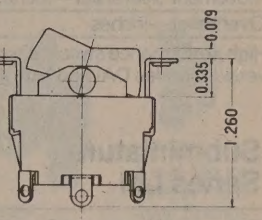


- UL and CSA approved.

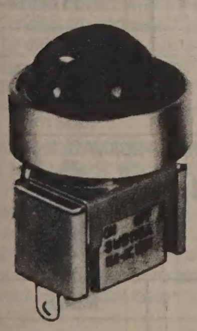
Type Name	Rating AC125V				No. of Termi-nals
W210K-5	10	OFF	—	ON	4
W215K-5	15	OFF	—	ON	4
W210N-5	10	ON	—	ON	6
W215N-5	15	ON	—	ON	6
W210P-5	10	ON	OFF	ON	6
W215P-5	15	ON	OFF	ON	6

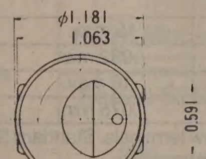


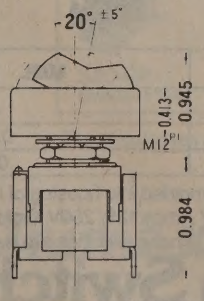

1.654
1.378
1.244
1.024
0.256
0.335
0.315
0.748
2-M3


0.079
0.335
1.260

Type Name	Rating AC125V			No. of Termi-nals
SWB110A	10	OFF	ON	2
SWB115A	15	OFF	ON	2
SWB110D	10	ON	ON	3
SWB115D	15	ON	ON	3

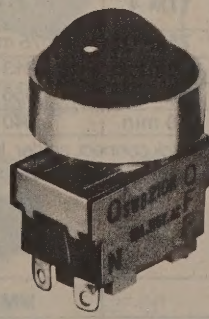


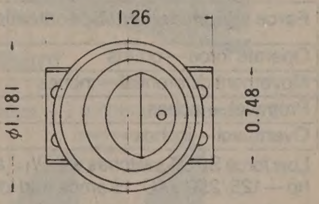

ϕ1.181
1.063
0.591

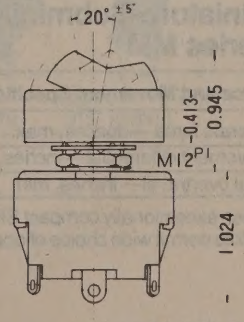

-20°±5°
0.413
0.945
M12P1
0.984

JAPAN(D.PAT)

Type Name	Rating AC125V			No. of Termi-nals
SWB210K	10	OFF	ON	4
SWB215K	15	OFF	ON	4
SWB210N	10	ON	ON	6
SWB215N	15	ON	ON	6


SWB215K
O
F
N


1.26
ϕ1.181
0.748


20°±5°
0.413
0.945
M12P1
1.024

JAPAN(D.PAT)

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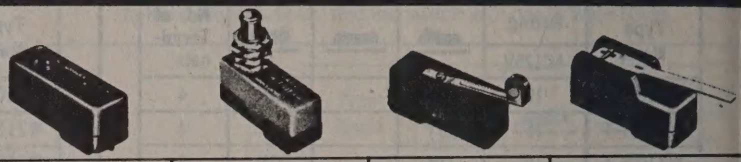
For More Information. Circle No. 480

Unimax Snap-Acting Switches

Unimax offers the industry's widest selection of precision, general purpose, miniature, subminiature and miniature subminiature snap-action switches, as well as toggle and pushbutton switch assemblies and metal-cased limit switches. And, we'll develop and produce a special switch to meet your specific requirements—in form, function or fit. Shown below are a few of the many available types.

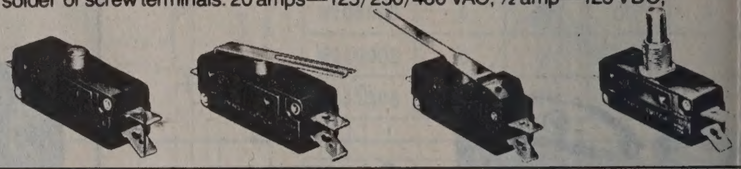
Basic Precision Series 2HB



Force and Movement Specifications	2HB-1	2HBJ-1	2HBW-1	2HBT-1
Operate force range—ounces	9 to 13	9 to 13	5 max.	1 to 2.5
Movement differential—inches	.0004-.002	.0004-.002	.050 max.	.078 max.
Overtravel—inches	.005 min.	.219 min.	.062 min.	.188 min.

SPDT basic high precision snap-acting switches, available with solder or screw terminals. 20 amps—125/250/480 VAC; ½ amp—125 VDC; ¼ amp—250 VDC. UL and CSA.

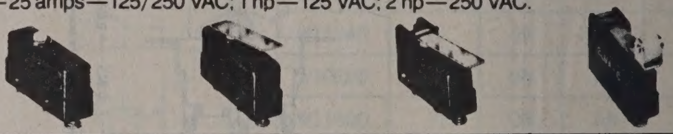
General Purpose Series A



Force and Movement Specifications	A	AL	AT	AJ
Operate force range—ounces	20 max.	12 max.	4 max.	20 max.
Movement differential—inches	.010 max.	.093 max.	.062 max.	.010 max.
Overtravel—inches	.050 min.	.062 min.	.187 min.	.187 min.

High performance switches with quick-connect terminals. 15 amps— 125/250 VAC; ¾ hp—125 VAC; 1½ hp—250 VAC. Available in DPDT version (Series DA) and high current (Series A800 and DA800) —25 amps—125/250 VAC; 1 hp—125 VAC; 2 hp—250 VAC.

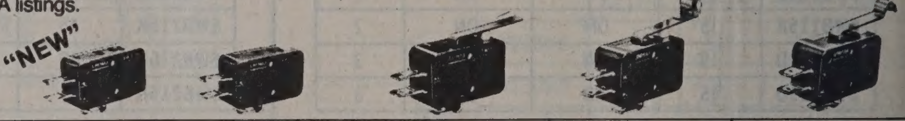
Subminiature Series LM



Force and Movement Specifications	2LM-C	2LML-C	2LMT-C	2LMA-C
Operate force—maximum	5 oz.	6 oz.	40 grams	40 grams
Movement Differential —inches	.004 max.	.031 max.	.019 max.	.019 max.
Overtravel—inches	.005 min.	.047 min.	.011 min.	.011 min.

Suitable for most applications, where small size is required. Available in 4 terminal styles. Rated at 5 amps—125/250 Vac; 10 amp ratings also available. UL and CSA listings.

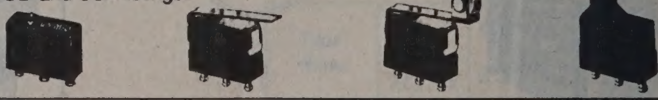
Miniature Series TM



Force and Movement Specifications	1TM-4	2TM-4	2TMT15-4	2TMA15-4	2TMT14-4
Operate force—grams	75 max.	75 max.	45 max.	45 max.	50 max.
Movement differential—inches	.013 max.	.013 max.	.032 max.	.030 max.	.050 max.
Pretravel—inches	.056 max.	.056 max.	.16 max.	.16 max.	.140 max.
Overtravel—inches	.040 min.	.040 min.	.075 min.	.065 min.	.062 min.

Low force SPDT switches with $^3/_{16}$" and ¼" wide quick connect, solder lug or screw terminals. Standard Series 2TM: 10 amps—250 VAC; $^1/_3$ hp—125/250 VAC; 15 amps and low level ratings also available. UL and CSA listings.

Miniature-Subminiature Series MM



Force and Movement Specifications	MM	MML	MMW	MMD
Operate force—ounces, max.	5	4		5
Movement differential—inches, max.	0.002	0.25		.004
Total overtravel—inches, min.	0.004	.045		.040

These exceptionally compact SPDT switches are furnished with turret terminals molded into housing of high-strength phenolic. Integral actuators permit wide choice of operating means and simplify installation. Rated at 7 Amps 125/250V. Gold contact low level versions also available.

These switches are available from your local Unimax distributor.
Ask for Catalog 60

Unimax Switch ®

UNIMAX SWITCH CORPORATION
A Subsidiary of The Unimax Corporation, Wallingford, CT 06492 • (203) 269-8701
or your local distributor.

Unimax Digital Thumbwheel Switches

Standard Thumbwheels

Series SF/SR

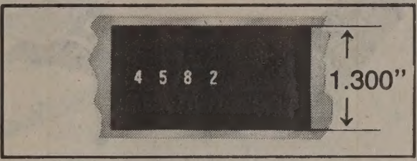
The SNAP 'N MOUNT "No Hardware" Digital Thumbwheel Switch System
No assembly hardware required—snap-together assembly of all elements, including blank bodies, half bodies, dividers and end plates. Only 5 parts per switch! Each positive detent action thumbwheel is 8 mm (.315") wide, and comes in a standard matte black finish (a variety of colors available on request). Available options include removable stop pins —customer or factory installed—and window dust covers.

Smart Switches

Series S standard "no hardware" thumbwheels combined with integrated circuits and discrete components, to provide integral logic functions which previously had to be added externally to the switch. Types include:

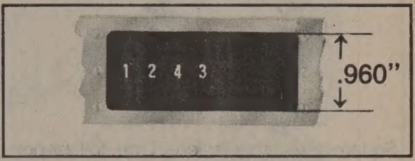
- Digital Comparators
- Counter/Timer Decades
- Resistance Decades
- Seven Segment Drivers
- Kelvin-Varley Voltage Dividers

Ask for Catalog 80



Front Mounting Series SF

Each pair of end caps has two integral snap-springs for locking. 30 standard output codes to satisfy most applications, plus special codes on request. All PCB's ($^1/_{32}$" thick) are available with extended length (Option A) for mounting diodes or other components. Outputs are on .100 centers. Standard wiring terminations include solder wire wrap and PCB header pins.



Rear Mounting Series SR

Each pair of end caps has .125" mounting holes. 30 standard output codes. All features and specifications same as Series SF.

Series S Accessories

SF/SR-DP
Divider Plate

SF/SR-BB
Blank Body

SF/SR-HB
Half Body

SF-EP
End Caps (pair)

SR-EP
End Caps (pair)

SF-DPD
Front-Mount
Divider Plate
With Springs
(for long banks)

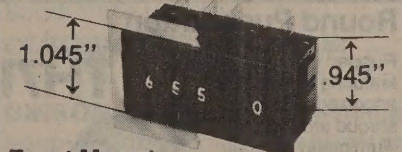
Sub-Miniature Thumbwheels

Series S2D

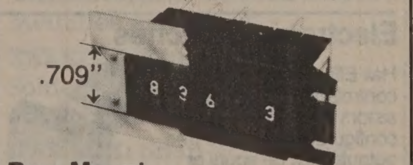
Space-saving miniature Snap 'N Mount "no hardware" digital thumbwheels with front or rear mounting versatility. Standard 8mm (.315") width, .945" height. Nine most widely used output codes available as standard, other codes on request. Options include stop pins, right angle terminations, PC boards with solder-type pins, and extended boards with provision for components or with components already mounted.

Standard color combination is matte black body, black wheel with white markings. Special combinations may be selected from black, white, grey, red, blue or yellow bodies and wheel markings are available in a variety of colors. A 1000 piece minimum order is required for special color combinations.

Ask for Catalog 82



Front Mount



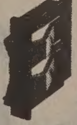
Rear Mount

Series S2D Accessories

End Plates—2 required per assembly

S2D-DP
Divider Plate

S2D-BB
Blank Body


S2F-EP
Front Mount

Rear Mount
choice of:

S2S-EP
.157" (4 mm)

S2R-EP
.315" (8 mm)

These switches are available from your local Unimax distributor.

Unimax Switch®

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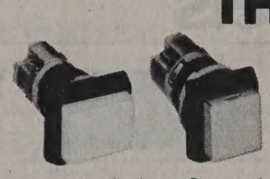
For More Information. Circle No. 481

Unimax
Lighted Pushbutton Controls
Status Symbols®

Tapered Bezel

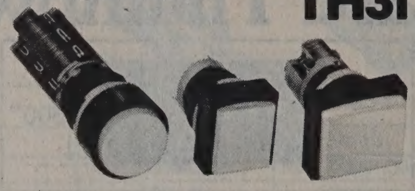
SERIES **TH01**



Square or rectangular lens. One- to four-pole versions in either momentary or alternate action with 5A, 250V ratings. Matching indicator models available.

Straight Bezel

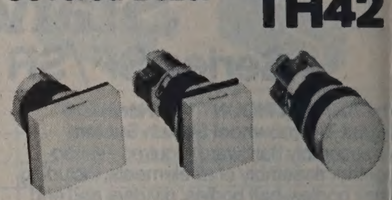
SERIES **TH31**



Larger lens cap, narrower bezel. One-to four-pole versions in either momentary or alternate action.

Covered Bezel

SERIES **TH42**



Extra-large lens extends over bezel, covering the full panel surface. Available in rectangula square and round versions.

Key Operated

SERIES **TH65,66**

TH65: Two-position, one-to four-pole maintained or monetary action.
TH66: Two-position, one-to four-pole maintained action, with key removable in the on or off positions.

Interlock

The widest possible choice of interrelated switching combinations, custom-designed to meet your needs. Switch elements are identical to all others on this page.

Oil Tight

SERIES **TH52, 82,63,64,72**

A wide range of styles and capabilities for a broad variety of applications. All are sealed against oil and water, and conform with NEMA #4, 13 requirements and IEC 144/IP 65, DIN 40050/P54.

Mushroom Cap

SERIES **TH51**

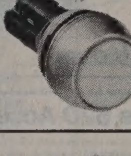
Rugged, industrial-grade complete functional units, with non-illuminated pushbutton actuator cap, in your choice of colors.

Electronic Switches

Hall Effect integrated circuit controls *two* output transistors in an open collector configuration. Bounce-free outputs may be equal or complementary, and are suitable for direct control of all logic circuits.

Round Pushbutton

SERIES **TH71**



Rugged industrial design featuring a protective anodized aluminum shroud around an illuminated lens cap, in a choice of colors.

Rotary

SERIES **TH81**

One- to four-pole switch, or indicator. Grey operator cap has a built-in colored illuminated lens insert. Full 360° travel, with detented switch operation every 90°.

Special Assemblies

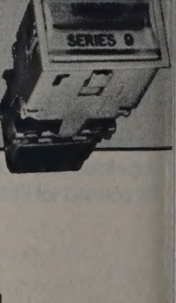
The variation of available custom interlock matrix switches is virtually unlimited. Contact your local Unimax representative for application assistance.

These switches are available from your local Unimax distributor.

Ask for Catalog 53.

Four Lamp Series 9

QPL APPROVE



Modular construction with broad choice of combinations: display, color code, switching, etc. 2, 3 or 4 SPDT with momentary or alternate push-on push-off action, or indicato only. Multi-unit interlocking available. Independent illumination of up to 4 lamps, in 4 separate quadrants of a single pushbutton.
Ask for Catalog 50

Unimax Switch®

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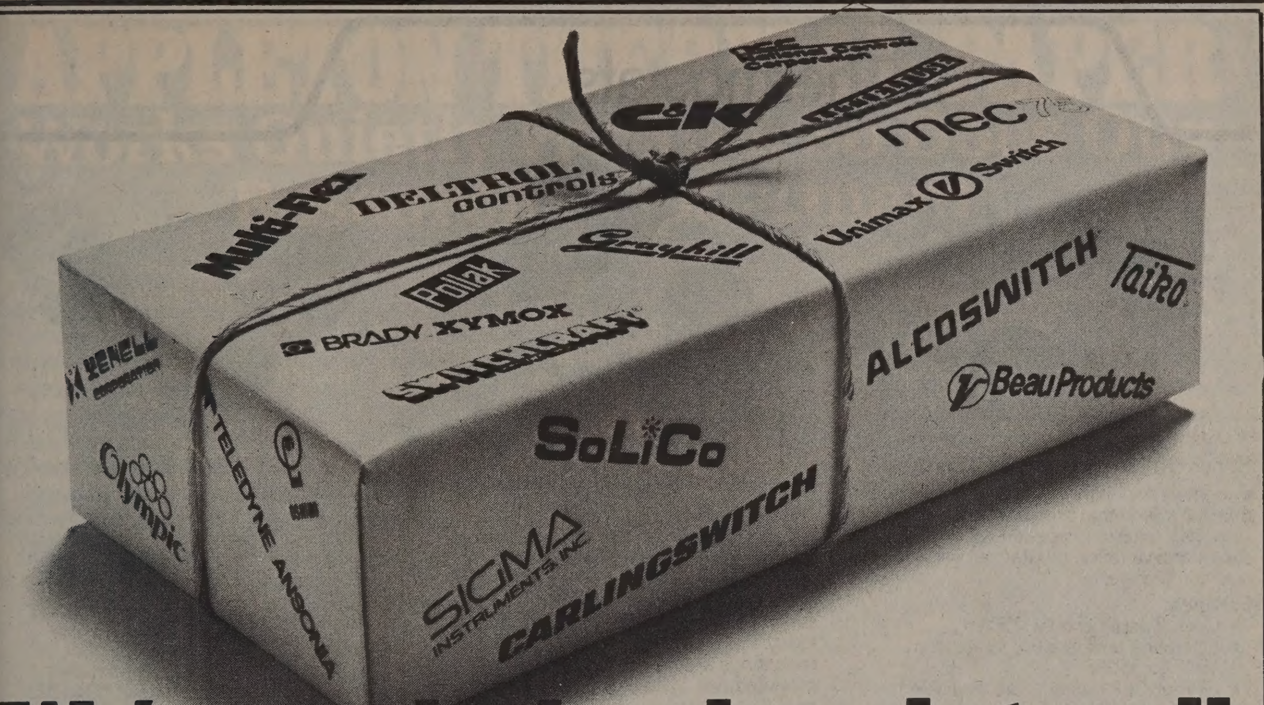
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C W INDUSTRIES: IDC connector systems.

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DELTROL: Relays, solenoids, timers.

GRAYHILL: Dip, pushbutton, keyboard, rotary switches.

LITTELFUSE; Fuses and fuseholders.

MARKEL: Heat shrink tubing, Hygrade sleeving high-temp wire, coaxial cable.

MULTIFLEX: Switch seals for toggle, pushbutton and rotary.

NATIONAL CONTROLS: Solid-state timers.

OLYMPIC WIRE & CABLE: Electronic wire and cable.

OMRON: Relays, thumbwheels, snap-action, lighted pushbutton switches.

OSHINO: Incandescent lamps.

OSLO: Lighted pushbutton and rocker switches.

POLLAK: Automotive and marine switch components.

SIGMA INSTRUMENTS: General purpose, reed, power, solid-state relays.

SOLICO: Indicator lights, LED's, lighted pushbutton switches.

SWITCHCRAFT: Switches, plugs, jacks, connectors.

TAIKO: Lighted pushbutton switches and relays.

TELEDYNE/ANSONIA: Solderless terminals and connectors.

UNIMAX: Snap-action, and lighted pushbuttons.

UNIMEC: Modular Switch and keycap switches.

XENELL: Neon indicator and control circuit lamps.

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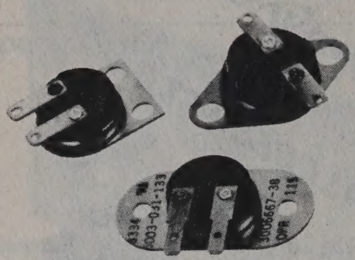
For More Information. Circle No. 482

Thermostats



Series 5003 — Low-Profile Thermostat

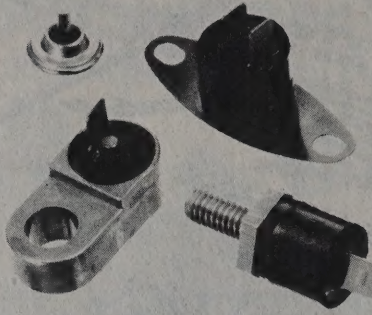
Extremely thin, lightweight, wafer-type thermal switch that provides fast, positive response, excellent repeat reliability, good shock and vibration resistance over a wide operating range.

Features:
- Overall depth is only .250".
- Operating temperature range from 15°F to 355°F.
- OPR or CLR contacts are available.
- 120Vac 5 amp, 240Vac 3 amp.
- Weight 2.3 grams.
- Variety of mountings and terminations available.
- Enviromental sealing available.
- Approval: ЯU ⓒ

Series 5200 — Isolated Contact Thermostat

This hermetically sealed thermostat is perfect for applications requiring isolated contacts. The laser-welded construction withstands vibration and shock, and is designed to meet MIL-Spec requirements. Its size and reliability make it highly suitable for products such as business machines, hot glue-melt systems and other industrial-environment products.

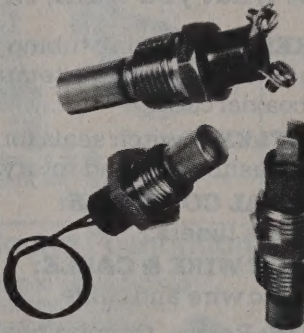
Features:
- Hermetically sealed.
- Designed to meet military standards.
- Operating temperature range from 15°F to 500°F.
- ЯU Certified for regulating.



Series 5011 — Low-Cost, Grounded Thermostat

A very low-cost thermostat that will meet a number of exacting requirements for shock and vibration resistance. It is hermetically sealed and offers fast response. The only surface-sensing grounded device offered today. Plug, wire-lead, and isolated-base mountings are available. 1/4-20 boss-mounted and 3/8-16 UNC-2A sizes.

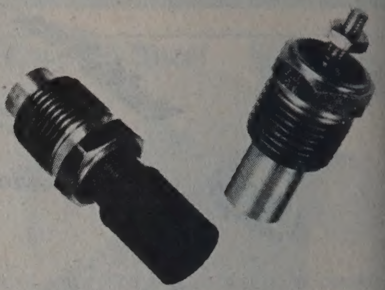
Features:
- Low-cost, grounded unit.
- Operating temperature range from 15°F to 550°F.
- Many mounting packages available: 120Vac, 32Vdc, 3 amp.
- Stud-mounted version available.



Series 5100 — Isolated Case Thermostat

This two-terminal, immersion-type hermetically sealed thermostat can be used on water-cooled engines, hydraulic systems, degreasers, industrial air compressors and tanks where liquids are heated. Its isolated contact is designed to switch 110Vac within your control circuitry. It offers rapid response to liquid or air temperature.

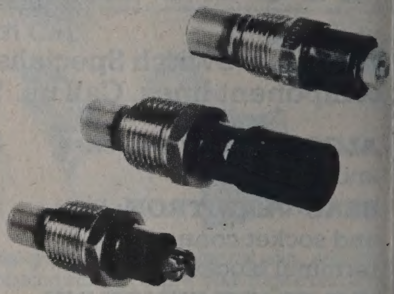
Features:
- Hermetically sealed.
- All stainless T.I.G. construction.
- Operating temperature range from 15°F to 550°F.
- 120Vac 3 amp and 240Vac 1.5 amp. models available.
- Approval: ЯU ⓒ



Series 5021 — Sealed Immersion-Type Thermostats

A single throw, snap-action, sealed temperature control. Snap action disc located in the very tip of the probe. Ideally suited to protect engines from overheating damage by accurately sensing high water and oil temperatures.

Features:
- Solid one piece body construction.
- Operating temperature 15°F to 325°F.
- High vibration resistance.
- Conforms to MIL-12285/2.



Series 5020 — Hermetically Sealed Thermostat

This snap-action hermetically sealed temperature control is designed for use wherever a sealed unit and high vibration resistance are required. Protects engines from damage from overheating by sensing high water or oil temperatures. Snap-action disc located in the very tip of the probe assures rapid and true response to liquid temperature. The all-welded construction (and grounded case) of this sealed thermostat insures meeting Thermal Shock Specifications of MIL-STD-202, Method 107, Test Condition B. The tube will withstand a Pressure Exposure Limit of 1500 PSI. Insulation Resistance of 50 megohms minimum at 500 Vdc.

Features:
- Hermetically sealed.
- Grounded case.
- Operating temperature range from 15°F to 525°F.
- 32Vdc, 3 amp.
- 5020 – 13 Conforms to MIL-12285/1.

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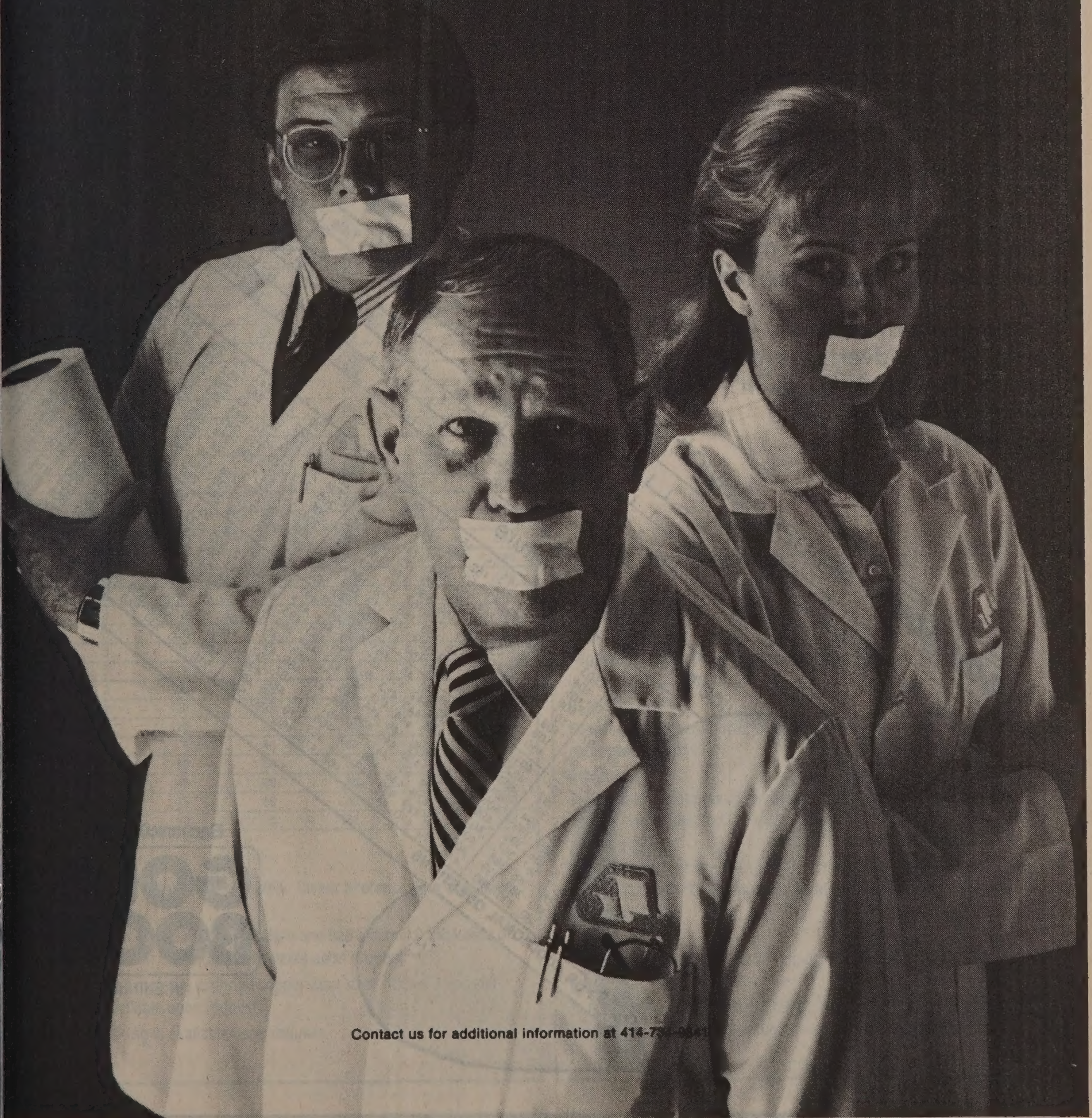

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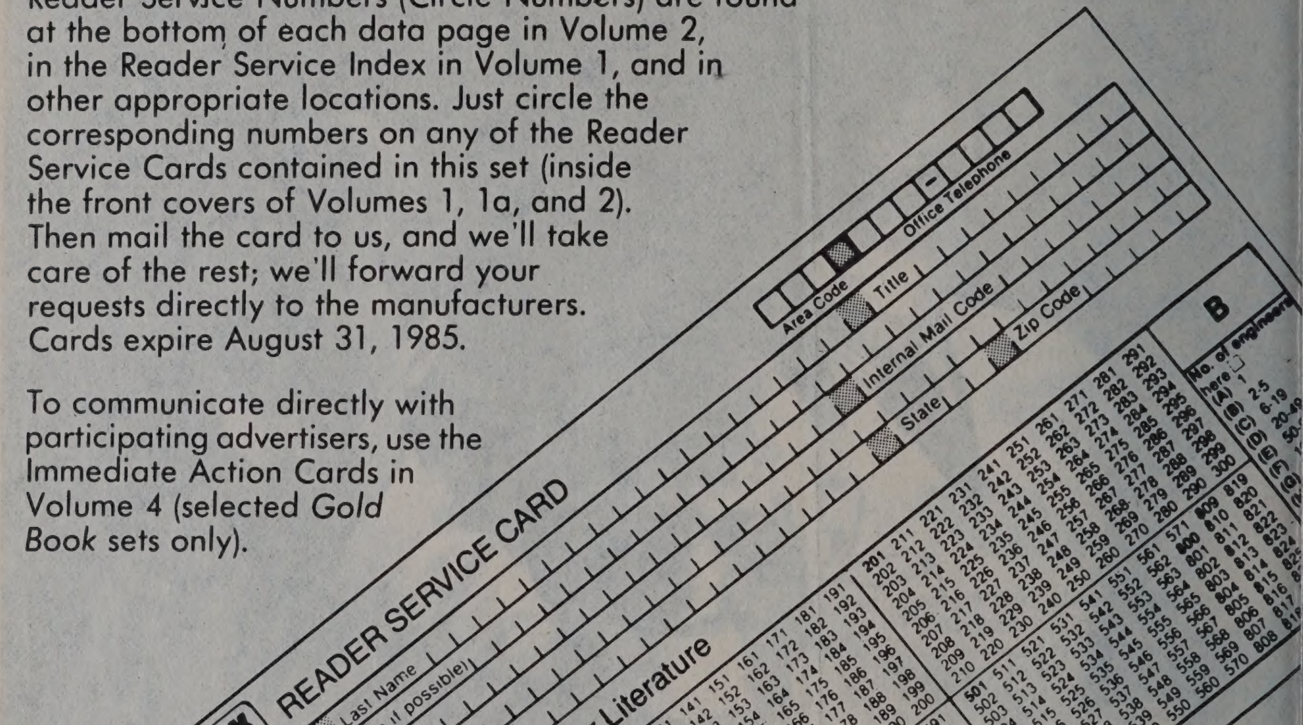
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CAL-R®, INC.

HERMISTOR DIVISION

"SOFT-START"

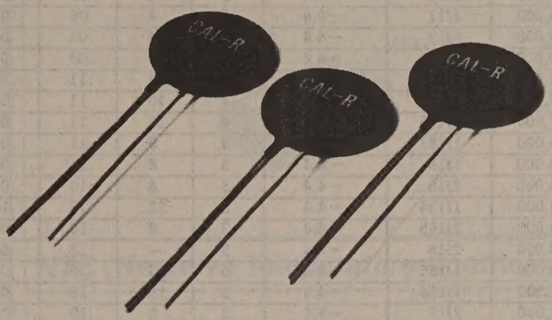
INRUSH CURRENT SUPPRESSING DEVICES

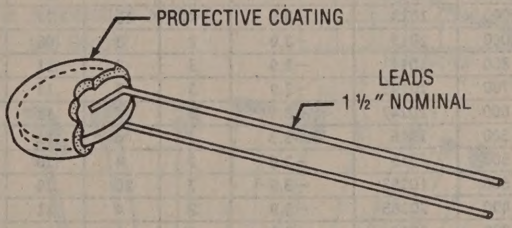
''Soft-Start'' devices display relatively high resistance to starting currents in a variety of electronic circuits. Having a negative temperature coefficient of resistance, these devices exhibit a large decrease in resistance when an AC or DC current is applied.

Unlike circuit breakers and fuses, ''Soft-Starts'' prevent dangerous, short-duration, peak inrush currents present at turn-on. Especially useful in power supplies where charging capacitors initially present extremely low impedance, ''Soft-Starts'' actually limit inrush currents thereby extending the life of other critical components.

Part Number	$I_{Max.}$ (Amperes)	$R_{o25°C}$ (Ohms)	$R@I_{Max.}$ (Ohms)	Maximum Diameter (Inches)	Maximum Thickness (Inches)	Lead Diameter (Inches)
25SS25	25	1	.01	1.10	.35	.040
20SS20	20	1	.015	.90	.30	.040
18SS36	18	2	.03	.90	.35	.040
15SS38	15	2.5	.03	.60	.30	.040
14SS56	14	4	.05	.90	.35	.040
12SS60	12	5	.06	.90	.50	.040
12SS30	12	2.5	.04	.90	.35	.040
10SS50	10	5	.06	.90	.35	.040
10SS25	10	2.5	.04	.90	.25	.040
9SS45	9	5	.06	.90	.25	.040
9SS23	9	2.5	.04	.60	.25	.032
8SS40	8	5	.05	.60	.25	.040
8SS32	8	4	.07	.60	.25	.040
7SS35	7	5	.07	.60	.25	.032
7SS18	7	2.5	.05	.60	.25	.032
6SS60	6	10	.15	.60	.35	.040
6SS42	6	7	.15	.60	.30	.040
6SS30	6	5	.07	.60	.25	.032
5SS50	5	10	.20	.60	.35	.040
5SS35	5	7	.15	.60	.30	.040
5SS20	5	4	.15	.60	.25	.032
4SS48	4	12	.22	.50	.35	.040
4SS28	4	7	.15	.60	.30	.040
4SS20	4	5	.15	.60	.25	.032
3SS30	3	10	.20	.50	.30	.032
3SS21	3	7	.14	.60	.25	.032
3SS15	3	5	.17	.60	.25	.032
3SS08	3	2.5	.15	.60	.25	.032
2SS80	2	40	.60	.70	.25	.032
2SS40	2	20	.28	.60	.25	.032
2SS20	2	10	.20	.60	.25	.032
2SS10	2	5	.40	.60	.25	.032
1.5SS90	1.5	60	1.00	.60	.25	.032
1.5SS60	1.5	40	.80	.60	.25	.032
1.5SS38	1.5	25	.60	.50	.30	.032
1.5SS15	1.5	10	.25	.50	.25	.032

- Standard R_o25°C tolerance is ±20%. Closer tolerances are available upon request.
- Protective silicone coating is standard and has a nominal thickness of .02 inches. Other coatings are available upon request.
- Standard lead material is tinned copper-clad steel. Nickel or copper leads are available upon request.
- Special marking is available upon request.





DEFINITIONS

I_{max}

Represents the maximum rated steady state DC or RMS current and is expressed in amperes.

R_o25°C

Represents the zero power resistance of the device at +25°C and is expressed in ohms.

$R@I_{max}$

Represents the approximate resistance at maximum steady state current conditions and is expressed in ohms.

Ambient Temp.

Full rated current may be applied in the ambient temperature range of +25°C to +65°C and must be derated in accordance with I_{max} derating curve.

I_{op}

Represents the actual operating current applied.

Cool-Down Time

Is the amount of time needed for a ''Soft-Start'' device to cool enough to cause the necessary amount of resistance to limit inrush current.

CAL-R® INC. THERMONETICS DIVISION

THERMISTORS — Negative Temperature Coefficient

THERMISTOR SPECIFICATIONS

R@ 25°C Ω ±10%	Part Number	NTC %/°C @ 25°C	Nominal D.C.*	Nominal T.C.**	Max. Dimensions A	Max. Dimensions B	Leads AWG#	Type
100,000	2J05	−4.4	3	10	.06	.26	30	Bar
75,000	2J06	−4.4	3	8	.06	.20	30	Bar
50,000	2J07	−4.4	3	7	.06	.15	30	Bar
30,000	2J08	−4.4	2	6	.06	.08	30	Bar
25,000	2J09	−4.4	2	5	.06	.07	30	Bar
20,000	2J10	−4.4	2	5	.06	.06	30	Chip
15,000	2J11	−4.4	2	4	.06	.05	30	Chip
10,000	2J12	−4.4	2	4	.06	.04	30	Chip
10,000	1J112	−4.4	2	4	.08	.05	30	Disc
10,000	1J13	−4.4	4	12	.11	.10	28	Disc
8,000	1J14	−4.4	4	10	.11	.08	28	Disc
7,000	1J145	−4.4	4	10	.11	.07	28	Disc
6,000	1J147	−4.4	3	9	.11	.06	28	Disc
5,000	1J15	−4.4	3	8	.11	.05	28	Disc
5,000	2J15	−4.4	3	8	.10	.04	28	Chip
4,000	1J154	−4.4	5	23	.16	.10	28	Disc
4,000	2J165	−4.4	3	8	.10	.04	28	Chip
3,000	2J16	−4.4	3	—	.12	.04	28	Chip
3,000	1J155	−4.4	6	20	.16	.08	28	Disc
2,500	1J158	−4.4	5	19	.16	.07	28	Disc
2,000	2J17	−4.4	3	5	.10	.03	28	Chip
2,000	1J20	−4.4	7	25	.22	.09	24	Disc
2,000	1D10	−3.9	2	3	.06	.04	30	Disc
2,000	2D10	−3.9	2	4	.06	.04	30	Chip
1,500	1D111	−3.9	2	3	.08	.06	30	Disc
1,000	2J21	−4.4	6	15	.18	.04	24	Chip
1,000	1J24	−4.4	9	48	.32	.09	24	Disc
1,000	1D112	−3.9	2	4	.08	.04	30	Disc
1,000	1D13	−3.9	4	10	.11	.08	28	Disc
1,000	2D13	−3.9	2	3	.08	.04	28	Chip
800	1D14	−3.9	3	8	.11	.06	28	Disc
700	1D145	−3.9	3	7	.11	.05	28	Disc
600	1D147	−3.9	3	7	.11	.04	28	Disc
500	1D15	−3.9	3	6	.11	.04	28	Disc
500	2D15	−3.9	2	4	.10	.04	28	Chip
500	1D153	−3.9	7	20	.16	.08	28	Disc
400	2D165	−3.9	2	4	.11	.04	28	Chip
300	2D16	−3.9	3	5	.10	.03	28	Chip
300	1D19	−3.9	7	25	.22	.09	24	Disc
200	2D20	−3.9	6	—	.15	.04	—	Chip
100	2D21	−3.9	6	—	.18	.04	24	Chip
100	2B13	−3.3	2	4	.07	.04	28	Chip
80	2B14	−3.3	2	4	.08	.04	28	Chip
80	2D211	−3.9	5	—	.20	.04	24	Chip
50	2D24	−3.9	6	—	.32	.04	24	Chip
50	2B15	−3.3	2	4	.10	.04	28	Chip
30	2D31	−3.9	7	—	.35	.04	24	Chip
30	2B16	−3.3	2	4	.10	.03	28	Chip
25	2D33	−3.9	7	—	.36	.04	24	Chip
20	2D34	−3.9	7	—	.36	.04	24	Chip
20	2B17	−3.3	3	4	.16	.04	28	Chip
10	2B21	−3.3	5	—	.18	.04	28	Chip
5	2B24	−3.3	6	—	.30	.04	24	Chip

"INTERCHANGEABLE (±0.2°C 0° To 80°C) THERMISTORS"***

EPOXY COATED

2,000	5J102	—4.4	3	10	.125	.125	30	Spherical
3,000	5J103	—4.4	3	10	.125	.125	30	Spherical
5,000	5J105	—4.4	2	8	.100	.100	30	Spherical
10,000	5J110	—4.4	2	8	.100	.100	30	Spherical
20,000	5J120	—4.4	2	8	.100	.100	30	Spherical

*****INTERCHANGEABLE THERMISTORS**

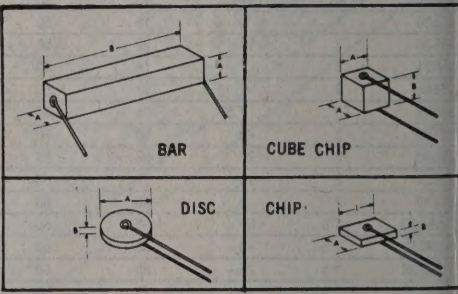
Thermistors designed for interchangability over narrower temperature ranges are available to your specification at lower cost.

R/T CONVERSION TABLE

TEMPERATURE °C	TEMPERATURE °F	CURVE B R_t/R_{25}	CURVE D R_t/R_{25}	CURVE J R_t/R_{25}
—60	—76	43.0	73.04	140.5
—50	—58	24.3	38.95	67.0
—40	—40	14.4	21.51	33.7
—30	—22	8.93	12.33	17.7
—21.5	—6.7	6.09	—	10.6
—20	— 4	5.69	7.307	9.71
—10	+14	3.68	4.476	5.53
0	32	2.45	2.825	3.27
10	50	1.68	1.830	1.99
20	68	1.18	1.216	1.25
25	77	1.00	1.000	1.00
30	86	.854	.8267	.806
37.8	100	.671	—	.583
40	104	.628	.5742	.533
50	122	.464	.4067	.360
60	140	.350	.2937	.249
70	158	.267	.2160	.175
75	167	.236	—	.148
80	176	.208	.1615	.126
90	194	.163	.1229	.0916
100	212	.130	.0946	.0679
104.4	220	.118	—	.0598
110	230	.105	.0739	.0511
120	248	.0852	.0584	.0389
125	257	.0771	—	.0342
130	266	.0700	.0470	.0301
140	284	.0579	.0382	.0235
150	302	.0483	.0313	.0185

The alphabetical letter in the part number indicates the curve. To determi the approximate resistance of a thermistor at a specified temperatur multiply the thermistor resistance at 25°C by the ratio factor opposite th temperature on the R/T conversion table.

CURVE B	Ratio $\frac{R@\ 25°C}{R@\ 125°C} = 12.95 \pm 10\%$
CURVE D	Ratio $\frac{R@\ 25°C}{R@\ 125°C} = 19.8 \pm 10\%$
CURVE J	Ratio $\frac{R@\ 25°C}{R@\ 125°C} = 29.85 \pm 10\%$



***DISSIPATION CONSTANT**

Dissipation Constant, expressed in mw/°C, represents the amount of po required to raise the temperature of a thermistor 1°C.

****TIME CONSTANT**

Time Constant, expressed in seconds, is the time required for a thermis dissipating zero power to change 63% of the difference between its in temperature value and that of a new temperature environment.

CAL-R thermistors conform to AOL and confidence levels specified in MIL-T-23648, tables V and VI.

Coatings, marking, special leads, probes, resistor/thermistor networks, resistance values from 1 ohm to 150 KΩ, and other product variations are produced to meet your design requirements. Resistance tolerances of ± 1% through ± 20% are available and may be specified at 25°C or any temperature within the operating range. Maximum operating temperature with leads 150°C.

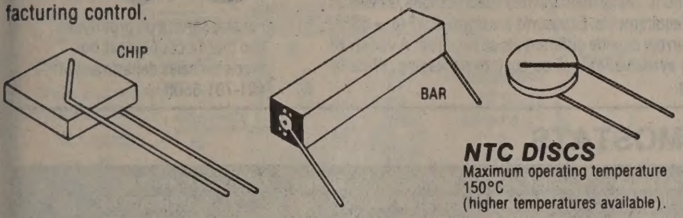
CAL-R® INC.
THERMISTORS • RESISTORS • MICROELECTRONICS
1601 OLYMPIC BOULEVARD, SANTA MONICA, CALIFORNIA 90404 (213) 450-1761 • TWX 910-343-6966

For More Information. Circle No. 485

CAL-R® INC. THERMISTORS

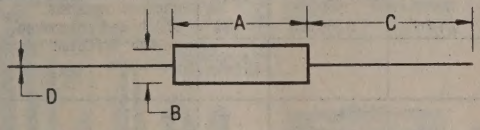
LEADED CHIP, BAR & CUBE

Cal-R Leaded chip and bar thermistors are produced from metal oxide ceramic materials utilizing a unique process which affords the highest degree of manufacturing control.



NTC DISCS
Maximum operating temperature 150°C
(higher temperatures available).

LINEAR PTC DEVICES



Temperature Coefficient: +.45%/°C & ±.02%/°C (+0.6%°C available).

EPOXY COATED — RESISTANCE TOLERANCE ±1, 3, 5 & 10%

R@8°C	Type	D.C.	Max. Watts	"A" (In.)	"B" (In.)	"C" (In.)	"D" (In.)
5K	MB20	4.0	.06	.200	.100	1.5	.016
10K	MB30	5.3	.08	.250	.125	1.5	.020
40K	MB40	6.6	.10	.375	.125	1.5	.020
60K	AB2525	13.0	.20	.250	.250	2.0	.032
100K	AB2537	16.0	.25	.375	.250	2.0	.032
200K	AB2550	17.0	.25	.500	.250	2.0	.032
300K	AB2575	23.0	.35	.750	.250	2.0	.032
350K	AB25100	26.0	.40	1.000	.250	2.0	.032

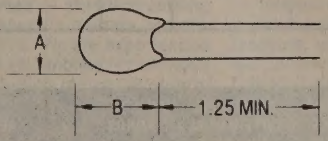
SILICONE COATED — RESISTANCE TOLERANCE ±1, 3, 5 & 10%

R@8°C	Type	D.C.	Max. Watts	"A" (In.)	"B" (In.)	"C" (In.)	"D" (In.)
300	PTB05	7.7	.5	.312	.094	1.5	.020
500	PTB10	6.6	1.0	.344	.094	1.5	.020
700	PTB15	5.7	1.5	.406	.094	1.5	.020
1.2K	PTB17	7.5	1.7	.531	.094	1.5	.020
2.5K	PTB20	9.0	2.0	.500	.156	1.5	.032
3K	PTB30	13.3	3.0	.500	.188	2.0	.032
4K	PTB31	13.0	3.1	.562	.188	2.0	.032
4K	PTB32	14.3	3.2	.812	.188	2.0	.032
5K	PTB35	16.6	3.5	.625	.250	2.0	.040
7K	PTB50	20.0	5.0	.875	.312	2.0	.040
8K	PTB55	21.0	5.5	1.000	.312	2.0	.040
10K	PTB70	23.0	7.0	1.219	.312	2.0	.040
16K	PTB95	28.3	9.5	1.375	.415	2.0	.040
20K	PTB100	30.0	10.0	1.781	.375	2.0	.040
25K	PTB125	40.0	12.5	1.969	.415	2.0	.040

INTERCHANGEABLE THERMISTORS (+0.2°C, 0°C to 80°C)

Thermistors designed for interchangeability over a temperature range of 0°C to 80°C without the necessity of recalibrating the system.

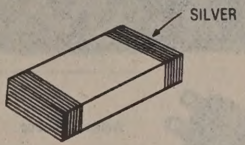
EPOXY COATED



Ohms @25°C	Part Number	NTC %/°C@25°C	Nominal D.C.	Nominal T.C.	Max. Dimensions "A"	Max. Dimensions "B"	Leads AWG*	Type
2,000	5J102	−4.4	3	10	.125	.125	30	Spherical
3,000	5J103	−4.4	3	10	.125	.125	30	Spherical
5,000	5J105	−4.4	2	8	.100	.100	30	Spherical
10,000	5J110	−4.4	2	8	.100	.100	30	Spherical
20,000	5J120	−4.4	2	8	.100	.100	30	Spherical

HYBRID CHIP

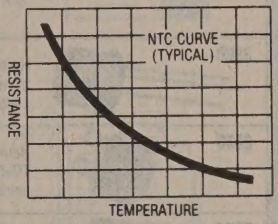
Cal-R Hybrid Chip Thermistors are produced by the same exacting manufacturing process as the Leaded Chip Thermistor and demonstrate the same electrical characteristics. Only the configuration is changed in order that they may be mounted in hybrid circuits utilizing the same equipment and techniques employeed in the installation of other hybrid components. Cal-R hybrid chip thermistors are available with either silver or palladium silver terminations to meet your process requirements.

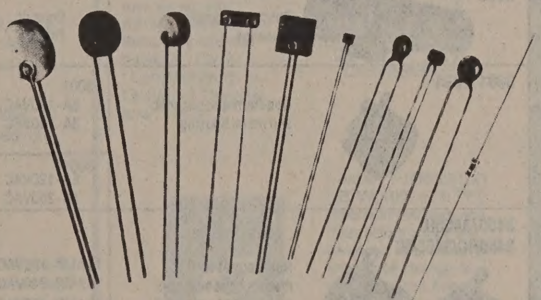


NTC (Negative Temperature Coefficient)

Thermistors offer inexpensive solutions to:

- Temperature Compensation
- Time Delay
- Soft Start
- Gas and Liquid Level Sensing
- Temperature Sensing and Control

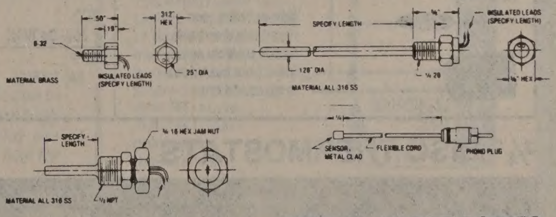




TEMPERATURE SENSING PROBES

NTC, PTC & NETWORKS (TEMPERATURE RANGE −60 TO +400°C)

Resistance (@25°C) range 50 ohm to 1 megohm — tolerance 10% to 0.5% or better.



TYPICAL PROBE BODIES

CAL-R probes are designed for air, surface, and liquid temperature measurement and control applications. Special industrial probes can be produced to customer specifications.

CAL-R engineers will design Temperature Sensing Probes for your special application. Outline your problem or specifications and send them to: CAL-R Applications Engineering Department.

Elmwood Sensors Inc.

Subsidiary of Fasco®

Dial Prototype

For fast service on prototypes and thermocouples call our precision sales department at 401-781-6500

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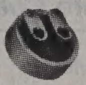
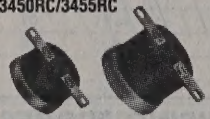
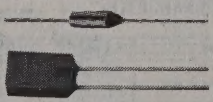
North Shields, Tyne & Wear NE29 8SA England
Phone: (063) 25-82821. Telex: 53284

Elmwood thermostats are precision-engineered for quick, reliable response in high limit or control applications. Many meet military specifications, as well as U.L., C.S.A. and European requirements. Exposures are from −65°F to +55°F, ratings to 15 Amps, with narrow or wide differentials as required. A variety of brackets and terminals are available, as well as custom packaging. Write or phone for complete catalog.

SUB-MINIATURE SNAP-ACTION THERMOSTATS

DESCRIPTION		ELECTRICAL RESISTIVE RATING	SET POINT RANGE INCLUDING TOL	NARROWEST TOLERANCE ALLOWABLE	NARROWEST DIFFERENTIAL AVAILABLE	AGENCY LISTINGS	TYPICAL APPLICATIONS
3100/3106 	Welded hermetic	3100 7A-30VDC 3A-240VAC	−20° to 500°F −28.89° to	±3°F ±1.7°F	6°F Max 3.3°C Max	UL CSA	High-temp control for copy machines, computers, aircraft, electronic controls. 3106 for "Dry Circuit" applications.
		3106 .5A-50VDC .1A-120VAC	260°C				
3150/3156 	Similar to 3100 except low silhouette .301° max. design	3150 6A-120VAC 1.5A-240VAC	−20° to 350°F −28.89° to	±3°F ±1.7°F	6°F Max 3.3°C Max	UL	Copy machines, computers, aircraft, electronic controls. where space is critical. 3156 for "Dry Circuit" applications.
		3156 .5A-50VDC .1A-120VAC	177°C				
3800 	Hermetically sealed, all welded construction. Long life.	125VA-24VAC 360VA-600VAC	20°F to 480°F −5°C to 250°C	±9°F ±5°C	18°F 10°	UL CSA	Running overtemperature protection for AC & DC motors. Onwinding mount.
3600 	Hermetically sealed, TO-5 case, with contacts for logic level.	1Amp 28V AC/DC 5 MA 5VDC	35°C to 105°C	±5°F	5°F Stand.		PC board mounted protection for power supply boards, logic boards, etc.
3000 	Custom package housings	Consult Factory	0°F to 400°F −18°C to 204°C	±4°F ±2.2°C	10°F Max 5.6°C Max		Aircraft bleed air duct sensing, hydraulic oil temp control, liquid bath control, heater control.
3001/3004 	Non-hermetic phenolic and metal housing	3001 6A-120VAC 3A-240VAC	0° to 335°F 17.8° to	±40°C ±2.2°C	8°F Max 4.4°C Max	UL, CSA	Computer, copy machines, telecommunications equipment. 3004 meets European spacing requirements.
		3004 8A-120VAC 4A-250VAC	168.3°C			BSI VDE	
3450/3455R **3450RC/3455RC** 	Non-hermetic "C" models have high temperature base material	15 AMP-120VAC 10 AMP-240VAC 10 AMP-277VAC	32°F to 500°F −0°C to 260°C	±5°F ±3°C	20°F 11°	UL, CSA Int'l	Power supplies, communication, medical equipment, computers where high amp loads are present. 3455R/RC is used where increased spacing for international req's are needed.
3455RM/CM 	Non-hermetic manual reset. Will not recycle automatically at room temperature. CM model for high temp.	15 AMP-120VAC 10 AMP-240VAC	125° to 500°F 0° to 260°C	±8°F ±5°C	Man. reset auto reset below 40°F 4.44°C	UL, CSA Int'l national	Where manual reset is required. 3455RM/CM meet increased spacing for Int'l requirements.
TCO/MTP 	Non-eutectic, non-resettable thermal fuse which protects equipment from hazardous temp conditions	TCO 25A-240VAC	162° to 464°F 72° to 240°C	+0°C	N/A	UL, CSA	Electric heaters, table-top appliances, small motors and transformers. Special configuration avail.
		MTP 5A-120VAC	162° to 306°F 72° to 152°C	−3°C		Int'l	

¾" DISC THERMOSTATS

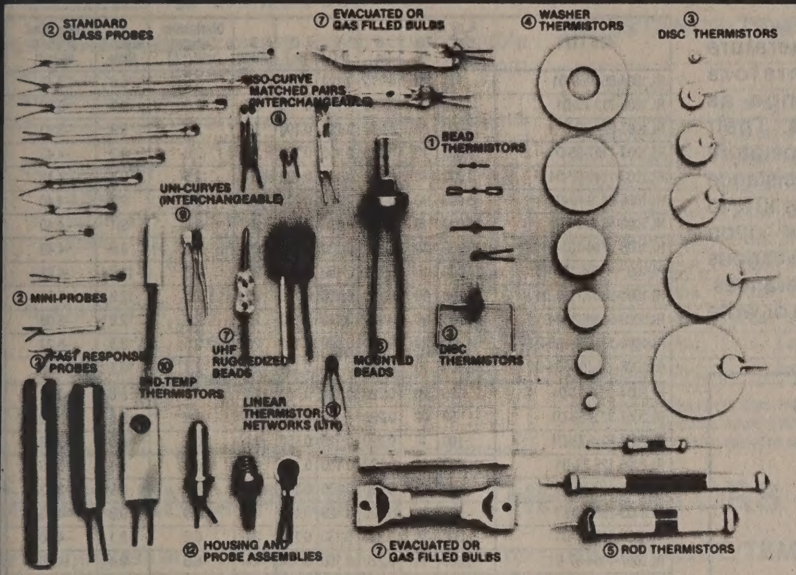
DESCRIPTION		ELECTRICAL RESISTIVE RATING	SET POINT RANGE INCLUDING TOL	NARROWEST TOLERANCE ALLOWABLE	NARROWEST DIFFERENTIAL AVAILABLE	AGENCY LISTINGS	TYPICAL APPLICATIONS
2500/2570 	3/4" Non-hermetic automatic reset device. 2570 series used for Defrost applications.	2500 25A-240VAC	0°F to 350°F −18°C to 177°C	±5°F	10°F	UL, CSA	Electric heaters, clothes dryers, wood stoves. 2570 Series is designed for refrigerators, freezers, HVAC and food dispensing applications.
		2570 10A-120VAC 5A-240VAC	20°F to 221°F −29°C to 105°C	±3°C	5°C		

For More Information. Circle No. 486

THERMISTORS

Fenwal Electronics

BROADEST THERMISTOR LINE AVAILABLE ANYWHERE


② STANDARD GLASS PROBES
⑦ EVACUATED OR GAS FILLED BULBS
④ WASHER THERMISTORS
③ DISC THERMISTORS
ISO-CURVE MATCHED PAIRS (INTERCHANGEABLE) ⑧
① BEAD THERMISTORS
UNI-CURVES (INTERCHANGEABLE) ⑨
② MINI-PROBES
② FAST RESPONSE PROBES
⑩ MID-TEMP THERMISTORS
⑦ UHF RUGGEDIZED BEADS
⑥ MOUNTED BEADS
③ DISC THERMISTORS
LINEAR THERMISTOR NETWORKS (LTN) ⑪
⑫ HOUSING AND PROBE ASSEMBLIES
⑦ EVACUATED OR GAS FILLED BULBS
⑤ ROD THERMISTORS

THE MOST COMPLETE LINE OF PRECISION THERMISTORS

THERMISTOR CONFIGURATIONS

1. Glass Coated Beads — used where small size, fast response, high precision, stability, and temperatures to 300°C are required.

2. Glass Probes — medium-small in size. Many of the advantages of beads but rugged, more easily mounted, useful in liquid media.

3. Discs — used where medium power dissipation is a requirement and space not a problem. Useful to 150°C.

4. Washers — used where high power dissipation is a prime requirement.

5. Rods — these units have power dissipation intermediate between discs and washers and are also used where their physical shape is an asset.

6. Mounted Beads — provide ease in using glass beads in such applications as gas chromatography, flow and vacuum measurement, etc.

7. Vacuum and Gas Filled Assemblies — high power sensitivity for specialized circuit applications.

INTERCHANGEABLE THERMISTORS

8. Iso-Curve® Interchangeable Thermistors — these units available in bead or glass probe configurations, follow standard L-2B curves over wide temperature range, and are completely interchangeable. Units match standard curves as close as ± ¼% of resistance or as required. Bulletin L-2B.

9. Uni-Curve® Interchangeable Thermistors — completely interchangeable units having an accuracy of + 0.2%C over a temperature range of 0°C to 70°C and available on special order to other tolerances and ranges. Bulletin L-6B.

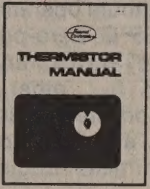
LINEAR THERMISTOR NETWORKS(LTN)

10. Linear Thermistor Networks (LTNTM) — precision resistors and thermistors which are designed to produce a resistance change or voltage output that varies linearly with temperature over the selected temperature range. Ask for Bulletin L-9A.

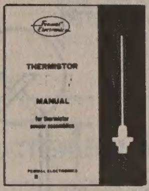
THERMISTOR PROBES

11. Probe Assemblies — standard catalog types or built to specific military or commercial requirements. We are experienced in design of probe assemblies for all fields of application including industrial control and indication, aerospace — specializing in telemetry applications, and oceanographic — featuring fast response, very high pressure, and interchangeability using our Iso-Curve and Uni-Curve Thermistors. Ask for Catalog L-5A.

FREE...*technical* THERMISTOR LITERATURE


THERMISTOR MANUAL

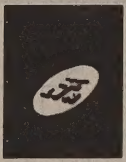
THERMISTOR MANUAL (EMC-6B) Most complete up-to-date listing of thermistors available. Theory, engineering data, complete specifications.


THERMISTOR
MANUAL

THERMISTOR HOUSING MANUAL (L-5A). Detailed information on how Fenwal Electronics can build thermistor sensor assemblies to fit your requirements.

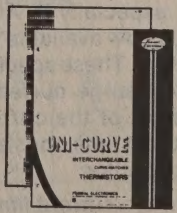
THERMISTOR APPLICATION AND TECHNICAL DATA NOTES: "Designing Linear Temperature Read-Out Circuits" AN-1A; "Using Thermistors to Compensate for Transistor Temperature Sensitivity" AN-2A; "Stability & Reliability Characteristics" TD-1A; "Considerations in Testing of Thermistors" TD-2A.

THERMISTOR
APPLICATION NOTES



LINEAR THERMISTOR NETWORKS (LTN TM) precision resistors and thermistors which are designed to produce a resistance change or voltage output that varies linearly with temperature over the selected temperature range. Ask for Bulletin L-9A.

INTERCHANGEABLE THERMISTORS: ISO-CURVE manual (L-2B) and UNI-CURVE manual (L-6B) provide in-depth data pertaining to precision and low-cost RT, curve-matched interchangeable thermistors.


UNI-CURVE
INTERCHANGEABLE
THERMISTORS

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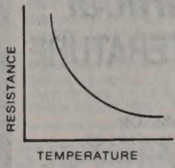
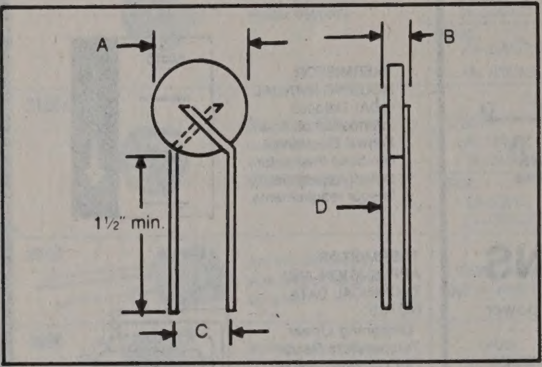
DISC TYPE THERMISTORS WITH CROSSED LEADS



NTC (Negative Temperature Coefficient) thermistors decrease in resistance as temperature increases. Their maximum operating temperature is 125° C. Zero-power resistance values at 25° C range from 10 Ω to 250K Ω ; other values upon request. Disc thermistors are available with various coatings, lead styles, and resistance tolerances. Contact Keystone Thermistor Engineering or write for catalog T384.



KCC TYPE	R_o@ 25°C (Ω)	Tol. ±%	A (in.)	B (in.)	C (in.)	D (AWG)	Dissipation Constant (mW/°C)	Resist.† Ratio	Temp. Coef. @ 25°C (%/°C)
RL1004-65.6-59-D1	100	20	0.110	0.120	0.100	26	2.5	5.6	-3.42
RL1003-312-73-D1	500	10	0.110	0.110	0.100	26	2.5	6.9	-3.83
RL1007-624-73-D1	1,000	10	0.110	0.150	0.100	26	2.8	6.9	-3.83
RL1003-1157-95-D1	2,000	10	0.110	0.150	0.100	26	2.8	9.2	-4.43
RL1003-1746-97-D1	3,000	10	0.110	0.110	0.100	26	2.5	9.1	-4.40
RL1004-2910-97-D1	5,000	10	0.110	0.120	0.100	26	2.5	9.1	-4.40
RL1009-5820-97-D1	10,000	10	0.110	0.170	0.100	26	3.0	9.1	-4.40
RL1005-5744-103-D1	10,000	10	0.110	0.130	0.100	26	2.5	9.6	-4.49
RL1007-13.8K-120-D1	25,000	10	0.110	0.150	0.100	26	2.8	11.4	-4.84
RL1003-26.7K-140-D1	50,000	10	0.110	0.110	0.100	26	2.5	12.9	-5.08
RL1006-53.4K-140-D1	100,000	10	0.110	0.140	0.100	26	2.7	12.9	-5.08
RL1004-104.7K-155-D1	200,000	10	0.110	0.120	0.100	26	2.5	13.8	-5.23
RL1006-135.2K-138-D1	250,000	10	0.110	0.140	0.100	26	2.7	12.1	-4.96
RL2004-16.4-59-D1	25	20	0.220	0.130	0.156	24	6.5	5.6	-3.42
RL2007-32.8-59-D1	50	20	0.220	0.160	0.156	24	6.5	5.6	-3.42
RL2003-62.4-73-D1	100	10	0.220	0.120	0.156	24	6.5	6.9	-3.83
RL2006-125-73-D1	200	10	0.220	0.150	0.156	24	6.5	6.9	-3.83
RL2008-187-73-D1	300	10	0.220	0.170	0.156	24	6.5	6.9	-3.83
RL2003-289-95-D1	500	10	0.220	0.120	0.156	24	6.0	9.2	-4.43
RL2004-582-97-D1	1,000	10	0.220	0.130	0.156	24	6.5	9.1	-4.40
RL2007-1164-97-D1	2,000	10	0.220	0.160	0.156	24	6.5	9.1	-4.40
RL2006-1600-103-D1	2,786	10	0.220	0.150	0.156	24	6.5	9.6	-4.49
RL2005-2203-120-D1	4,000	10	0.220	0.140	0.156	24	6.5	11.4	-4.84
RL2006-2753-120-D1	5,000	10	0.220	0.150	0.156	24	6.5	11.4	-4.84
RL2012-5506-120-D1	10,000	10	0.220	0.210	0.156	24	7.2	11.4	-4.84
RL2006-13.3K-140-D1	25,000	10	0.220	0.150	0.156	24	6.5	12.9	-5.08
RL2005-27K-138-D1	50,000	10	0.220	0.140	0.156	24	6.5	12.1	-4.96
RL2008-52.3K-155-D1	100,000	10	0.220	0.170	0.156	24	6.5	13.8	-5.23
RL3004-6.56-59-D1	10	20	0.320	0.130	0.250	24	7.0	5.6	-3.42
RL3504-31.2-73-D1	50	10	0.370	0.130	0.250	24	7.0	6.9	-3.83
RL3006-59.4-85-D1	100	10	0.320	0.150	0.250	24	7.2	8.4	-4.23
RL3004-144-95-D1	250	10	0.320	0.130	0.250	24	7.0	9.2	-4.43
RL3004-291-97-D1	500	10	0.320	0.130	0.250	24	7.0	9.1	-4.40
RL3005-574-103-D1	1,000	10	0.320	0.130	0.250	24	7.0	9.6	-4.49

†Resistance Ratio: Ratio of zero-power resistance @ 0°C to zero-power resistance @ 50°C.

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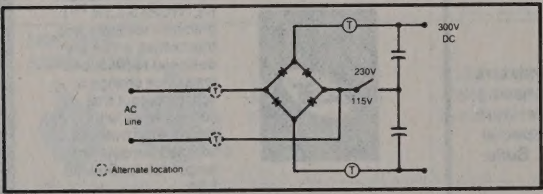
INRUSH CURRENT LIMITERS



The circuit diagram above displays a typical way to limit inrush current.

Protection against extremely high peak inrush current, especially in AC/DC switching power supplies, is now available with Keystone Inrush Current Limiters. These special NTC thermistors effectively control surge currents because the thermal time constant of the current limiter is longer than the electrical time constant (RC) of the thermistor and the capacitor.

All inrush current limiters are insulated with a protective coating. Caution must be taken when parts are cleaned in solvents.

Type	R_o @ 25°C ± 25% (Ω)	Max.* Steady State Current (amps)	Nominal Resistance @ Imax (Ω)	A max. (in.)	B max. (in.)	C ref. (in.)	D (AWG)
CL-10	0.7	12	0.03	0.740	0.200	0.328	18
CL-20	1.3	8	0.04	0.525	0.150	0.328	18
CL-30	2.5	8	0.06	0.740	0.200	0.328	18
CL-40	5	6	0.11	0.740	0.200	0.328	18
CL-50	7	5	0.16	0.740	0.220	0.328	18
CL-60	10	5	0.18	0.740	0.200	0.328	18
CL-70	16	4	0.27	0.740	0.200	0.328	18
CL-80	47	3	0.49	0.740	0.200	0.328	18
CL-90	120	2	1.18	0.910	0.200	0.328	18
CL-100	0.5	16	0.02	0.910	0.200	0.328	18
CL-110	10	3.2	0.18	0.360	0.140	0.250	24
CL-120	10	1.7	0.34	0.360	0.140	0.250	24
CL-130	50	1.6	0.76	0.420	0.150	0.250	24
CL-140	50	1.1	0.89	0.420	0.150	0.250	24
CL-150	5	4.7	0.11	0.530	0.150	0.328	22
CL-160	5	2.8	0.20	0.530	0.150	0.328	22
CL-170	16	2.7	0.33	0.530	0.150	0.328	22
CL-180	16	1.7	0.49	0.530	0.150	0.328	22
CL-190	25	2.4	0.41	0.530	0.150	0.328	22
CL-200	25	1.7	0.49	0.530	0.150	0.328	22

*These values are *suggested* maximums based upon a 25° C ambient, no air flow environment with the thermistor mounted ½" from the circuit board. Contact Keystone Engineering to discuss Iss ratings with air flow.

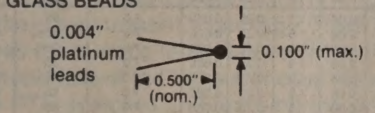
Keystone CARBON COMPANY
Thermistor Division • St. Marys, Pa. 15857
814-781-1591 • Telex No. 91-4517

For More Information. Circle No. 488

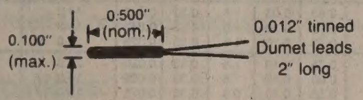
Keystone CARBON COMPANY

Glass bead thermistors are exceptionally stable because the glass seal protects the thermistor from hostile environments.

GLASS BEADS



GLASS PROBES



GLASS BEADS • GLASS PROBES

RESISTANCE/TEMPERATURE CHARACTERISTICS

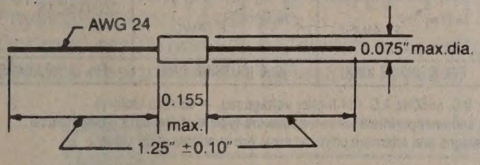
KCC TYPE	RESISTANCE (Ω)								Temp. Coef. @ 25°C (%/°C)
	-25°C	0°C	25°C	50°C	100°C	150°C	200°C	260°C	
RL0504-8783-95-G_*	189.3K	48.48K	15K	5484	1049	290.3	104.0	38.6	-4.33
RL0504-11.64K-97-G_	268.6K	65.76K	20K	7206	1364	370.4	130.3	47.4	-4.39
RL0504-16.92K-112-G_	462.6K	105.3K	30K	10.18K	1735	427.2	115.9	26.9	-4.64
RL0504-27.76K-120-G_	803.5K	182.2K	50K	16.5K	2658	642.5	204.7	67.2	-4.77
RL0504-55.53K-120-G_	1.61M	364.5K	100K	33K	5317	1285	409.4	134.4	-4.77
RL0504-111.3K-125-G_	3.38M	743.4K	200K	65.8K	10.22K	2416	762.2	249.2	-4.82
RL0504-272.6K-142-G_	9.31M	1.97M	500K	158.6K	22.2K	4700	1345	389	-5.00
RL0504-530.5K-148-G_	18.99M	3.94M	1 Meg	301.7K	41.74K	8780	2494	729	-5.11
RL0504-1.294M-176-G_	—	10.34M	2.5 Meg	716.7K	86.77K	15.96K	3955	982.5	-5.31
RL0504-2.588M-176-G_	—	20.68M	5 Meg	1.434M	173.6K	31.92K	7910	1965	-5.31

*Not presently available in Glass Probes.
Tolerance on resistance values ± 20% @ 25°C. Closer tolerances available.
Beads have a maximum operating temperature of 260°C.

—G1 for Glass Beads with platinum leads.
—G15 for Glass Probes.

GLASS ENCAPSULATED THERMISTORS

Keystone glass encapsulated NTC thermistors are tiny pellets of thermistor material hermetically sealed in glass bodies with a controlled amount of selected atmosphere. The hermetic seal makes these parts extremely stable in applications up to 204° C (400° F).



Temperature Range: −50°C to +204°C
Time Constant: 3 sec.
Dissipation Constant: 2.0 mW/°C
Tolerance: ±10% @ 25°C

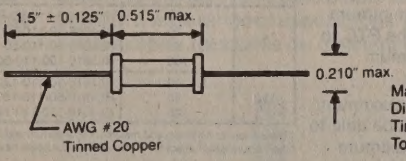
RESISTANCE/TEMPERATURE CHARACTERISTICS

KCC TYPE	RESISTANCE (Ω)								Temp. Coef. @ 25°C (%/°C)
	-25°C	0°C	25°C	50°C	75°C	100°C	150°C	204°C	
AL03006-624-73-G1	10.11K	2888	1K	403.9	185.6	94.4	31.0	12.1	-3.91
AL03006-1248-73-G1	20.22K	5776	2K	807.8	371.2	188.8	62.0	24.2	-3.91
AL03006-5818-97-G1	133.3K	32.96K	10K	3577	1469	671.2	182	59.9	-4.41
AL03006-11.7K-98-G1	253K	64.16K	20K	7234	2966	1356	361.2	115.9	-4.34
AL03006-29.1K-97-G1	625K	160K	50K	18.2K	7510	3431	918.5	293.2	-4.32
AL03006-58.2K-97-G1	1.25M	319.9K	100K	36.4K	15.02K	6862	1837	586.4	-4.32
AL03006-110K-130-G1	3.29M	729K	200K	64.2K	23.66K	9580	2184	595.8	-4.84
AL03006-269.8K-138-G1	8.91M	1.92M	500K	155.7K	55.85K	22.64K	4943	1329	-4.99
AL03006-535K-145-G1	18.72M	3.90M	1 Meg	305.3K	106.9K	42.47K	8946	2329	-5.07
AL03006-2.6M-164-G1	—	20.41M	5 Meg	1.45M	489.3K	185.9K	36.16K	8777	-5.26

ROD-TYPE THERMISTORS

HIGH-TEMPERATURE COEFFICIENT RODS

KCC TYPE	RESISTANCE @°C						Temp. Coef. @ 25°C (%/°C)
	0	25	50	75	100	125	
AL1545-6240-73-R1	28.2K	10K	4100	1890	956	520	-3.83
AL1545-11.6K-97-R1	67.2K	20K	7140	2920	1352	685	-4.46
AL1545-28.9K-97-R1	168K	50K	17.8K	7320	3381	1710	-4.46
AL1545-55K-120-R1	372K	100K	32.4K	12.2K	5270	2080	-4.86
AL1545-109K-125-R1	753K	200K	63.9K	23.9K	10.1K	4720	-4.91
AL1545-268K-137-R1	1.95M	500K	154K	55.6K	22.6K	10.4K	-5.03
AL1545-523K-155-R1	4.06M	1 Meg	294K	100K	39.3K	17.1K	-5.22



Maximum operating temperature: 125°C
Dissipation constant: 9mW/°C
Time constant: 45 sec.
Tolerance: ± 10% @ 25°C

LOW-TEMPERATURE COEFFICIENT RODS

KCC TYPE	RESISTANCE @°C						Temp. Coef. @ 25°C (%/°C)
	0	25	50	75	100	125	
AL1545-40.1-26-R1	80.6	50	32.9	22.6	16.2	11.9	-.1.78
AL1545-80.2-26-R1	161	100	65.8	45.3	32.4	23.8	-1.78
AL1545-160-26-R1	322	200	132	90.6	64.8	47.7	-1.78
AL1545-340-26-R1	685	425	280	192	137	101	-1.78
AL1545-391-29-R1	847	500	314	206	142	100	-1.98
AL1545-782-29-R1	1690	1K	628	413	284	201	-1.98
AL1545-1560-30-R1	3430	2K	1240	808	548	387	-2.03
AL1545-3860-31-R1	8680	5K	3060	1980	1327	924	-2.07
AL1545-7730-31-R1	17.4K	10K	6130	3950	2654	1850	-2.07
AL1545-15.3K-33-R1	35.6K	20K	12K	7560	4976	3400	-2.17
AL1545-37.9K-34-R1	90K	50K	29.5K	18.5K	12K	8120	-2.22

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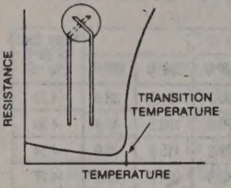
PTC — POSITIVE TEMPERATURE COEFFICIENT THERMISTORS



Positive Temperature Coefficient (PTC) thermistors are characterized by an extremely large resistance change in a small temperature span. The figure at left depicts a generalized resistance temperature plot for a PTC. The temperature at which the resistance begins to increase rapidly is referred to as the transition temperature. This point can be changed from below 0° C to above 160° C.

TYPICAL PTC APPLICATIONS

• Automatic Color TV Degaussing • Air Flow Measurement • Non-Destructive Fuse • Single Phase Motor Starting • Liquid Level Sensing • Combination Heater-Thermostat • Arc Suppression • Time Delay Fusing.

For detailed application notes, write for Bulletin P-780.

Operating Voltage V_{OP}	Type Number	R_o @ 25°C ±30% (Ω)	Transition Temperature T_{TR} (°C)	Reference Dimensions (In.) A	B	C	D	E	Dissipation† Constant δ (mW/°C)	Time† Constant τ (Sec.)	Fig. No. *
12	RL5505-1-120-12-PTO	1	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
	RL5305-2-120-12-PTO	2	120	0.53	0.05	1.5	0.33	0.032	14.0	50	A
	RL3005-10-120-12-PTO	10	120	0.30	0.05	1.5	0.25	0.020	7.0	35	A
	RL3005-25-120-12-PTO	25	120	0.30	0.06	1.5	0.25	0.020	7.0	35	A
25	RL3006-50-30-25-PTO	50	30	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-40-25-PTO	50	40	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-50-25-PTO	50	50	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-60-25-PTO	50	60	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-70-25-PTO	50	70	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-80-25-PTO	50	80	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-90-25-PTO	50	90	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-100-25-PTO	50	100	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-110-25-PTO	50	110	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-120-25-PTO	50	120	0.30	0.06	1.5	0.25	0.020	7.0	35	A
50	RL5506-10-110-50-PTO	10	110	0.55	0.06	1.5	0.33	0.032	14.0	50	A
	RL5510-20-110-50-PTO	20	110	0.55	0.10	1.5	0.33	0.032	15.0	80	A
	RL4010-50-110-50-PTO	50	110	0.40	0.10	1.5	0.33	0.025	12.0	60	A
120	RL7510-10-120-120-PTO	10	120	0.75	0.10	1.5	0.33	0.020	20.0	90	A
	RL6010-20-120-120-PTO	20	120	0.60	0.10	1.5	0.33	0.032	18.0	90	A
	RL5510-25-65-120-PTO	25	65	0.55	0.10	0.5	0.33	0.025	15.0	90	B
	RL4510-50-120-120-PTO	50	120	0.45	0.10	1.5	0.33	0.025	12.0	70	A
240	RL5515-50-65-240-PTO	50	65	0.55	0.15	1.5	0.33	0.032	17.0	80	A
	RL6015-100-120-240-PTO	100	120	0.60	0.15	1.5	0.33	0.032	18.0	90	A
	RL3020-1500-100-240-PTO	1500	100	0.30	0.20	1.5	0.25	0.020	12.0	60	A

†The values for dissipation constant and time constant are for reference only. Actual values are a function of method of mounting, air flow, and other factors which affect the PTCs ability to dissipate heat. Contact Keystone Engineering for further information.
*Represents standard lead configurations. Other lead styles shown are available for custom made thermistors.

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TYPICAL CONFIGURATIONS

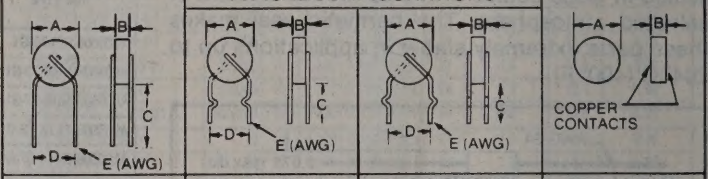


FIG. A (STRAIGHT LEAD) FIG. B (INSIDE KINK) FIG. C (OUTSIDE KINK) FIG. D (NO LEADS)

NOTE:
1. Operating Voltage: D.C. or 60Hz A.C. (for higher voltage req. — contact factory).
2. The specifications and configurations shown above are typical of standard items. Special characteristics, designs and alternate physical sizes are available upon request.

PTC RESETTABLE FUSES

Typical applications for PTC fuses:

- Telephone line fault protection
- Fuse for intermittent solenoids
- Over-current protection for transformers
- Locked rotor protection for FHP motors

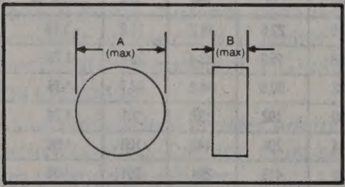
Minimum Limit Current — The minimum amount of current required by the PTC to guarantee switching at the minimum ambient temperature.

Maximum Limit Current — The maximum amount of current the PTC must be able to pass without switching at the maximum ambient temperature.

Operating Voltage V_{op}	No Load Resistance @ 25°C (±20%) (Ω)	Type Number	Minimum Limit† Current (amps) 0°C	20°C	Maximum Limit† Current (amps) 30°C	55°C	T_{TR} (Ref.) (°C)	Heat Capacity (Watt-Sec/°C)	Diss.† Const. (mW/°C)	Max. Dia. (In.)
12	1	RL5305-1-110-12-PTF	1.30	1.20	0.80	0.60	110	0.5	14.0	0.60
	5	RL4005-5-110-12-PTF	0.44	0.37	0.29	0.20	110	0.3	10.0	0.45
	10	RL3005-10-110-12-PTF	0.33	0.30	0.20	0.16	110	0.2	7.0	0.35
	25	RL2505-25-110-12-PTF	0.23	0.19	0.13	0.09	110	0.1	6.0	0.32
50	5	RL5506-5-110-50-PTF	0.55	0.50	0.30	0.25	110	0.7	14.0	0.60
	10	RL4006-10-110-50-PTF	0.30	0.27	0.18	0.16	110	0.4	10.0	0.45
	50	RL5310-50-110-50-PTF	0.23	0.20	0.11	0.10	110	1.1	15.0	0.60
	100	RL3810-100-110-50-PTF	0.10	0.09	0.06	0.05	110	0.5	12.0	0.42
120	10	RL7510-10-110-120-PTF	0.39	0.36	0.25	0.17	110	2.2	20.0	0.80
	50	RL4510-50-110-120-PTF	0.16	0.15	0.09	0.07	110	0.7	14.0	0.50
	100	RL3510-100-110-120-PTF	0.09	0.08	0.06	0.04	110	0.5	11.0	0.40

†The values for minimum and maximum limit current and dissipation constant are for reference only. Actual values are a function of method of mounting, air flow, and other factors which affect the PTCs ability to dissipate heat. Contact Keystone engineering for further information.

PTC HEATERS



Typical applications for PTC heaters:

- Contact lens cleaner kits
- Medical equipment
- In-line diesel fuel heaters
- Temperature stabilization of electronic components

Operating Voltage V_{OP}	Type Number	No Load Resistance @ 25°C (Ref.) (Ω)	Transition Temperature (Ref.) (°C)	A (In.)	B (In.)	Typical Operating Temperature Minimum Heat Sinking† °C
24	6306-200-15-24-PTH	200	15	0.68	0.08	20††
	5506-20-120-24-PTH	20	120	0.60	0.08	160
	5506-20-140-24-PTH	20	140	0.60	0.08	180
	5506-40-110-24-PTH	40	110	0.60	0.08	130
120	5510-100-120-120-PTH	100	120	0.60	0.12	160
	5510-200-110-120-PTH	200	110	0.60	0.12	140
	5510-150-140-120-PTH	150	140	0.60	0.12	180
240	6315-250-120-240-PTH	250	120	0.68	0.18	160
	5520-250-140-240-PTH	250	140	0.60	0.23	180
	6315-500-110-240-PTH	500	110	0.68	0.18	140

†Measured at 25°C ambient, PTC mounted in small spring clip. ††Measured at −40°C ambient.

For More Information. Circle No. 488

Keystone
CARBON COMPANY

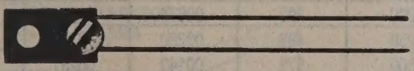
PTC SURFACE-MOUNT OVERTEMPERATURE PROTECTORS

Positive Temperature Coefficient (PTC) thermistors — act as solid-state switches. A typical application of these surface mount units is to prevent destruction of a power transistor.

PTCs are bonded to a tab which is mechanically mounted to the power transistor package. The PTC thermistor measures the surface temperature of the transistor. When the temperature of the transistor case reaches a critical point, the PTC switches and turns off the drive circuitry for the transistor. This action prevents its destruction. Then, as the transistor cools, so does the thermistor, automatically resetting itself to once again guard the power transistor.

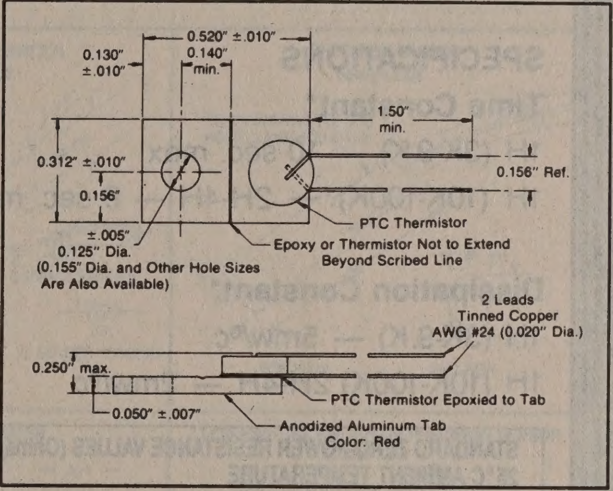
Specifications:

1. Resistance @ 25° C: 100Ω + 30% (70Ω - 130Ω).
2. Transition temperature per table is defined as the temperature at which the measured resistance is two times the minimum resistance.
3. Maximum voltage that can be applied to the device in DC or 60Hz sinusoidal wave form AC is 30 volts.
4. Maximum operating temperature 140° C.
5. Dielectric withstand between PTC element and aluminum tab is 50 VDC min.
6. Basic construction: .200″ dia. x .060″ thk. PTC disc with radial leads attached to an anodized aluminum tab.
7. Physical design — as shown.
8. Optional resistance values, switch temperatures and physical designs are available upon request.



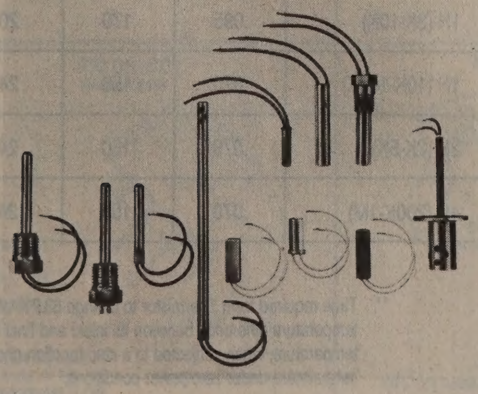
PTC SURFACE TEMPERATURE SENSORS

Type Number	Transition Temp. °C (Ref.)
RL2006-100-30-30-PT1	30
RL2006-100-40-30-PT1	40
RL2006-100-50-30-PT1	50
RL2006-100-60-30-PT1	60
RL2006-100-70-30-PT1	70
RL2006-100-80-30-PT1	80
RL2006-100-90-30-PT1	90
RL2006-100-100-30-PT1	100
RL2006-100-110-30-PT1	110
RL2006-100-120-30-PT1	120


0.520″ ±.010″
0.130″ ±.010″
0.140″ min.
1.50″ min.
0.312″ ±.010″
0.156″
0.156″ Ref.
PTC Thermistor
±.005″
0.125″ Dia.
(0.155″ Dia. and Other Hole Sizes Are Also Available)
Epoxy or Thermistor Not to Extend Beyond Scribed Line
2 Leads Tinned Copper AWG #24 (0.020″ Dia.)
0.250″ max.
PTC Thermistor Epoxied to Tab
0.050″ ±.007″
Anodized Aluminum Tab Color: Red

THERMISTOR PROBES

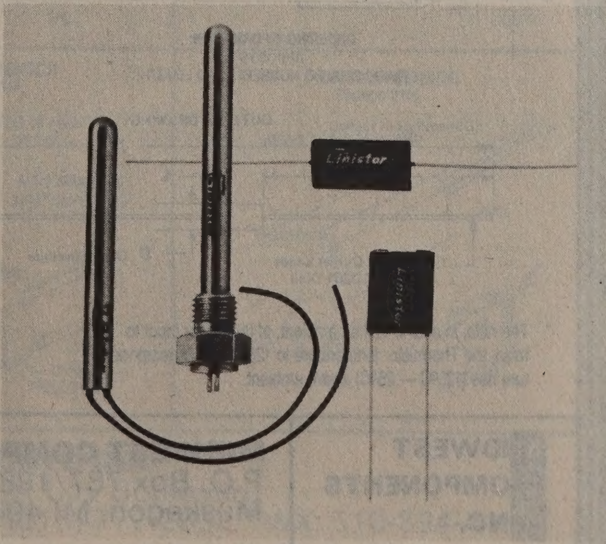
The probes illustrated below include stainless steel, aluminum, and chrome-plated materials in a variety of configurations. In addition, a variety of other designs are available. These probes are used in conjunction with solid state circuitry for liquid level measurement, and for use as sensors to measure the temperature of liquids or surface temperatures.



Keystone CARBON COMPANY
Thermistor Division • St. Marys, Pa. 15857
814-781-1591 • Telex No. 91-4517

LINISTOR® ASSEMBLIES

Keystone developed Linistor assemblies to give an accurate resistance response over a temperature span of 0° to 100° C. Because Linistor assemblies have flattened out the thermistor resistance curve to a constant and predictable straight-line plot, they are valuable in a wide range of applications. Four standard encasements are available. Tolerance on resistance of Linistor is ±2% at 25° C.


Linistor
Linistor

NTC THERMISTORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

H-Series Hermetically Sealed Thermistors Manufactured by MIDWEST COMPONENTS INC. are small, rugged, and good for use up to 400ºC. The H-Series sensor is a preferred choice for all types of temperature sensing compensation or control circuits. Uniform dimensions make them desirable for automatic insertion in printed circuit boards. Dumet leads are weldable and/or solderable.

TYPICAL CHARACTERISTICS

		CATALOG NUMBER					
SPECIFICATIONS	**TEST CONDITION**	**Fig. 2. 1H**	**Fig. 2. PIH**	**Fig. 1. APIH**	**Fig. 2. UH**	**Fig. 2. 2H**	**Fig. 2. 4H**
Resistance @ 25°C (OHMS)	Zero Power	±10%	±2%	±2%	± .8%	±10%	±10%
Resistance Ratio $R_{25°C} / R_{25°C}$		29.85	29.85	29.85	29.85	19.80	48.75
Maximum Withstand Temperature: °C		-55 -400	-55 to 400	-55 to 400	-55 to 400	-55 to 400	-55 to 400
Operating Temperature Range; °C		-55 -400	-55 to 400	-55 to 200	-55 to 200	-55 to 400	-55 -400
Interchangeability °C	0-100°C	N/A	1°C	1°C	.2°C	N/A	N/A
Stability (Change in Resistance)	1000 hrs. at 100°C		< .1%	< 1%	<. 1%		
Resistance Range		3K-100K	3K-100K	3K-100K	3K-100K	2K-5K	200K-1M

SPECIFICATIONS

Time Constant*

1H (3K-9 K) — 10 sec. max

1H (10K-100K) — 2H-4H — 8 sec. max

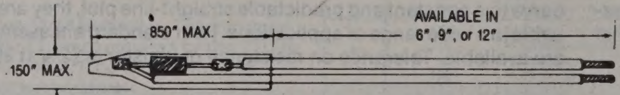
Dissipation Constant*

1H (3K-9.K) — 5mw/ºc

1H (10K-100K) 2H-4H — 2mw/ºc

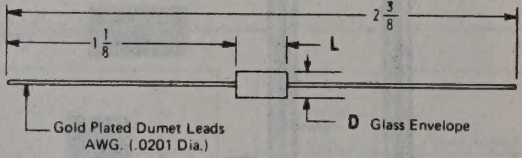
STANDARD ZERO-POWER RESISTANCE VALUES (Ohms) at 25°C AMBIENT TEMPERATURE

							2000	2200	2400	2700	3000
3300	3600	3900	4300	4700	5100	5600	6200	6800	7500	8200	9100
10000	11000	12000	13000	15000	16000	18000	20000	22000	24000	27000	30000
33000	36000	39000	43000	47000	51000	56000	62000	68000	75000	82000	91000
96000	100000		200000	300000		400000		500000		600000	700000
800000											



ORDERING INFORMATION:
AP1H103-6
[BASIC CATALOG NUMBER] [LEAD LENGTH]

(Dimensions in Inches) OUTLINE DRAWING



Temperature		Resistance Ratio Characteristics		
°C	°F	R_T/R_{25} MULTIPLIER 1H-	2H-	4H-
-55	-67	95	54	131
-40	-40	34	21.7	45.5
-21.5	-6.7	10.5	8.0	13.2
0	32	3.3	2.82	3.71
25	77	1.00	1.00	1.00
37.8	100	.58	.62	.543
50	122	.36	.41	.32
75	167	.148	.182	.114
104.4	220	.0595	.082	.0399
125	257	.0335	.505	.0205
150	302	.0180	.0300	.0101
200	392	.00670	.0116	.00285
250	482	.00280	.00555	.00110
300	572	.00140	.00291	.000454
350	662	.000800	.00178	.000113
400	752	.000450	.00104	.000113

To find the resistance of a particular H-Series Thermistor at any temperature in this table, multiply its 25°C resistance by the multiplier for that temperature.

GRADE	D	L	AWG
1H (3K-10K)	.095	.170	20
1H (10K-100K)	.070	.150	24
2H (2K-5K)	.070	.150	24
4H (200K-1M)	.070	.150	24

---

* The ratio, in a 25ºC still air ambient, of the power input to raise, the Thermistor temperature to 125ºC and its temperature rise (125ºC — 25ºC) above ambient.

** Time required for a Thermistor to change 63.2% of the temperature difference between its initial and final body temperature, when subjected to a step function change in temperature under zero-power conditions.

MIDWEST
COMPONENTS
INC.

MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

TUFF·SENSORS™

TEMPERATURE SENSORS INCAPSULATED IN THERMOPLASTIC

MANUFACTURED BY MIDWEST COMPONENTS, INC.

TUFF·SENSORS™, a family of thermoplastic molded probes, provide reliable protection against environmental extremes for our line of temperature sensors and switches. Use of high performance plastics creates a temperature probe that resists temperature variations, humidity, chemicals and rough handling.

Many standard sizes and shapes are available, with selection of type based on conditions of use.

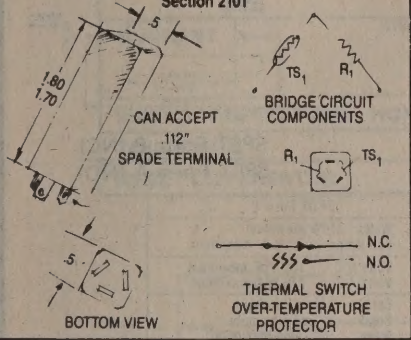
Custom designs available to your specifications.

PLASTICS AND THEIR PROPERTIES

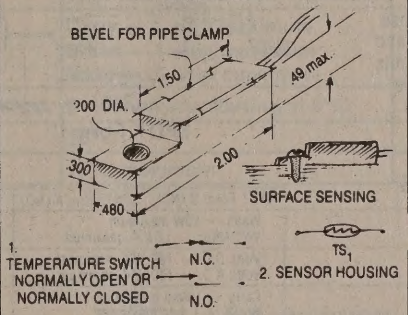
PROPERTIES	UNIT TERMS	ASTM TEST STD	VALOX* 310SEO(GE)	NORYL* N225(GE)	RYTON† R10(PHILLIPS)	POLYPROPYLENE SHELL 5620
1 DIELECTRIC	$\frac{V}{MIL}$	D149	560	630	324	600
2 MELT TEMP	°F	———	437	520	540	334
3 MOISTURE ABSORPTION @73°F	$\frac{\%}{24H}$	D570	08	07	04	03
4 TENSILE STRENGTH	———	D638	8500	8000	12000	4800
5 COMPRESSIVE STRENGTH	PSI	D695	14500	8000	17500	———
6 FLEXURAL STRENGTH	PSI	D790	14700	1100	18000	1450
7 SHEAR STRENGTH	PSI	D732	7700	8500	11200	60
8 IMPACT RESISTANCE	$\frac{FT°}{IN}$	D256	07	6 0	80	90
9 HARDNESS (ROCKWELL)	R	D785	120	116	———	81
10 THERMAL CONDUCTIVITY	$\frac{BTU\ IN}{HR\ FT^2\ °F}$	———	1 2	1 35	4 3	H B
11 FLAMMABILITY U L RATING	UL94V	———	VO	VO	VO	———
12 ACCEPTABILITY FOR FOOD CONTACT	———	———	YES	———	———	YES

*Registered trademarks of the General Electric Co †Registered trademark of the Phillips Chemical Co

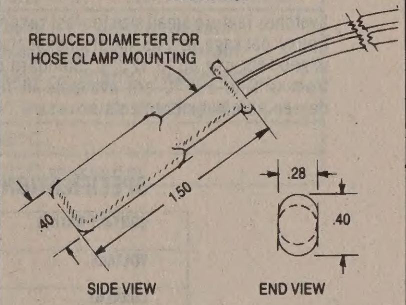
THERMAL SWITCH
Section 2101


.5
1.80
1.70
CAN ACCEPT
.112"
SPADE TERMINAL
TS1
R1
BRIDGE CIRCUIT
COMPONENTS
R1
TS1
.5
BOTTOM VIEW
N.C.
N.O.
THERMAL SWITCH
OVER-TEMPERATURE
PROTECTOR

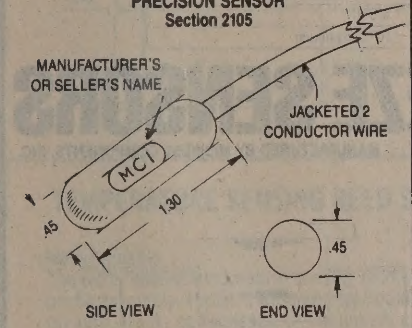
TEMPERATURE SWITCH
Section 2103


BEVEL FOR PIPE CLAMP
1.50
.49 max.
.200 DIA.
.300
2.00
.480
SURFACE SENSING
1.
TEMPERATURE SWITCH
NORMALLY OPEN OR
NORMALLY CLOSED
N.C.
N.O.
TS1
2. SENSOR HOUSING

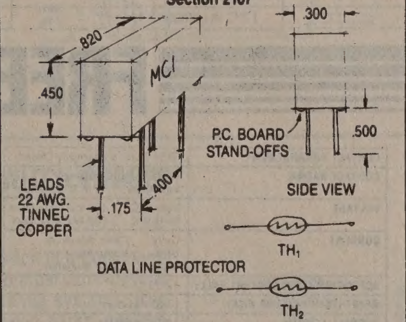
PRECISION SENSOR
Section 2104


REDUCED DIAMETER FOR
HOSE CLAMP MOUNTING
.40
1.50
.28
.40
SIDE VIEW
END VIEW

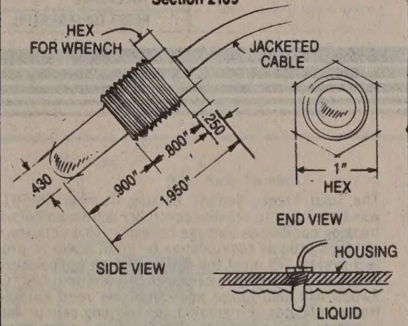
PRECISION SENSOR
Section 2105


MANUFACTURER'S
OR SELLER'S NAME
JACKETED 2
CONDUCTOR WIRE
MCI
1.30
.45
.45
SIDE VIEW
END VIEW

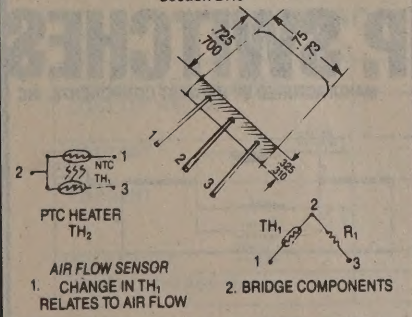
CURRENT LIMITER
Section 2107


.300
.820
MCI
.450
P.C. BOARD
STAND-OFFS
.500
LEADS
22 AWG.
TINNED
COPPER
.175
.400
SIDE VIEW
TH1
DATA LINE PROTECTOR
TH2

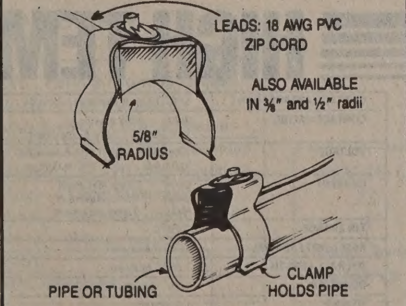
TEMPERATURE SWITCH OR PRECISION SENSOR
Section 2109


HEX
FOR WRENCH
JACKETED
CABLE
.250
.800"
.430
.900"
1.950"
1"
HEX
END VIEW
SIDE VIEW
HOUSING
LIQUID

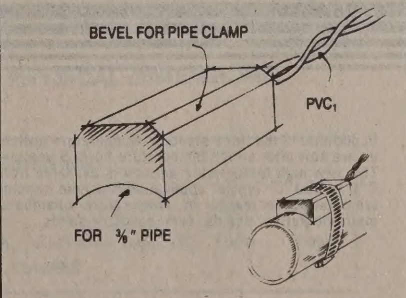
PTC OR NTC
Section 2110


.725
.700
.15 R
1
2
3
NTC
TH1
1
2
3
.325
.310
PTC HEATER
TH2
2
TH1
R1
1
3
AIR FLOW SENSOR
1. CHANGE IN TH1
RELATES TO AIR FLOW
2. BRIDGE COMPONENTS

PRECISION SENSOR
Section 2114


LEADS: 18 AWG PVC
ZIP CORD
ALSO AVAILABLE
IN ⅜" and ½" radii
5/8"
RADIUS
PIPE OR TUBING
CLAMP
HOLDS PIPE

PRECISION SENSOR
Section 2115


BEVEL FOR PIPE CLAMP
PVC1
FOR ⅜" PIPE

MIDWEST
COMPONENTS
INC.

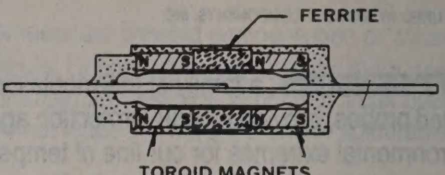
MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

For More Information. Circle No. 489

TEMPERATURE SENSING SWITCH

MANUFACTURED BY MIDWEST COMPONENTS, INC.

CONVENIENT AND RELIABLE TEMPERATURE CONTROL



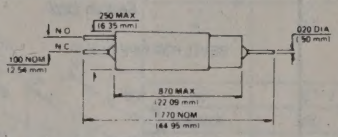
Miniature temperature switches use an electro-ceramic element instead of a bimetallic switch. The Reed Switch Temperature Sensor works on these two principles: a reed switch actuation occurs because of changes in strength of a magnetic field in the vicinity of the contact gap; and certain materials exhibit great changes in magnetic reluctance when the temperature is varied in the vicinity of the material's curie temperature.

The unit has good response time, and is operable in a variety of atmospheres and solutions. Variations in configurations suitable for installation in automotive engine crankcases and automatic transmissions, or mountings for use in computer cabinets are possible. Other applications include oven over-heat alarms, corrosive liquid temperature control, food freezer thaw warning and cooling fan stop indication. This switch replaces many thermally actuated devices now used where increased life is required or protection of the switching contacts from adverse environments is deemed desirable.

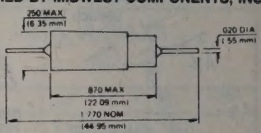
EPOXY PACKAGED SWITCHES

MANUFACTURED BY MIDWEST COMPONENTS, INC.

Switches feature small size for fast response. Eopxy package resists most chemicals and is good for use up to 125°C. Standard units from 0°C to 125°C are available in five degree nominal increments.



SPDT Form C



SPST Form B (NC)
SPST Form A (NO)

SPECIFICATIONS

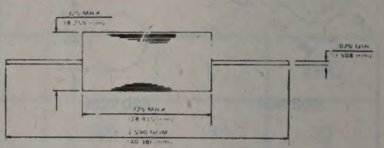
	SPST Form B (NC) SPST Form A (NO)	SPDT Form C
CONTACT RATING	Watts – 10W maximum Volt Amps – 12 V.A. maximum	Watts – 10W maximum Volt Amps – 12 V.A. maximum
VOLTAGE	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – .5 amp maximum	Carry – 1 amp maximum Break – 1 amp maximum Make – .500 amp maximum
OPEN TEMPERATURE – NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum

FREEZE SENSORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

The Solar Freeze Sensor, Catalog Number TS-5B1, was developed to provide controller activation before freezing conditions damage collector. This activation will then provide recirculation or drain down to protect system. To meet the needs of high temperature exposure, the switch is packaged to withstand 400°C. Switch has also found application as road surface freeze indicator, refrigerated van warning sensor and is widely used as a frost sensor in the agricultural industry.

CONTACT ARRANGEMENT	SPST Form B (Normally Closed)
CONTACT RATING	Watts 10W maximum Volt Amps 12 V A maximum
VOLTAGE	Volts D C 100 VDC maximum Volts A C 120 VAC maximum
CURRENT	Carry 1 amp maximum Break 1 amp maximum Make 5 amp maximum
ACTIVATION (TEMPERATURE FALL)	1-7°C
RESET (TEMPERATURE RISE)	10°C maximum
OVERALL LENGTH	1 590" nominal
DIAMETER	325" maximum
WEIGHT	1 6 grams

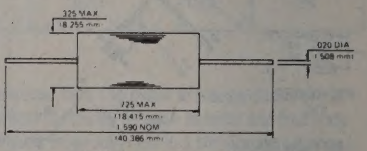


HIGH TEMP. SWITCHES

MANUFACTURED BY MIDWEST COMPONENTS, INC.

In addition to the three standard temperature switches, we now offer a high temperature Form B version. This new high temperature version is available from 0°C to 250°C. Typical applications include sensing temperature increases in temperature chambers, instrumentation, liquids, semi-solids or solids.

CONTACT ARRANGEMENT	SPST Form B (Normally Closed)
CONTACT RATING	Watts – 10W maximum Volt Amps – 12 V A maximum
VOLTAGE	Volts D C – 100 VDC maximum Volts A C – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – 5 amp maximum
TOLERANCE	±10°C
RESET DIFFERENTIAL	10°C maximum
OVERALL LENGTH	1 590" nominal
DIAMETER	325" maximum
WEIGHT	1 6 grams



MIDWEST
COMPONENTS
INC.

MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

For More Information. Circle No. 489

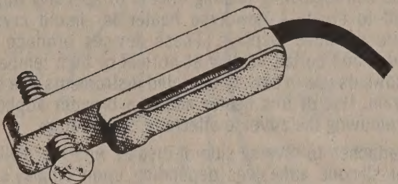
TEMPERATURE SENSING SWITCH

MANUFACTURED BY MIDWEST COMPONENTS, INC.

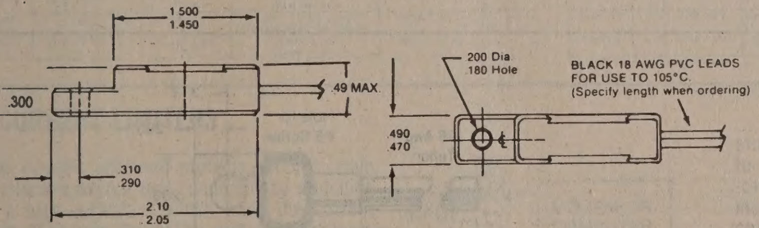
TEMPERATURE SENSING REED SWITCHES PMS SERIES

Midwest Components, Inc. has now packaged the reliable temperature sensing reed switch in a convenient and easy to use housing. The molded plastic body offers the additional advantages of complete moisture and dust protection at an economical price.

This rugged switch can be quickly mounted with a screwdriver. An indentation on the housing also facilitates attachment by ordinary hose clamps or clip hardware supplied by the user. Type A (normally open) or Type B (normally closed) switches may be used in this new package.



CONTACT ARRANGEMENT	SPST Form B (NC)	SPST Form A (NO)
CONTACT RATING	Watts — 10W maximum Volt Amps. — 12 V.A. maximum	Watts — 10W maximum Volt Amps — 12 V.A. maximum
VOLTAGE	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum
CURRENT	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp maximum	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp. maximum
SWITCH TEMPERATURE — NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum

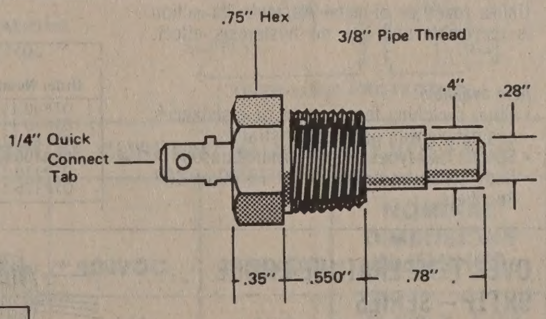


KEY TO ORDERING:

PMS	XXX	A or B	XX
↑	↑	↑	↑
Temp Switch	Temp In °C	Form	Lead Length in Inches

TEMPERATURE SENSING REED SWITCH PROBES

Now Available . . .
The ultra reliable temperature sensing reed switch in a convenient probe assembly. Probe is designed for liquid temperature sensing on auto, truck, compressor, or equipment cooling systems. Rugged brass body is hermetically sealed against harsh environments. Switching temperatures are available from - 10°C to 150°C. 3 million operations are possible at full rated load.



PHYSICAL DIMENSIONS

SPECIFICATIONS

CONTACT ARRANGEMENT	SPST Form B (Normally Closed) *
CONTACT RATING	Watts – 10W maximum Volt Amps–12 V.A. maximum
VOLTAGE	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – .5 amp maximum
TOLERANCE	±10°C
RESET DIFFERENTIAL	10°C maximum

KEY TO ORDERING:

TS	*XXX*	*B*	*P*
↑	↑	↑	↑
Temp. Switch	Activation Temp. (°C)	Form	Probe

EXAMPLE: TS100BP

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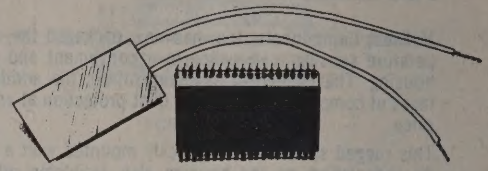
SPECIALTY CERAMICS

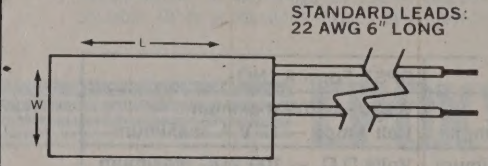
MANUFACTURED BY MIDWEST COMPONENTS, INC.

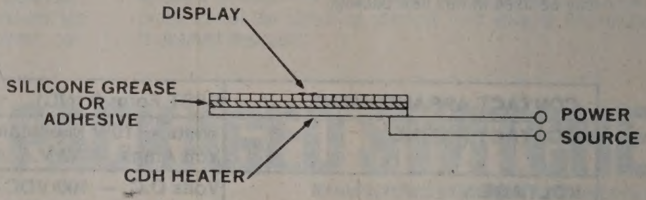
SELF REGULATING DISPLAY HEATER



The unique self-regulating heating effects of specially doped ceramics are utilized to create a new type heater for liquid crystal or other temperature sensitive displays. These devices produce heat at cold temperatures and curtail heating at normal or high temperatures. This feature allows its use in battery operated instruments due to low normal current drain. Use of this heater allows a broader application of displays by removing the adverse effects of temperature.

Heater is attached to reverse side of display with thermally conductive epoxies or silicone adhesives depending upon display's thermal coefficient of expansion or temperature to which it may be subjected. Actual performance of the display will depend upon manufacturers specifications.





ORDER NUMBER	SIZE* L X W	OPERATING VOLTAGE**	NOMINAL RESISTANCES R@ - 35°C	NOMINAL RESISTANCES R@ 50°C
CDH001	2.0" x .9"	12-28 AC or DC	5 OHMS	1500 OHMS MIN.
CDH002	3.1" x 1.1"	12-28 AC or DC	3 OHMS	1000 OHMS MIN.
CDH003	3.6" x 1.1"	12-28 AC or DC	2.5 OHMS	750 OHMS MIN.

*Other sizes available — consult factory

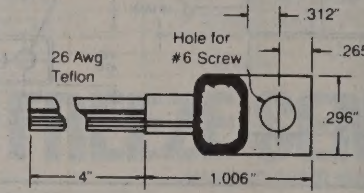
OVER TEMPERATURE PROTECTORS

MIDWEST COMPONENTS' Over Temperature Protector provides shutoff or regulation of expensive RF or AF Power Transistors. Protects against over heating that occurs from output stage component failure, antenna breakage, or short conditions.

Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect.

Also available:

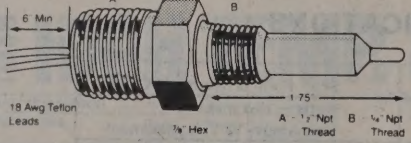
- Other switching temperature or resistances compatible with package constraints.
- Special lead types or end terminations.
- Body styles for protection of TRIAC or SCR Rectifiers.

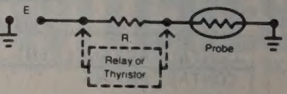


Order Number	Switching Temp. (Nom.)	Resistance at 25°C (Ohms)	Resistance at Switching Temperature	Max. Cont. Oper. Temp.
OTP60.11	60°C	100 ± 40%	250 OHMS (min.)	150°C
OTP70.11	70°C	100 ± 40%	250 OHMS (min.)	150°C
OTP80.11	80°C	100 ± 40%	250 OHMS (min.)	150°C
OTP100.11	100°C	100 ± 40%	250 OHMS (min.)	150°C
OTP120.11	120°C	100 ± 40%	250 OHMS (min.)	150°C
OTP125.11	125°C	100 ± 40%	250 OHMS (min.)	150°C

OVER TEMPERATURE PROBE 9RT1P—SERIES

This rugged Probe is designed for over temperature sensing on compressors, engines, or fluid transfer lines. When over temperatures occur its resistance increases by a factor of five or more. This large increase allows simple interface with relay or Thyristor controls. Probe functions on AC or DC without regard for polarity. Stainless steel is used to minimize corrosion.





Order Number	Resistance at 25°C (Ohms) ± 40%	Activation Temperature ± 5°C	Resistance at Activation Temperature
9RT1P106	2000	100°C	10,000
9RT1P101	2000	113°C	10,000
9RT1P107	2000	120°C	10,000
9RT1P108	2000	125°C	10,000

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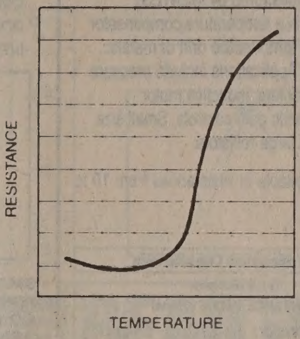
PTC SWITCHING THERMISTORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

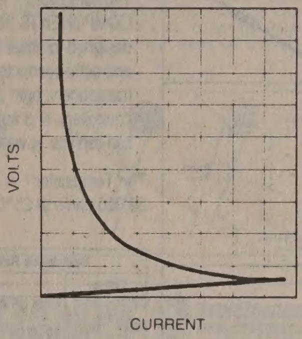
THE POSITIVE WAY TO SENSE, MEASURE, CONTROL, REGULATE AND PROTECT.

MIDWEST COMPONENTS INC. PTC **switching thermistors** are thermally sensitive resistors which exhibit large positive increases in resistance with temperature. At customer specified temperatures the resistance rises abruptly from a low value to a high value. This resistance shift is infinitely repeatable and has no hysteresis associated with its action.

TYPICAL PTC RESISTANCE VS. TEMPERATURE CURVE



TYPICAL VOLTAGE CURVE VS. CURRENT



• DISCRETE PTCS

Popular styles for current limiting or sensing. Most types come standard with protective coatings

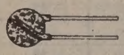


Fig. 1

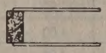


Fig. 2

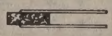


Fig. 3

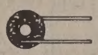


Fig. 4

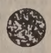


Fig. 5

ORDER NUMBER	FIG	SWITCH TEMPERATURE	BASE RESISTANCE	TEST PARAMETERS	NOMINAL DIMENSIONS	Protective Coating (✓)
100D10117	1	0°C ± 5°C	100 ohms ± 40% @ −35°C	R @ 0°C ± 5°C 500 ohms ± 40%	42" Dia 05" Thk	
108D10001	5	8°C ± 10°C	10 ohms ± 40% @ −35°C	R @ 50°C = 3000 ohms min	65" Dia 05" Thk	
110Q20101	3	10°C ± 5°C	250 ohms ± 40% @ −35°C	R @ 10°C ± 5°C = 1250 ohms ± 40%	30" x 10" x 15"	
130D25000	5	30°C ± 5°C	25 ohms ± 20% @ −5°C	R @ 30°C ± 5°C = 5 x R 25°C ± 20%	78" Dia 08" Thk	
140D25001	1	40°C ± 5°C	25 ohms ± 50% @ 25°C	R @ 50°C = 125 ohms ± 50%	38" Dia 065" Thk	
150Q80112	2	50°C ± 5°C	750 ohms ± 33% @ 25°C	R @ 50°C ± 5°C = 3 750 ohms ± 33%	30" x 10" x 15"	
160D10116	1	60°C ± 5°C	100 ohms ± 40% @ 25°C	R @ 60°C ± 5°C = 5 x R 25°C Protective Current Level = 20 ma	3" Dia 20" Thk	✓
165D15001	5	65°C ± 5°C	15 ohms ± 33% @ 25°C	R @ 65°C ± 5°C 75 ohms ± 33%	58" Dia 050" Thk	
165Q80111	2	65°C ± 5°C	750 ohms ± 33% @ 25°C	R @ 65°C ± 5°C = 3 750 ohms ± 33%	30" x 10" x 15"	
170D10117	1	70°C ± 5°C	100 ohms ± 40% @ 25°C	R @ 70°C ± 5°C = 5 x R 25°C Protective Current Level = 40 ma	3" Dia 20" Thk	✓
175Q15114	3	75°C ± 5°C	150 ohms ± 30% @ 25°C	R @ 75°C ± 5°C = 750 ohms ± 30%	30" x 10" x 15"	
180D10113	1	80°C ± 5°C	100 ohms ± 40% @ 25°C	R @ 80°C ± 5°C = 5 x R 25°C Protective Current Level = 60 ma	340" Dia 240" Thk	✓
180D15015	5	80°C ± 5°C	15 ohms ± 40% @ 25°C	R @ 80°C ± 5°C = 75 ohms ± 40%	48" Dia 15" Thk	

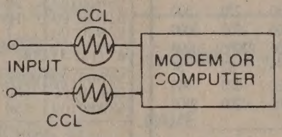
ORDER NUMBER	FIG	SWITCH TEMPERATURE	BASE RESISTANCE	TEST PARAMETERS	NOMINAL DIMENSIONS	Protective Coating (✓)
180Q20206	2	80°C ± 5°C	2000 ohms ± 40% @ 25°C	R @ 80°C ± 5°C = 10 000 ohms ± 40%	45" x 12" x 15"	
180W30115	4	80°C ± 5°C	300 ohms ± 50% @ 25°C	R @ 80°C ± 5°C = 1500 ohms ± 50%	6"O D 4"I D 17" Thk	
185D10102	1	85°C ± 5°C	100 ohms ± 20% @ 25°C	R @ 85°C ± 5°C = 500 ohms ± 20%	25" Dia 15" Thk	✓
195Q80115	2	95°C ± 5°C	750 ohms ± 33% @ 25°C	R @ 95°C ± 5°C = 3 750 ohms ± 33%	30" x 10" x 15"	
200D40012	1	100°C ± 5°C	40 ohms ± 40% @ 25°C	R @ 100°C ± 5°C = 200 ohms ± 40%	30" Dia 20" Thk	✓
200D65011	1	100°C ± 5°C	65 ohms ± 38% @ 25°C	R @ 100°C ± 5°C = 5 x R 25°C Protective Current Level = 80 ma	4" Dia 275" Thk	✓
220Q32214	2	120°C ± 5°C	3200 ohms ± 25% @ 25°C	R @ 120°C ± 5°C = 16 000 ohms ± 25%	30" x 10" x 15"	✓
222W75101	4	122°C ± 5°C	750 ohms ± 33% @ 25°C	R @ 122°C ± 5°C = 3 750 ohms ± 33%	6"O D 38"I D 17" Thk	
223D80011	1	123°C ± 5°C	8 ohms ± 40% @ 25°C	R @ 123°C ± 5°C = 40 ohms ± 40%	6" Dia 20" Thk	✓
225D10102	1	125°C ± 5°C	100 ohms ± 40% @ 25°C	R @ 125°C ± 5°C = 5 x R 25°C Protective Current Level = 100 ma	40" Dia 25" Thk	✓
225D28011	1	125°C ± 5°C	28 ohms ± 27% @ 25°C	R @ 125°C ± 5°C = 140 ohms ± 27%	28" Dia 23" Thk	
227D11212	1	127°C ± 5°C	1100 ohms ± 40% @ 25°C	R @ 127°C ± 5°C = 5500 ohms ± 40%	1" Dia 160" Thk	
227D60010	1	127°C ± 5°C	60 ohms ± 40% @ 25°C	R @ 127°C ± 5°C = 5 x R 25°C Protective Current Level = 125 ma	6" Dia 30" Thk	✓

ALL LEADS TINNED COPPER 1" MINIMUM

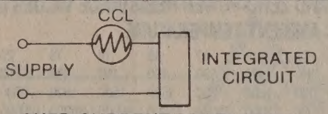
• CURRENT LIMITERS

The ceramic element protects circuits from destructive overcurrent conditions by switching to a high resistance which trims the current back to a safe level. The unit then recovers automatically when the overcurrent condition is corrected.

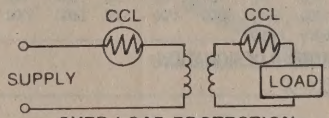
The ceramic current limiter is an inexpensive alternative to fuses and fixed resistors. It has obvious advantages over all of these since it has infinite life, is self resetting which eliminates field servicing and will not "flame out" eliminating the fire hazard of fixed resistors.



DATA COMMUNICATIONS LINE PROTECTOR



OVER-CURRENT PROTECTION



OVER-LOAD PROTECTION

ORDER NUMBER	MAXIMUM Ω @ 25°C	MAXIMUM VOLTS DC	NOMINAL CON-TINUOUS CURRENT	RESIDUAL CURRENT @ APPLIED VOLTAGE 50VDC	100VDC	150VDC	NOMINAL DIMENSIONS IN INCHES
CCL020.01	140 Ω	125	20 MA	8 MA	6 MA	N/A	.23 dia. x .1 thk.
CCL060.01	86 Ω	150	60 MA	16 MA	10 MA	8 MA	.4 dia. x .3 thk.
CCL100.01	40 Ω	150	100 MA	19 MA	13 MA	11 MA	.4 dia. x .3 thk.
CCL140.01	80 Ω	150	140 MA	23 MA	15 MA	13 MA	.56 dia. x .25 thk.
CCL150.01	23 Ω	150	150 MA	24 MA	16 MA	14 MA	.65 dia. x .32 thk.
CCL300.01	10 Ω	70	300 MA	31 MA	N/A	N/A	.55 dia. x .14 thk.
CCL450.01	12 Ω	100	450 MA	40 MA	30 MA	N/A	.6 dia. x .07 thk.

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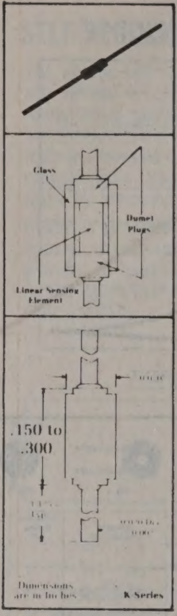
For More Information. Circle No. 489

TEMPSISTOR

TEMPSISTOR
TEMPERATURE
COMPENSATOR

MANUFACTURED BY MIDWEST COMPONENTS, INC.



The Tempsistor© manufactured by MIDWEST COMPONENTS INC. is a temperature compensator designed to offset the temperature drift of metallic and semi-conductors. Applications include pressure transducers, opto amplifiers, inductive motor controllers, and automatic gain controls. Small size can replace ⅛ watt or large resistors.

The Tempsistor© is available in resistances from 10 to 39,000 ohms at 25°C.

Resistance Ratio Temperature Characteristics					
Temp.		R / R Multiplier			
		RESISTANCE VALUE (Ohms)			
°C	°F	10-56 Ω	68-820 Ω	1-2.7K Ω	3.3-39K Ω
−25	−13	.73	.65	.65	.61
0	32	.86	.82	.81	.83
25	77	1.00	1.00	1.00	1.00
50	122	1.15	1.21	1.19	1.19
75	167	1.32	1.44	1.39	1.37
100	212	1.49	1.68	1.58	1.52
125	257	1.68	1.94	1.75	
150	302	1.89	2.21		

TEMPSISTOR© SPECIFICATIONS

DISSIPATION CONSTANT -
Style 1K and 2K = 2.5 MW/ºC.
Style 3K = 5 MW/ºC

TIME CONSTANT - *
Style 1K and 2K = 8 sec. in still air, 1 sec in rapidly stirred oil.
Style 3K = 19 sec. in still air, 2.2 sec. in rapidly stirred oil.

STANDARD ZERO-POWER RESISTANCE VALUES (Ohms)
at 25ºC AMBIENT TEMPERATURE

10	11	12	13	15	16	18	20	22	24	27	30
100	110	120	130	150	160	180	200	220	240	270	300
1000	1100	1200	1300	1500	1600	1800	2000	2200	2400	2700	3000
10000	11000	12000	13000	15000	16000	18000	20000	22000	24000	27000	30000
33	36	39	43	47	51	56	62	68	75	82	91
330	360	390	430	470	510	560	620	680	750	820	910
3300	3600	3900	4300	4700	5100	5600	6200	6800	7500	8200	9100
33000	36000	39000									

PART NUMBER DESIGNATION:
XX — XXX—X

SPECIFY ONE OF THREE CHOICES FOR FIRST 2 DIGITS
1K — Resistance range 10-820 .150" long body Max. Operate Temp. 150ºC.
2K — Resistance range 1K-3.0K .150" long body Max. Operate Temp. 125ºC.
3K — Resistance range 3.3K-39K .350" long body Max. Operate Temp. 100ºC.
ALL STYLES WILL WITHSTAND 400ºC. WITHOUT PHYSICAL OR ELECTRICAL DAMAGE.

NEXT 3 DIGITS DENOTE RESISTANCE VALUE AT 25ºC.
1st digit denotes 1st significant figure
2nd digit denotes 2nd significant figure
3rd digit denotes multiplier by the power of 10

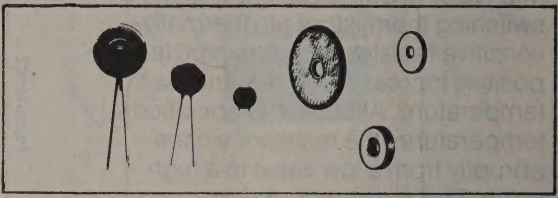
LAST DIGIT OF PART NUMBER DENOTES TOLERANCE AT 25ºC.
L — ±20% K — ±10% (standard) J — ±5%

EXAMPLE OF PART NUMBER SPECIFICATION
2K — 272 — K
Part would be a .150" long body, 2.7 K ±10% @25ºC.

VARISTORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

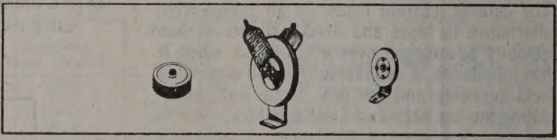
Varistor manufactured by MIDWEST COMPONENTES INC. offer inexpensive answers to problems of transient, surge, and lighting suppression. Energy handling capabilities are limitless depending upon size and construction of devices.



SMALL TYPE DISCS DESIGNED FOR PROTECTION OF CONTACTORS, RELAYS, AND SOLID STATE COMPONENTS

3" (76.2) AND 6" (152.4) DIAMETER DISCS FOR MEDIUM POWER APPLICATIONS ALLOW FOR CUSTOM ASSEMBLIES FOR POWER SUPPLY COMPONENTS

Catalog Number	Maximum Values						Specifications	
	Continuous Operating Voltage (Volts)		Continuous Power Rating (Watts)	Discharge Capacity (Watt-Seconds)	Peak Discharge -Voltage for Given DC Discharge Current		DC Test Voltage & Current	
	(DC)	(AC)			(Amps)	(Volts)	(Volts ±20)%	(Amps)
.5" (12.7) DIA.								
70D5010	150	135	25	30	10	400	175	001
68D5010	60	54	25	30	10	200	75	0025
67D5010	30	27	25	30	25	100	35	005
65D5010	15	13 5	25	20	25	60	15	010
.75" (19.05) DIA.								
71D7000	150	135	75	50	125	400	175	.005
68D7000	60	54	75	50	25	185	70	0125
66D7000	30	27	75	50	25	185	70	0125
63D7000	15	13 5	75	50	.50	100	35	.025
1.0" (25.4) DIA.								
71D10000	300	270	1 5	275	25	1000	350	005
68D10000	150	135	1 5	275	.50	575	175	010
66D10000	60	54	1 5	275	1 0	305	70	025
63D10000	30	27	1 5	275	1 5	175	35	050
3" (76.2) DIA.								
71W30100	1500	1350	3 5	9,250	10	7500	1800	0.0025
69W30100	300	270	3 0	5,100	1 5	1350	520	0 050
68W30100	150	135	3 0	5,100	2 5	800	230	0.050
67W30100	60	54	3 0	1,700	5 0	250	85	0 100
66W30100	30	27	3 0	1,700	5 0	150	36	0 100
63W30100	15	13 5	3 0	1,350	10	100	25	0.500
62W30100	7	6 3	3 0	1,100	10	40	9	0 500
6" (152.4) DIA.								
69W60100	275	250	10	22,500	10	1200	550	0 500
68W60200	200	180	10	22,500	12 5	990	400	0 500
68W60100	150	135	10	22,500	15	780	300	0 500



3" (76.2) AND 6" (152.4)
ASSEMBLIES FOR HIGH ENERGY USES. ALL UNITS HAVE STANDARD BRACKET MOUNTS AND SOLDERLESS TERMINALS FOR FAST CONNECTION

Type	Catalog Number	Continuous DC Operating Voltage Rating (Volts)	Continuous Power Loss in Operation (Watts)	Discharge Capacity (Watt-Seconds)
BRACKET	9RV3A12	150	3	5,100
	9RV3A14	300	3	5,100
	9RV3A15	600	6	10,200
	9RV6A4	150	40	90,000
	9RV6A5	300	20	45,000
	9RV6A6	275	10	22,500
	9RV6A7	275	20	45,000
	9RV6A8	275	30	67,500
	9RV6A9	275	40	90,000
	9RV6A10	550	20	45,000
BOX	9RV6A65	550	120	270,000
	9RV6A55	550	240	540,000

MIDWEST
COMPONENTS
INC.

MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

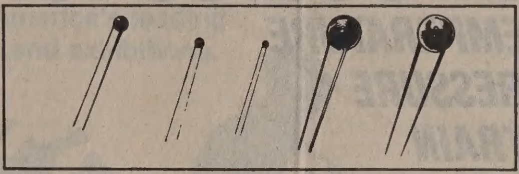
NTC THERMISTORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

• TEMPERATURE COMPENSATION AND SENSING

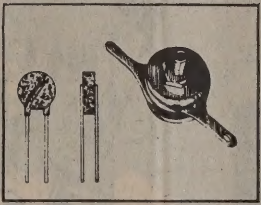
Type	Ohms @ 25°C	Res. Ratio 25°C/125°C	Diss. Const. MW/°C	Time Const.	Dia. In.
4D101	100K	48.78	4	12	.1
4D103	50K	48.78	4	8	.1
1D051	20K	29.85	2	4.5	.05
1D101	10K	29.85	4	12	.1
1D103	5K	29.85	4	8	.1
1D201	3K	29.85	8	34	.2
1D501	1K	29.85	19	140	.5
2D054	1K	19.80	2	3	.05
2D102	1K	19.80	4	10	.1
2D104	500	19.80	4	6	.1
2D202	300	19.80	8	24	.2
3D504	5	12.95	15.5	70	.5
4D051	200K	48.78	2	4.5	.05

Disc Series Thermistors are small rugged Thermistors with close electrical tolerances. Their small mass gives short thermal time constants, yet they are not so small that it is difficult to handle them. The tinned copper leads are easily soldered into electrical circuits.



SUPPRESSORS

INRUSH CURRENT SUPPRESSORS FOR SWITCHING POWER SUPPLIES.



Switching power supplies present high initial currents due to filter capacitor impedance upon turn-on. The use of Midwest's NTC (Negative Temperature Coefficient) devices limits this current to a low valve. After current flow their resistance becomes negligible and offers little voltage drop.

MCI P/N	Description	FIG.	Size	Cold Resistance at 25°C	Maximum Applied Current	Hot Resistance At Specified Current
D204CS	Radial Leaded Disc	A	.2" Dia	10 Ohms	1 Amp	.5 Ohms
D304CS	Radial Leaded Disc		.3" Dia	10 Ohms	2 Amps	.50 Ohms
D504CS	Radial Leaded Disc		.5" Dia	5 Ohms	3 Amps	.3 Ohms
D752CS	Radial Leaded Disc		.75" Dia	2.5 Ohms	4 Amps	.18 Ohms
1752CS	Radial Leaded Disc		.75" Dia	2.5 Ohms	5 Amps	.1 Ohms
1A8CS	Assembly	B	.75" Dia	3.15 Ohms	7.5 Amps	.11 Ohms
1A9CS	Assembly		.75" Dia	1 Ohm	10 Amps	.055 Ohms
2A0CS	Assembly		.75" Dia	1 Ohm	12 Amps	.045 Ohms
3A9CS	Assembly		.75" Dia	1 Ohm	15 Amps	[illegible] Ohms

BEAD PROBES

Glass coated bead Thermistors feature SMALL SIZE, FAST RESPONSE, and improved HIGH-TEMPERATURE STABILITY. Leads are fired-in platinum-iridium. Bead probes, incorporating the bead in the tip of a glass probe, offer the additional advantages of more rugged construction in an easy to mount package which can be used in liquid media. Tinned Dumet leads are supplied on probes. The maximum operating temperature for beads and bead probes is 400°C.

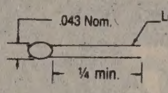


FIGURE 1

Outline Drawings
(Dim. in inches)

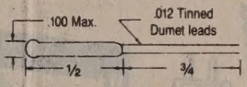


FIGURE 2
Bead probes also available in 2" lengths

TYPE	Zero Power Resistance at 25°C ohms ± 20%	Catalog Number	Resistance Ratio R25°C/R125°C ± 5%	Dissipation Constant (δ) Milliwatts/°C	Thermal Time Constant (τ) Seconds	Figure Number
Bead Probe	2000	8IG 20250	19.8	1	25	2
	10,000	8IG 10350	29.85			
	15,000	8IG 15350	29.85			
	50,000	8IG 50350	36.0			
	150,000	8IG 15450	39.7			
	500,000	8IG 50450	46.5			
	1,000,000	8IG 10550	51.5			

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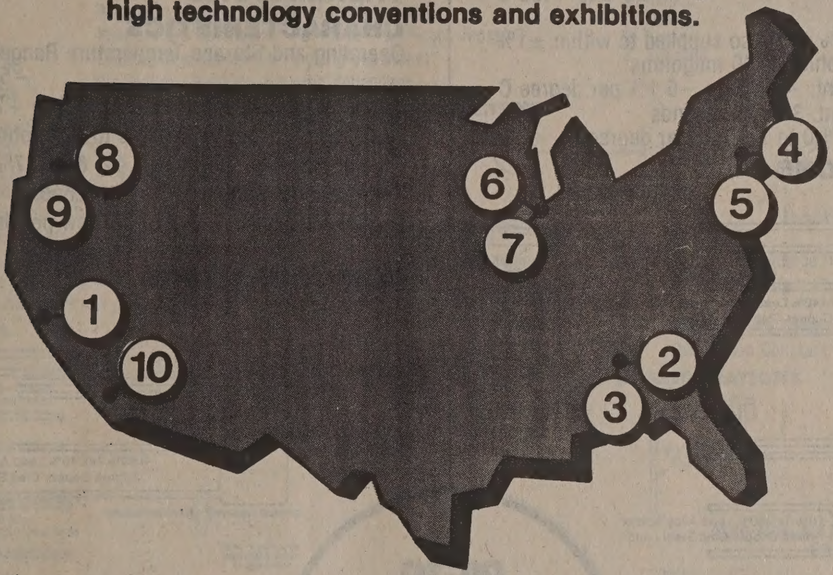

1 **Mini/Micro** *West*
February 5, 6, 7, 1985
Anaheim Hilton Exposition Center
Anaheim, California

2 **Southcon**
March 5, 6, 7, 1985
Georgia World Congress Center
Atlanta, Georgia

3 **Mini/Micro** *Southeast*
March 5, 6, 7, 1985
Georgia World Congress Center
Atlanta, Georgia

4 **Electro**
April 23, 24, 25, 1985
New York Coliseum
New York

5 **Mini/Micro** *Northeast*
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New York

6 **Midcon**
September 10, 11, 12, 1985
Rosemont Exposition Center
Chicago, Illinois

7 **Mini/Micro** *Midwest*
September 10, 11, 12, 1985
Rosemont Exposition Center
Chicago, Illinois

8 **Northcon**
October 22, 23, 24, 1985
Portland Memorial Coliseum
Portland, Oregon

9 **Mini/Micro** *Northwest*
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Portland Memorial Coliseum
Portland, Oregon

10 **Wescon**
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PIEZO THERMISTORS

NTC WAFER THERMISTORS

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +150°C

Resistance Tolerance: ±10% std. Also supplied to within ±1%

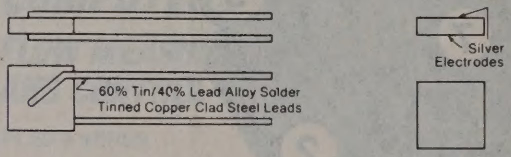
Resistance Range: 3 ohms to 10 megohms

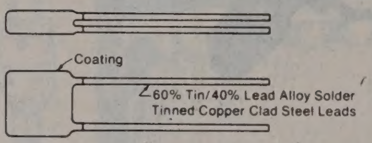
Temperature Coefficient: −3.4% to −6.1% per degree C

Thermal Time Constant: 3 to 23 seconds

Dissipation Constant: 1.0 to 7.9 mw per degree C

CONFIGURATIONS


Silver Electrodes
60% Tin/40% Lead Alloy Solder Tinned Copper Clad Steel Leads


Coating
60% Tin/40% Lead Alloy Solder Tinned Copper Clad Steel Leads

ALSO AVAILABLE: PHENOLIC + WAX COATING OR EPOXY COATING

NTC PRECISION INTERCHANGEABLE WAFER THERMISTORS

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +150°C

Temperature Tolerance: ±0.2°C (0°C to +70°C)

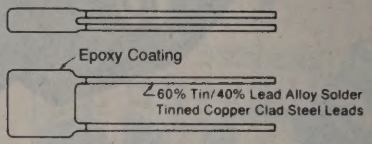
Resistance Range: 1000 ohms to 100K ohms

Temperature Coefficient: −4.4% & −4.7% per degree C

Thermal Time Constant: 3 to 9 seconds

Dissipation Constant: 1.3 to 3.0 mw per degree C

CONFIGURATIONS


Epoxy Coating
60% Tin/40% Lead Alloy Solder Tinned Copper Clad Steel Leads

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800-922-0504

NTC BEAD-IN-GLASS THERMISTORS

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +300°C

Resistance Tolerance: ±20% std. Also supplied to within ±1%

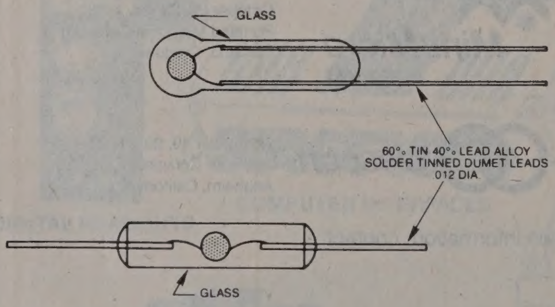
Resistance Range: 500 ohms to 500K ohms

Temperature Coefficient: −3.6% to −5.1% per degree C

Thermal Time Constant: 20 to 22 seconds

Dissipation Constant: .8 to 1.0 mw per degree C

CONFIGURATIONS


GLASS
60% TIN 40% LEAD ALLOY SOLDER TINNED DUMET LEADS .012 DIA
GLASS

NTC BEAD THERMISTORS

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +300°C

Resistance Tolerance: ±20% std. Also supplied to within ±1%

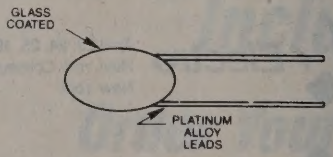
Resistance Range: 500 ohms to 5 megohms

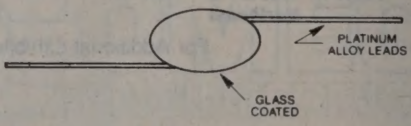
Temperature Coefficient: −3.4% to −5.6% per degree C

Thermal Time Constant: 1 to 2 seconds

Dissipation Constant: .1 to .7 mw per degree C

CONFIGURATIONS


GLASS COATED
PLATINUM ALLOY LEADS


PLATINUM ALLOY LEADS
GLASS COATED

Piezo also manufactures Microwave Probes, piezo elements, shapes, CATTS and fans. Our engineering department is prepared to analyze your PTC requirements. As one of the nation's largest manufacturers of thin-sheet piezo and thermistor hardware, we will provide you with the highest quality thermistor products at competitive prices.

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from PIEZO ELECTRIC PRODUCTS, INC.

NTC THERMISTOR PROBE ASSEMBLIES

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +150°C

Temperature Tolerance: Can be supplied to within ±0.2°C

Resistance Range: 1000 ohms to 100K ohms

Temperature Coefficient: −3.4% to −6.1% per degree C

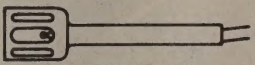
Thermal Time Constant: Housing dependent

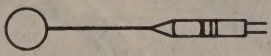
Dissipation Constant: Housing dependent

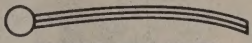
HOUSING MATERIALS

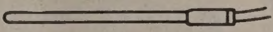
1. Stainless Steel
2. Aluminum
3. Copper
4. Plastic
5. Epoxy
6. Brass
7. Specials

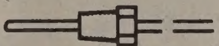
CONFIGURATIONS


AIR TEMP PROBE


MEDICAL PROBE


SURFACE TEMP. PROBE


LIQUID TEMP. PROBE


STUD MOUNTED

NTC DISC THERMISTORS

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +150°C

Resistance Tolerance: ±10% std. Also supplied to within 1%

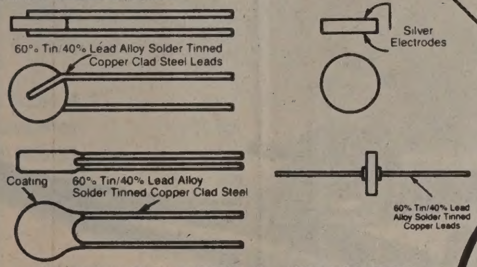
Resistance Range: 20 ohms to 10K ohms

Temperature Coefficient: −3.8% & −4.4% per degree C

Thermal Time Constant: 9 to 175 seconds

Dissipation Constant: 3 mw to 16 mw per degree C

CONFIGURATIONS


Silver Electrodes
60% Tin/40% Lead Alloy Solder Tinned Copper Clad Steel Leads
Coating
60% Tin/40% Lead Alloy Solder Tinned Copper Clad Steel
60% Tin/40% Lead Alloy Solder Tinned Copper Leads

ALSO AVAILABLE: PHENOLIC + WAX COATING OR EPOXY COATING

NTC ROD THERMISTORS

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +150°C

Resistance Tolerance: ±10% std. Also supplied to within ±1%

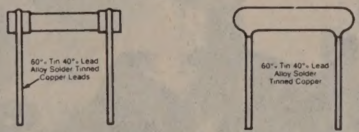
Resistance Range: 3K ohms to 150K ohms

Temperature Coefficient: −3.8% & 4.4% per degree C

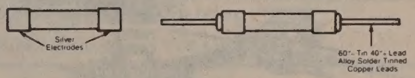
Thermal Time Constant: 20 to 95 seconds

Dissipation Constant: 3 to 6 mw per degree C

CONFIGURATIONS


60% Tin 40% Lead Alloy Solder Tinned Copper Leads
60% Tin 40% Lead Alloy Solder Tinned Copper

ALSO AVAILABLE: PHENOLIC + WAX COATING OR EPOXY COATING


Silver Electrodes
60% Tin 40% Lead Alloy Solder Tinned Copper Leads

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800-922-0504

NTC GLASS ENCAPSULATED THERMISTORS

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +204°C

Resistance Tolerance: ±10% std. Also supplied to within ±1%

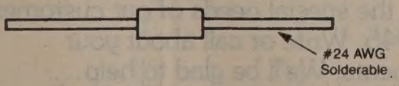
Resistance Range: 1000 ohms to 1 megohm

Temperature Coefficient: −3.8% to −4.7% per degree C

Thermal Time Constant: 8 seconds

Dissipation Constant: 2 mw per degree C

CONFIGURATION


#24 AWG Solderable

NTC CHIP THERMISTORS

CHARACTERISTICS

Operating and Storage Temperature Range: −55°C to +150°C

Resistance Tolerance: ±10% std. Also supplied to within ±1%

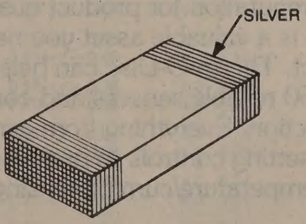
Resistance Range: 500 ohms to 2 megohms

Temperature Coefficient: −3.4% to −4.7% per degree C

Thermal Time Constant: 4 seconds

Dissipation Constant: 2 mw per degree C

CONFIGURATION



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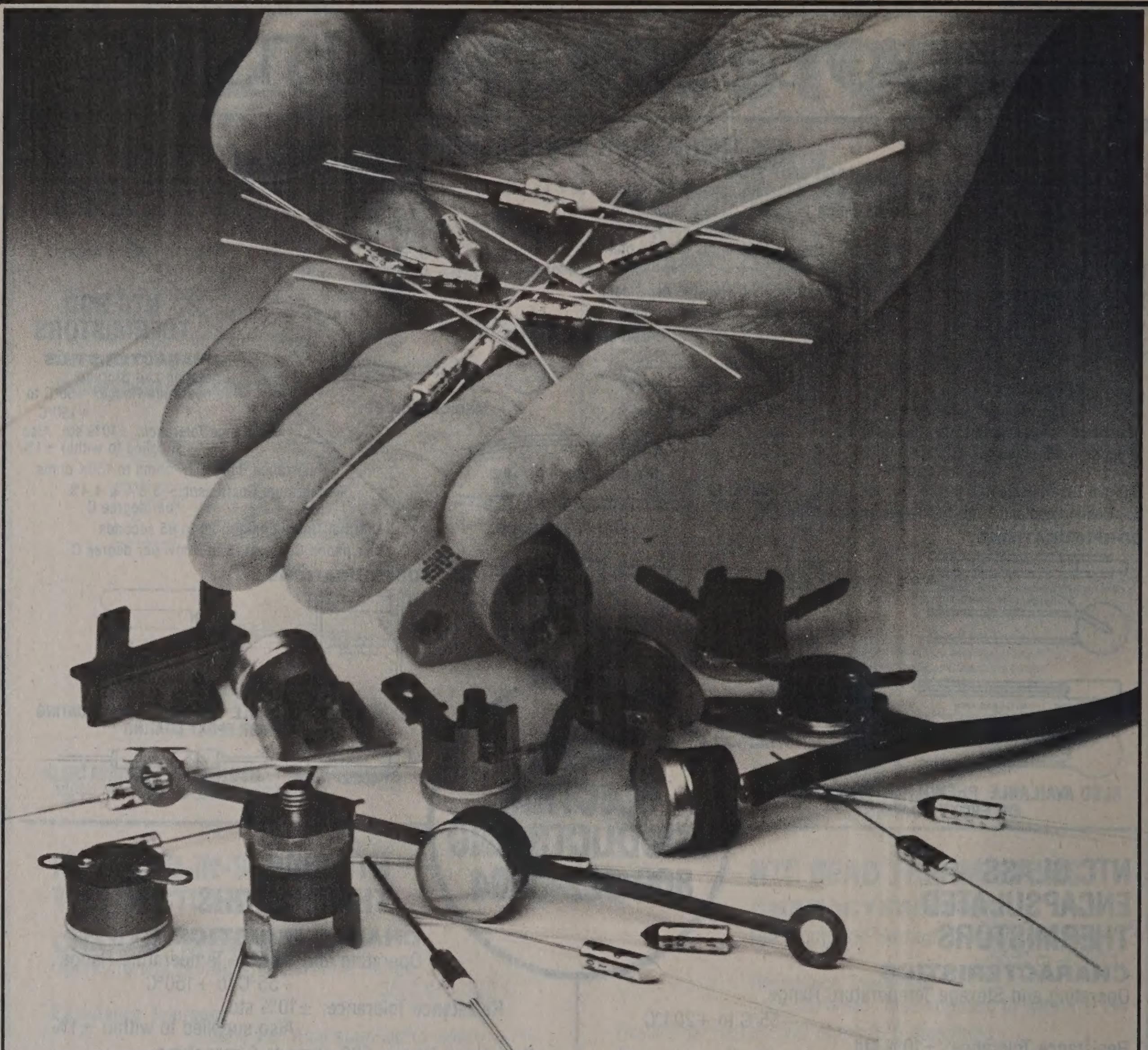

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VECO Chip Thermistors complement our thick film thermistors (Thinistors®) which are available in a wide variety of substrates and mounting configurations for non-contact sensing (IR detection).

CHIP THERMISTOR—(End Banded)

VECO Part No.	Zero Power Resistance R@ 25°C (Ohms ±10%)	Ratio R@ 0°C/R@ 50°C ± 5%	Ratio Code Letter
65SJ3B103	5,000,000	13	J
62SJ3B105	2,000,000	13	J
61SI3B105	1,000,000	11	I
55SI3B105	500,000	11	I
51SF3B103	100,000	9.1	F
45SF3B106	50,000	9.1	F
42SF3B106	20,000	9.1	F
41SC3B104	10,000	6.8	C
35SC3B107	5,000	6.8	C
32SB3B103	2,000	5.6	B
31SB3B105	1,000	5.6	B
25SB3B105	500	5.6	B

CHIP THERMISTOR—(Top & Bottom Metalization)

VECO Part No.	Zero Power Resistance R@ 25°C (Ohms ±10%)	Ratio R@ 0°C/R@ 50°C ± 5%	Ratio Code Letter
71SM0B063	10,000,000	24 Ø	M
65SK0B103	5,000,000	24 Ø	M
62SJ0B045	2,000,000	13, 15*	J,K*
61SJ0B043	1,000,000	13, 15*	J,K*
55SJ0B063	500,000	13	J
50SJ0B104	250,000	13	J
51SP0B063	100,000	10.45*,11*,12	Q*,I*,P
45SP0B103	50,000	10.45*,11*,12	Q*,I*,P
43SF0B045	30,000	8.7*,9.1,11*	E*,F,I*
40SF0B045	25,000	8.7*,9.1	E*,F
42SF0B044	20,000	8.7*,9.1	E*,F
41SF0B043	10,000	8.7*,9.1	E*,F
36SF0B043	6,000	8.7*,9.1	E*,F
35SF0B043	5,000	8.7*,9.1	E*,F
30SF0B063	2,500	9.1	F
32SF0B063/1	2,252	9.1	F
32SF0B063	2,000	9.1	F
31SC0B043	1,000	6.3*6.8,9.1*	N*,C,E*
25SC0B063	500	6.3*,6.8	N*,C
20SC0B105	250	6.3*,6.8	N*,C
21SC0B123	100	6.3*,6.8	N*,C

Above codes are for ratios with no* for ratio code letters
NOTE: Ø ± 6% Ratio
*Also available, size may vary slightly from nominal size

Explanation of Part No. Code

6 2	S	J	3	B	1 0	5
Resistance (Ohms), No. of Zeros after 1st digit + 1st Digit	Product Code S= Chip	Material Code Letter	Termination Number 3=No leads end banded contacts	Coating B=no coat	Chip Size length (inches) X100	Chip Thickness (inches) X200

VECO'S NEW METAL OXIDE CERAMIC THERMISTOR FOR CURRENT LIMITING

The newest VECO thermistors use the latest in innovative ceramics technology to limit peak inrush current when an electrical circuit is switched on. It extends the operating life of other components in a switching power supply, or many other circuits, due to its inrush current limiting capability.

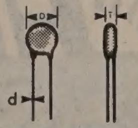
	ELECTRICAL CHARACTERISTICS			MECHANICAL DATA					
VICTORY P/N	No Load Resistance @25° C. +/−25%	1 Maximum Steady State Current	R. Maximum Resistance @ Maximum Current	Diameter (D)		Maximum Thickness (T)		Lead Diameter (d)	
	(Ohms)	(Amps)	(Ohms)	mm	Inch	mm	Inch	mm	Inch
V15-025-03	2.5	3	0.20	15 +/− 2	0.59 +/− 0.08	6.0	0.24	0.8	0.031
V15-025-07	2.5	7	0.07	15 +/− 2	0.59 +/− 0.08	6.0	0.24	0.8	0.031
V15-025-09	2.5	9	0.06	15 +/− 2	0.59 +/− 0.08	6.0	0.24	0.8	0.031
V20-025-10	2.5	10	0.05	20 +/− 2	0.79 +/− 0.08	6.0	0.24	1.0	0.040
V20-025-15	2.5	15	0.03	20 +/− 2	0.79 +/− 0.08	6.0	0.24	1.0	0.040
V15-050-02	5.0	2	0.50	15 +/− 2	0.59 +/− 0.08	6.0	0.24	0.8	0.031
V15-050-04	5.0	4	0.20	15 +/− 2	0.59 +/− 0.08	6.0	0.24	0.8	0.031
V15-050-07	5.0	7	0.08	15 +/− 2	0.59 +/− 0.08	6.0	0.24	0.8	0.031
V10-100-03	10	3	0.30	10 +/− 1	0.39 +/− 0.04	6.0	0.24	0.8	0.031
V20-100-02	10	2	0.65	20 +/− 2	0.79 +/− 0.08	6.0	0.24	1.0	0.040
V20-100-03	10	3	0.40	20 +/− 2	0.79 +/− 0.08	6.0	0.24	1.0	0.040
V20-100-04	10	4	0.25	20 +/− 2	0.79 +/− 0.08	6.0	0.24	1.0	0.040
V20-100-05	10	5	0.20	20 +/− 2	0.79 +/− 0.08	6.0	0.24	1.0	0.040
V15-400-02	40	2	0.70	15 +/− 2	0.79 +/− 0.08	6.0	0.24	0.8	0.031

MAX OPERATING TEMPERATURE 65°C

PARTS ARE EPOXY COATED

NOTES:
1. Metal Oxide Ceramic Thermistors can be used in AC or DC circuit locations.
2. If the resistance of one Metal Oxide Ceramic Thermistor does not provide sufficient current limiting, two or more may be used in series. This device cannot be used in parallel since the tendency is for one unit to conduct most of the available current.
3. Due to self-heat, the devices require a cool-down time after power is turned off. The time will vary with the particular application, heat dissipation, ambient temperature and mounting method.

V 15 025 07
07 — Steady State Current
025 — No Load Resistance
15 — Case Size
V — Veco Symbol



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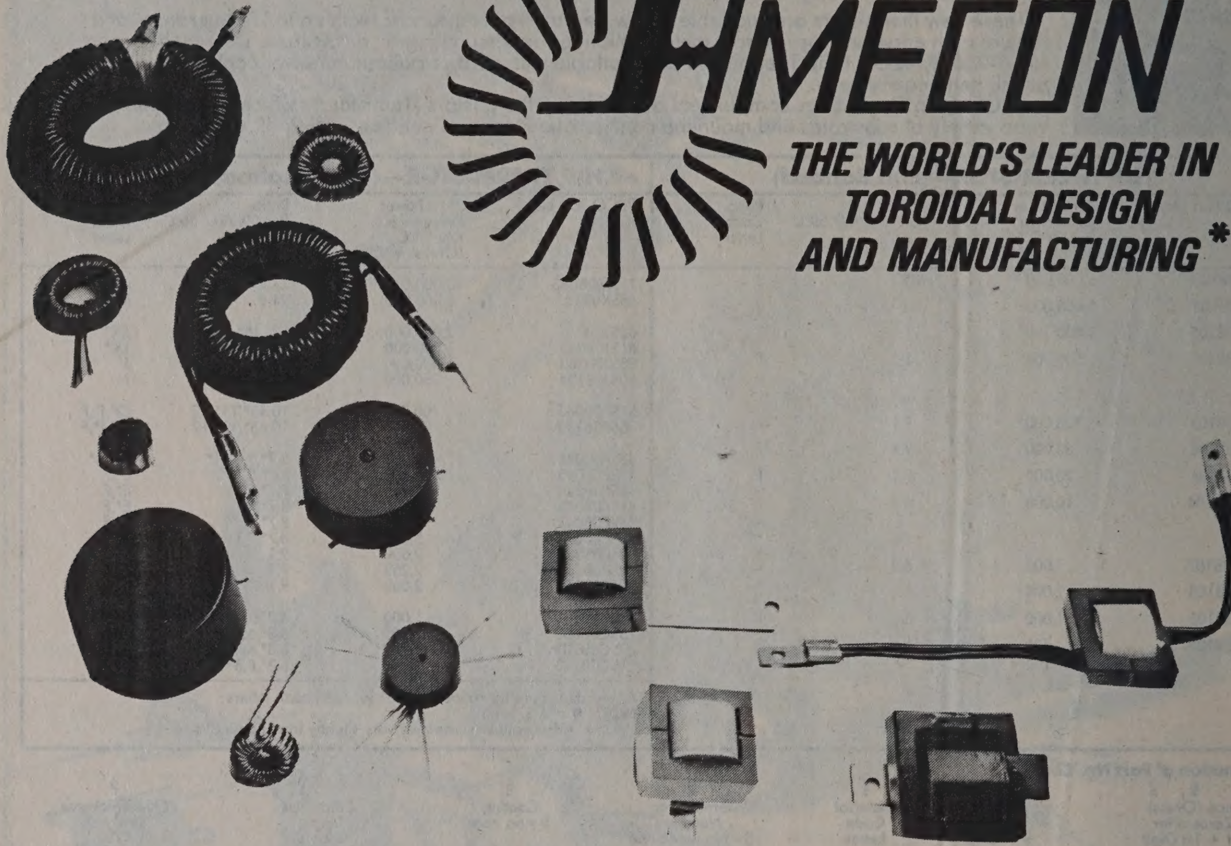

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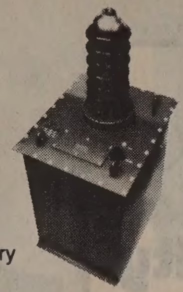
For More Information. Circle No. 494

High Voltage Line Isolation Transformers In Oil Insulating Tanks



Model 3–TR–150–11

FEATURES:

- ▼ Complete varnish impregnation under vacuum
- ▼ Epoxy anchoring
- ▼ Immersed in high grade insulating oil*
- ▼ Electrostatic shield between primary and secondary windings
- ▼ "AN" type connector provided for input connections
- ▼ Good regulation

*Note: Shipped without oil to minimize transportation charges, except when otherwise specified in order.

SPECIFICATIONS:

- ▼ Each model available with porcelain output insulator
- ▼ Models also available with two shielded polyethylene output cables in place of porcelain insulator
- ▼ Standard types available for 120V and 240V input lines in 1:1, 1:2, and 2:1 voltage ratios with other input and output voltages available upon request
- ▼ Recommended for industrial, research, and developmental applications

Standard 60Hz Types

Model No.*	Max. kVA	kV dc Insulation	Tank Size (in.) (W X D X H)**	Insulator Height (in.)***
1-TR-30-XX	1	30	10 X 12 X 11	6
1.5-TR-30-XX	1.5	30	13 X 13⅞ X 16½	6
1-TR-50-XX	1	50	13 X 13⅞ X 16⅜	8½
3-TR-50-XX	3	50	13 X 13⅞ X 16⅜	8½
1-TR-60-XX	1	60	9¾ X 12⅜ X 13⅜	11
2-TR-60-XX	2	60	16½ X 16½ X 21⅜	11
3-TR-60-XX	3	60	16½ x 16½ X 21⅜	11
5-TR-60-XX	5	60	16½ X 16½ X 21⅜	11
3-TR-75-XX	3	75	16½ X 16½ X 22	11
1-TR-100-XX	1	100	20¾ X 17½ X 17 13/16	14
3-TR-100-XX	3	100	20¾ X 17½ X 17 13/16	14
3-TR-150-XX	3	150	15½ X 18¾ X 24	19½
5-TR-150-XX	5	150	15½ X 18¾ X 24	19½
0.5-TR-250-XX	0.5	250	25 X 33 X 37 5/16	28¾
2-TR-250-XX	2	250	25 X 33 X 37 5/16	28¾
3-TR-250-XX	3	250	29¾ X 29¾ X 36⅜	28¾
5-TR-250-XX	5	250	25 X 33 X 37¼	28¾
4-TR-300-XX	4	300	39½ X 47½ X 50½	35
Models With Shielded Cables Instead Of Porcelain Insulator:				
0.5-CTR-250-XX	0.5	250	25 X 33 X 37 5/16	
2-CTR-250-XX	2	250	25 X 33 X 37 5/16	
3-CTR-250-XX	3	250	29¾ X 29¾ X 36⅜	
4-CTR-300-XX	4	300	25 X 33 X 37¼	
5-CTR-250-XX	5	250	39½ X 47½ X 50½	

*Note: Add the following suffix in place of XX:

For	Suffix	For	Suffix
120/120	11	240/120	21
120/240	12	240/240	22

**Note: Dimensions are nominal and outline drawings are available upon request.
***Note: If shielded polyethylene output cables are desired in place of porcelain insulator, designate part number with a "C" prefix, e.g., 1-CTR-30-XX.

Transformer, High Voltage—Filament Isolation Open Type Construction—Epoxy Coated

High Voltage Filament Isolation Transformers

Type	Secondary Volts	Secondary Amps	Isolation kV dc (Working)	Size (A X B X C)
AD 3227	5	1	10	2⅝ X 2⅜ X 3⅛
AD 3231	5	3	10	3 X 2⅝ X 3½
AD 3234	5	5	10	3¼ X 2⅝ X 3⅞
AD 3226	6.3	1	10	2⅝ X 2⅜ X 3⅛
AD 3230	6.3	3	10	3 X 2⅞ X 3½
AD 3233	6.3	5	10	3¼ X 2⅞ X 3⅞
AD 3238	5	1	20	4½ X 3 X 4
AD 3239	5	3	20	4⅜ X 3½ X 4⅜
AD 3240	5	5	20	4⅞ X 3½ X 5⅛
AD 3241	6.3	1	20	4½ X 3 X 4
AD 3242	6.3	3	20	4⅜ X 3½ X 4⅜
AD 3243	6.3	5	20	4⅞ X 3½ X 5⅛
AD 3247	5	1	30	4⅞ X 3½ X 5
AD 3248	5	3	30	5¾ X 3¾ X 5¼
AD 3249	5	5	30	6¼ X 3¾ X 6½
AD 3250	6.3	1	30	4⅞ X 3½ X 5
AD 3251	6.3	3	30	5¾ X 3¾ X 5¼
AD 3252	6.3	5	30	6¼ X 3¾ X 6½

All primaries: 115 volts, 60Hz.

Transformer, High Voltage—Line Isolation Open Type Construction—Epoxy Coated

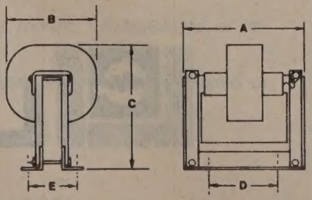
FEATURES:

- ▼ Designed for continuous operation at rated voltage and power
- ▼ Epoxy coated, air insulated up to 30kV dc, oil insulated over 30kV dc
- ▼ Well suited to applications requiring reliable isolated line voltage at power ratings up to 1kVA
- ▼ Other higher voltage and power units available upon request

SPECIFICATIONS:

Primaries: 115V or 230V, 60Hz
Secondaries: 115V

Type	Rating kVA	Size (A X B X C)	Mounting Dimensions (D X E)	Insulation kV dc Working
AD 1640	0.200	6⅛ X 4 X 5⅛	4½ X 3	10
AD 1641	0.500	7⅝ X 5⅞ X 7¾	5⅜ X 4¼	10
AD 1642	0.750	9½ X 6 5/16 X 8¼	7¼ X 4 13/16	10
AD 1643	1.000	8½ X 8 X 9¾	6 X 5	10
AD 1644	0.200	8½ X 4 X 5⅝	6⅞ X 3⅛	20
AD 1645	0.500	10¼ X 5⅝ X 7½	8 X 4¼	20
AD 1646	0.750	9¾ X 6¾ X 8	7½ X 4 13/16	20
AD 1647	1.000	11¼ X 6⅝ X 8¾	8¾ X 4⅝	20
AD 3060	0.250	8½ X 7¼ X 6½	7 5/16 X 3⅜	30
AD 3061	0.500	9¾ X 7 X 8¾	7 13/16 X 3½	30
AD 3062	0.750	10½ X 7½ X 9½	8½ X 3⅝	30
AD 3063	1.000	11 X 9 X 9½	8¾ X 3¾	30
AD 3064	0.250	10 X 7 X 6½	8 13/16 X 3⅜	40
AD 3065	0.500	11¼ X 7¼ X 8¾	9⅛ X 3½	40
AD 3066	0.750	12½ X 7½ X 9½	10¼ X 3⅝	40
AD 3067	1.000	12¾ X 9 X 9½	10 7/16 X 3¾	40
AD 3068	0.250	13¼ X 7¼ X 6½	12 X 3⅜	50
AD 3069	0.500	13¼ X 7¼ X 8¾	11⅛ X 3½	50
AD 3070	0.750	14½ X 7½ X 9½	12¼ X 3⅝	50
AD 3071	1.000	14¾ X 9 X 9½	12 7/16 X 3¾	50



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LENCO, dedicated to transformer design, product improvement, cost reduction and fast delivery to meet your specifications and most critical production schedule. An endless variety of types, sizes and performance capabilities for a wide variety of industries.

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AUDIO Impedance matching — Isolation —Broad frequency response — Low insertion loss — FCC Part 68.

CONSTANT VOLTAGE Regulating transformers built to your specifications for DC power supplies or low distortion AC.

CONTROL Custom designed to UL, VDE, CSA, etc. specifications.

CONVERTER High Conversion efficiency from DC input to filtered DC out. Toroidal, Laminated, Ferrite, (Switch-Mode) etc.

CURRENT Toroidal, Laminated, Core, Impregnated, or Encapsulated.

FILAMENT Dry type, Laminated core.

HIGH TEMPERATURE Vacuum impregnation with temperature material to 200°C. Epoxy encapsulated.

INDUCTORS Filter, A.C. Noise filtering, Switch-mode.

INPUT AND OUTPUT Designed to your specifications.

ISOLATION Audio, Step-down, Step-up, Foil electrostatic shielded, Electromagnetic shielded.

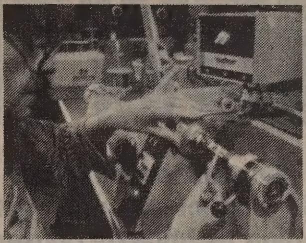
LOW PROFILE PC mount, Split bobbin, Vacuum varnish or epoxy impregnated.

MEDICAL UL 544 Patient connected, or non-patient connected. Power.

POT CORES PC mount, Frame mount, Encapsulated or Impregnated.

SWITCH-MODE POWER Dry type, Air cooled, Laminated or Ferrite.

THREE PHASE 50-60-400 Hertz up to 1 KVA.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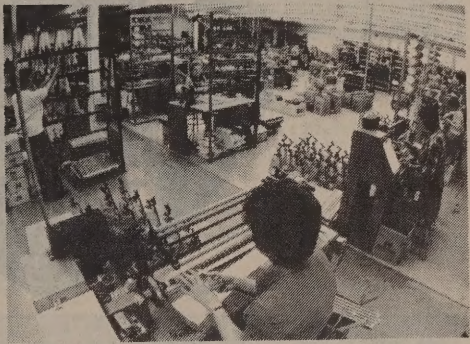
PRODUCTION TESTING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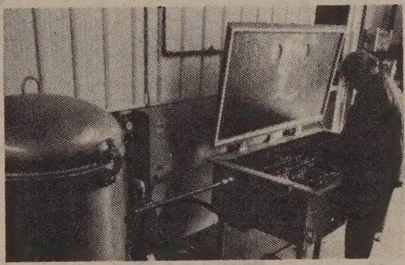
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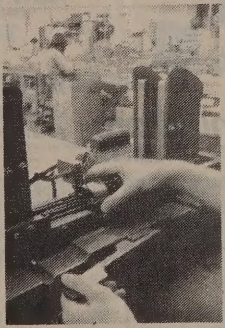
HAND WINDING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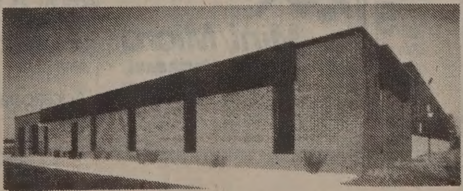
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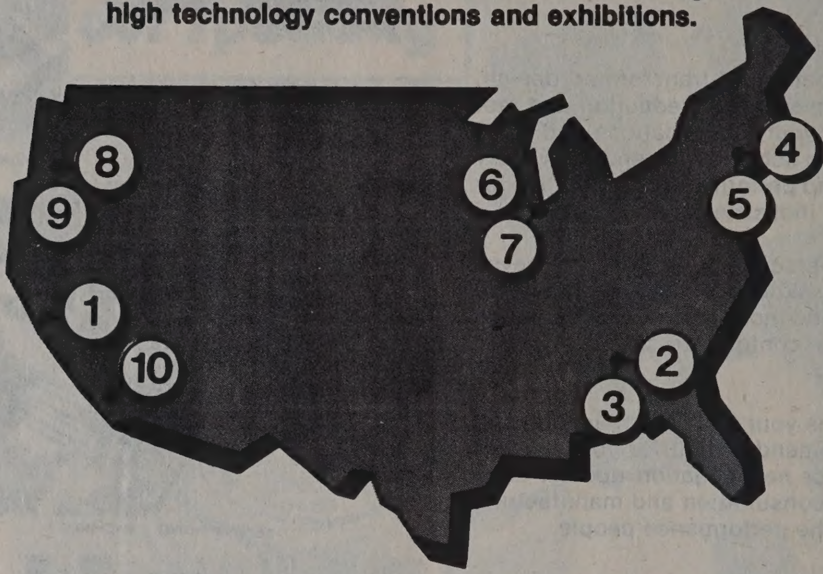

1	Mini/Micro West	February 5, 6, 7, 1985 Anaheim Hilton Exposition Center Anaheim, California
2	Southcon	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
3	Mini/Micro Southeast	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
4	Electro	April 23, 24, 25, 1985 New York Coliseum New York
5	Mini/Micro Northeast	April 23, 24, 25, 1985 Albert Hall New York
6	Midcon	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
7	Mini/Micro Midwest	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
8	Northcon	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
9	Mini/Micro Northwest	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
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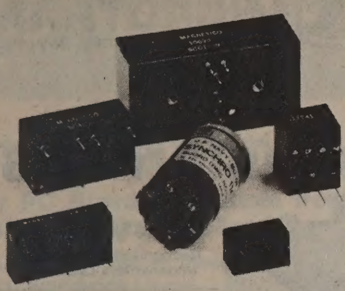
SCOTT T TRANSFORMERS



FEATURES:
- PRECISION/INTERCHANGEABILITY
- REPEATABILITY
- STABILITY/NO AGING
- NO SYSTEM TRIMMING REQUIRED

SYNCHRO TO RESOLVER CONVERTER TRANSFORMERS

Part No.	Input Voltage (L-L)	Output RMS Sine & Cosine	Frequency Hz	Input Z kΩ	Typical Load kΩ	Accuracy Arc Seconds	Size Inches	Weight Oz.
52975	11.8	1	400	20	100	4 min.	⅞ x ½ x 7/16	.5
10472	11.8	6	400	10	10	5 min.	¾ x 1½ x ⅜	.6
11870	90	6 CT	60	500	100	60	1.1 x 2.1 x 1.1	4
12094	90	6 CT	60 & 400	500	100	2 min.	1.1 x 2.1 x 1.1	4
50460	90	6	400	60	10	60	⅞ x 1⅝ x 11/16	2
50642	11.8	6	400	30	10	60	⅞ x 1⅝ x 11/16	2
50726	90	6 CT	400	500	100	60	13/16 x 1½ x ⅝	1.5
9652	11.8	5	400	100	10	30	1⅜ x 2¾ x ⅞	5
9514	90	4.25	400	1000	10	30	1⅜ x 2¾ x ⅞	5
52910	11.8	1	400	10	100	4 min.	½ x ⅞ x .31	.5
52450	90	6	400	100	100	5 min.	⅝ x 1¼ x ½	3¾
52290	11.8	3.2	400	20	10	3 min.	⅞ x ½ x 7/16	⅓
52569	90	2 CT	400	80	100	5 min.	⅝ x ⅞ x 5/16	⅓
13084	11.8	6 CT	400	100	100	1 min.	¾ x 1½ x ⅜	½
13530	11.8	1	400	10	50	1 min.	⅝ x 1¼ x .3	.5

RESOLVER TO SYNCHRO CONVERTER TRANSFORMERS

Part No.	Input Voltage 4 Wire	Output 3 Wire (L-L)	Frequency Hz	Load Ohms (L-L)	Input Z Ohms	Accuracy Arc Minutes	Size Inches	VA Rating
10084	11.8	11.8	400	150	1.5K	2	1 x 2 x .65 H	.5
10086	6.0	11.8	400	150	1K	2	1 x 2 x .65 H	1
10088	9.0	11.8	400	150	2K	1.5	1⅜ x 2¾ x .65 H	1
10090	9.0	90	400	2500	1K	1	1⅜ x 2¾ x ⅞ H	1
11999	7.0	11.8	400	30	500	1	2 x 4 x 1 H	3
50749	7.2	90	60	8000	700	2	1½ x 3⅜ x 1¼ H	3
12186	7.0	90	60	4000	250	1	2 x 4 x1½ H	3.2
52020	9	11.8	400	14	100	3.5	1½ x 2½ x 1¼	4.5
52021	9	90	400	800	100	3.5	2 x 4 x 1¼	1
52449	6	90	400	2500	150	3	1 x 1⅝ x 11/16	2
52164	6	90	400	2500	100	2	1½ x 3 x 1⅛	10
12945	6	11.8	400	300	1K	5	¾ x 1½ x 7/16	½

HOW TO ORDER:
Order Magnetico Standard Units directly by using the Magnetico Part Number.

VA RATING	SECONDARY VOLTAGE
Catalog Number	6.0 thru 300 (VRMS)

SCHEMATIC	SHIELD
X — No Tap	N — No Shield
T — Center Tap	S — Electrostatic Shield

EXAMPLE:
To order a 115 V 400 Hz to 26 V center tapped, 6 VA power transformer with no shield. Order Magnetico Number: **9602-26-T-N.**

VA RATING: 9602 **SCHEMATIC:** T
SECONDARY VOLTAGE: 26 **SHIELD:** N

STANDARD MINIATURE 400 Hz POWER TRANSFORMERS

CONDENSED PERFORMANCE DATA — PRIMARY VOLTAGE 115 VRMS. All Units Designed to Meet MIL-T-27D. IMMEDIATE DELIVERY FOR PROTOTYPE QUANTITIES.

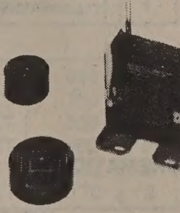
Catalog Number	VA Rating	Secondary Voltage (RMS)	O.D. ±1/32	Height ±1/32	Nominal Weight	Nom. Reg.	Nom.* Temp. Rise
9600	2	6-300 V	1″	19/32″	1 oz/ 30 gm	18%	10°C
9601	4	6-300 V	1″	11/16″	1.2 oz/ 35 gm	15%	12°C
9602	6	6-300 V	1″	⅞″	1.6 oz/ 45 gm	10%	18°C
9603	9	6-300 V	1″	1 1/16″	2.1 oz/ 60 gm	8%	20°C
9604	30	6-300 V	1⅜″	1½″	5.3 oz/150 gm	7%	23°C
10648	75	10-300 V	2″	1 5/16″	10 oz	±3%	30°C
10649	150	10-300 V	2¼″	1 9/16″	18 oz	±3%	40°C

Example: To order a 115 V 400 Hz to 26 V center tapped, 6 VA transformer with no shield — order Magnetico 9602-26-T-N
VA Rating: 9602 Secondary Voltage: 26 Schematic T: Shield: N.

SWITCHING TRANSFORMERS, 20 KHz

13962 — Input 160 VDC —
Output (2) 5V @ 4A, (2) 15V @ ½A —
Rated 55VA — 1.5 D x .8 Hi
13963 — Input 160 VDC —
Output (4) 5V @ 4A, (2) 15V @ .66A —
Rated 140 Watts — 1.75 D x .8 Hi
53248 — Input 160 VDC —
Output (2) 12V @ 65A —
Rated 650 Watts — 3″ x 2¾″ x 3″ Hi

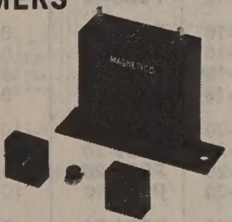
CUSTOM DESIGNS —
Multiple Outputs —
QUICK RESPONSE



CURRENT TRANSFORMERS

1V/Amp for Switching Applications
PC mount 13960 Series
1V/Amp for 400 Hz Power,
001V/Amp for 3000 Amp
Transmitter Monitor

Custom/Standard —
QUICK RESPONSE



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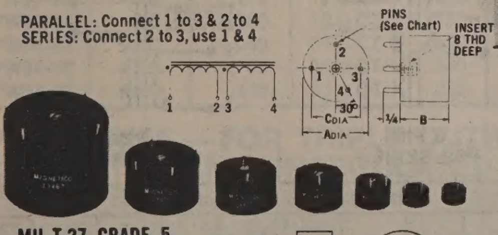
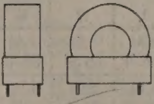
PARALLEL: Connect 1 to 3 & 2 to 4
SERIES: Connect 2 to 3, use 1 & 4



MIL-T-27 GRADE 5
Toroidal design on Molypermalloy Cores provides lowest leakage inductance and low pick up, PC mount, Hi-Q, low loss, stable inductance values.



OPEN TYPES OR VERTICAL MOUNTING (OPTIONAL)

Part No.	Induct. ±8% @ .1V 1kHz Par./Ser.		Res. Ohms Par./Ser.		DC Amps @ 90% Induct. Par./Ser.		Safe Operating Current Par./Ser.		A	B	C
13461-010	10 μH	40 μH	.015	.060	2.50	1.25	2.5†	1.25†	⅝	5/16	.500
-040	40 μH	160 μH	.050	1.00	1.25	.625	1.5†	.60†	⅝	5/16	.500
-100	100 μH	400 μH	.075	.30	.83	.415	1.0*	.5*	⅝	5/16	.500
13463-010	10 μH	40 μH	.005	.020	4.65	2.32	17.0*	8.5*	1	⅝	.875
-040	40 μH	160 μH	.012	.045	2.40	1.20	8.2*	4.1*	1	⅝	.875
-100	100 μH	400 μH	.030	.12	1.50	.75	5.0*	2.5*	1	⅝	.875
13464-090	40 μH	160 μH	.010	.040	5.4	2.7	20.0*	10.0*	1⅜	⅞	1.250
-100	100 μH	400 μH	.010	.040	3.4	1.7	10.0*	5.0*	1⅜	⅞	1.250
13465-200	200 μH	800 μH	.020	.080	2.75	1.37	10.0*	5.0*	1¾	1	1.625
13466-040	40 μH	160 μH	.003	.012	8.40	4.20	30.0*	15.0*	2	1⅛	1.875
-100	100 μH	400 μH	—	—	5.60	2.80	20.0*	10.0*	2	1⅛	1.875
13467-100	100 μH	400 μH	.004	.016	8.00	4.00	30.0*	15.0*	2½	1¼	2.375
-200	200 μH	800 μH	.009	.036	4.10	2.05	20.0*	10.0*	2½	1¼	2.375
-500	500 μH	2 MH	.015	.060	1.10	.55	4.0*	2.0*	2½	1¼	2.375

* 50% Inductance † 90% Inductance

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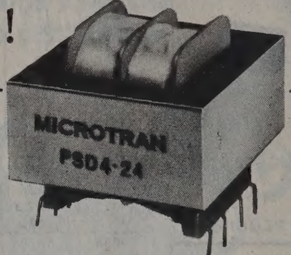

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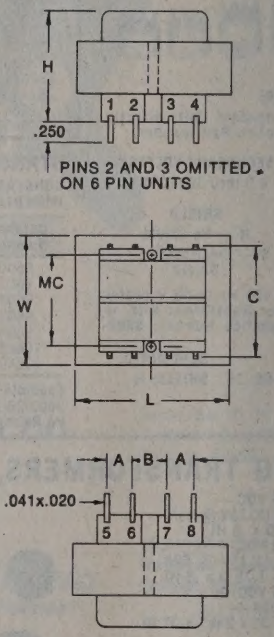
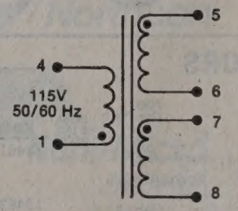
- 115V Single or 115/230V 50/60 Hz Dual Primary
- Dual Secondaries may be either Parallel or Series Connected
- Precision Spaced Molded-in Terminals
  - Terminal Numbers are Molded on Bobbin
- Class S 130°C Insulation
- Attractive Pricing — Superior Quality

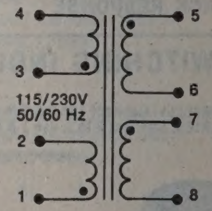
PART NO.		SECONDARY RMS RATING			
		Parallel Connected		Series Connected	
Single 115V PSS Series	Dual 115/230V PSD Series	AC Volts	RMS Amps	AC Volts	RMS Amps
PSS2-10	PSD2-10	5.0	0.22	10.0 CT	0.11
PSS3-10	PSD3-10	5.0	0.5	10.0 CT	0.25
PSS4-10	PSD4-10	5.0	1.2	10.0 CT	0.60
PSS5-10	PSD5-10	5.0	2.4	10.0 CT	1.2
PSS2-12	PSD2-12	6.3	0.18	12.6 CT	0.09
PSS3-12	PSD3-12	6.3	0.4	12.6 CT	0.2
PSS4-12	PSD4-12	6.3	1.0	12.6 CT	0.5
PSS5-12	PSD5-12	6.3	2.0	12.6 CT	1.0
PSS2-16	PSD2-16	8.0	0.14	16.0 CT	0.07
PSS3-16	PSD3-16	8.0	0.3	16.0 CT	0.15
PSS4-16	PSD4-16	8.0	0.8	16.0 CT	0.4
PSS5-16	PSD5-16	8.0	1.6	16.0 CT	0.8
PSS2-20	PSD2-20	10.0	0.11	20.0 CT	0.055
PSS3-20	PSD3-20	10.0	0.24	20.0 CT	0.12
PSS4-20	PSD4-20	10.0	0.6	20.0 CT	0.3
PSS5-20	PSD5-20	10.0	1.2	20.0 CT	0.6
PSS2-24	PSD2-24	12.0	0.09	24.0 CT	0.045
PSS3-24	PSD3-24	12.0	0.2	24.0 CT	0.1
PSS4-24	PSD4-24	12.0	0.5	24.0 CT	0.25
PSS5-24	PSD5-24	12.0	1.0	24.0 CT	0.5
PSS2-28	PSD2-28	14.0	0.08	28.0 CT	0.04
PSS3-28	PSD3-28	14.0	0.17	28.0 CT	0.085
PSS4-28	PSD4-28	14.0	0.4	28.0 CT	0.2
PSS5-28	PSD5-28	14.0	0.84	28.0 CT	0.42
PSS2-36	PSD2-36	18.0	0.06	36.0 CT	0.03
PSS3-36	PSD3-36	18.0	0.13	36.0 CT	0.065
PSS4-36	PSD4-36	18.0	0.34	36.0 CT	0.17
PSS5-36	PSD5-36	18.0	0.7	36.0 CT	0.35
PSS2-48	PSD2-48	24.0	0.046	48.0 CT	0.023
PSS3-48	PSD3-48	24.0	0.1	48.0 CT	0.05
PSS4-48	PSD4-48	24.0	0.25	48.0 CT	0.125
PSS5-48	PSD5-48	24.0	0.5	48.0 CT	0.25
PSS2-56	PSD2-56	28.0	0.04	56.0 CT	0.02
PSS3-56	PSD3-56	28.0	0.09	56.0 CT	0.045
PSS4-56	PSD4-56	28.0	0.22	56.0 CT	0.11
PSS5-56	PSD5-56	28.0	0.44	56.0 CT	0.22
PSS2-120	PSD2-120	60.0	0.02	120.0 CT	0.01
PSS3-120	PSD3-120	60.0	0.04	120.0 CT	0.02
PSS4-120	PSD4-120	60.0	0.1	120.0 CT	0.05
PSS5-120	PSD5-120	60.0	0.2	120.0 CT	0.1



SCHEMATICS



6 PIN
PSS SERIES



8 PIN
PSD SERIES

DIMENSIONS Inches (mm)									
PSS, PSD Series	VA	L	W	H	MC	A	B	C	Lb. (Gm.)
2	1.1	1.44 (36.6)	1.23 (31.2)	1.00 (25.4)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.17 (77.4)
3	2.4	1.44 (36.6)	1.23 (31.2)	1.26 (32)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.25 (114)
4	6	1.69 (43)	1.39 (35.3)	1.36 (34.5)	1.0625* (27.0)*	.250 (6.35)	.350 (8.9)	1.280 (32.5)	0.44 (200)
5	12	1.97 (50)	1.63 (41.4)	1.5 (38.1)	1.250* (31.8)*	.300 (7.62)	.400 (10.16)	1.410 (35.8)	0.70 (319)

* Clearance hole for 4-40 x 1⅜″ nylon mtg. screws. Order screw as P/N PS-S and nut as P/N PS-N.

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PW SERIES—FOR CONTROL AND POWER SUPPLY APPLICATIONS

115/230V 50/60 Hz Primary

Part No.	Secondary				Schematic	Fig.
	Parallel Connected		Series Connected			
	AC Volts	RMS Amps	AC Volts	RMS Amps		
PW28 SERIES • 0.5 VA						
PW28-10	10.0 CT	.050	(Single Secondary)		1†	A
PW28-16	16.0 CT	.031	(Single Secondary)		1†	A
PW28-24	24.0 CT	.021	(Single Secondary)		1†	A

† PW28 Series has 115V only primary. For 230V only primary, order as PW28-10-230, etc.

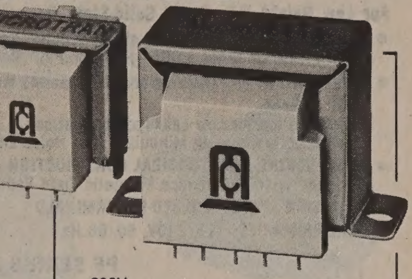
PW35 SERIES • 1.1 VA						
PW35-10	10.0 CT	.110	(Single Secondary)		1	A
PW35-12	12.6 CT	.090	(Single Secondary)		1	A
PW35-16	16.0 CT	.070	(Single Secondary)		1	A
PW35-24	24.0 CT	.046	(Single Secondary)		1	A
PW35-36	36.0 CT	.031	(Single Secondary)		1	A
PW41 SERIES • 3.5 VA						
PW41-10	10.0 CT	.350	(Single Secondary)		1	B
PW41-12	12.6 CT	.280	(Single Secondary)		1	B
PW41-16	16.0 CT	.220	(Single Secondary)		1	B
PW41-24	24.0 CT	.150	(Single Secondary)		1	B
PW41-36	36.0 CT	.100	(Single Secondary)		1	B
PW48 SERIES • 9.5 VA						
PW48-10	5.0	1.900	10.0 CT	.950	2	B
PW48-12	6.3	1.500	12.6 CT	.750	2	B
PW48-16	8.0	1.200	16.0 CT	.600	2	B
PW48-24	12.0	.800	24.0 CT	.400	2	B
PW48-36	18.0	.520	36.0 CT	.260	2	B
PW48-56	28.0	.340	56.0 CT	.170	2	B
PW54 SERIES • 12.5 VA						
PW54-10	5.0	2.500	10.0 CT	1.250	2	C
PW54-12	6.3	2.000	12.0 CT	1.000	2	C
PW54-16	8.0	1.560	16.0 CT	.780	2	C
PW54-24	12.0	1.040	24.0 CT	.520	2	C
PW54-36	17.0	.700	36.0 CT	.350	2	C
PW54-56	28.0	.446	56.0 CT	.223	2	C

PWT SERIES—FOR TRIPLE OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

115/230V 50/60 Hz Primary

Part No.	Secondary #1		Secondary #2		DC Output #1		DC Output #2		Schematic	Fig.
	AC Volts	RMS Amps	AC Volts	RMS Amps	CT FW DC Volts	Cur. mA DC	CT FW DC Volts	Cur. mA DC		
PWT54-1024	9.0 CT	.800	24.0 CT	.300	+5	670	±15	170	3	C
PWT54-1633	16.0 CT	.550	33.0 CT	.180	+9.0*	470	±21*	120	4	C

* +9.0 and ±21 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator; see Schematic #4.



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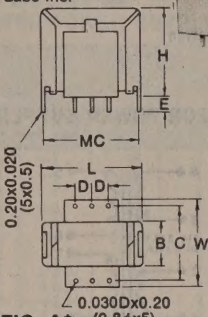
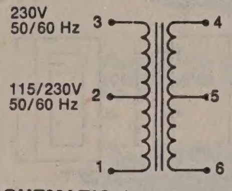


FIG. A*



SCHEMATIC 1

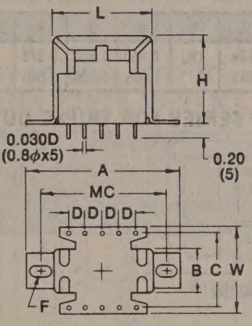
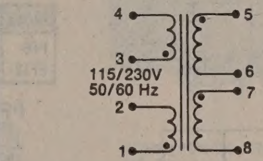
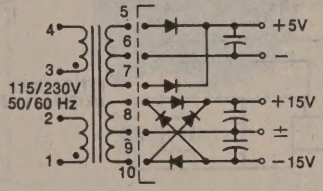


FIG. B*



SCHEMATIC 2



SCHEMATIC 3

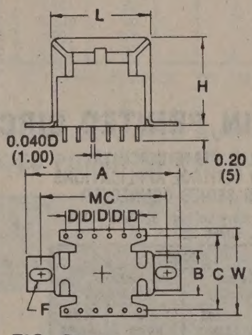
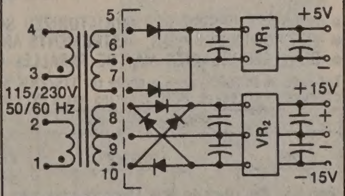


FIG. C*



SCHEMATIC 4

DIMENSIONS Inches (mm)

Series	Max VA	L	W	H	MC	A	B	C	D	E	F	Oz. (Gm)
PW28	0.7	1.16 (29.5)	1.32 (33.5)	1.10 (28)	1.12 (28.5)	— —	0.50 (12.5)	0.984 (25)	0.197 (5)	0.20 (5)	— —	2.5 (70)
PW35	2	1.44 (36.5)	1.69 (43)	1.26 (32)	1.40 (35.5)	— —	0.61 (15.5)	1.380 (35)	0.295 (7.5)	0.24 (6)	— —	4.5 (130)
PW41	5	1.67 (42.5)	1.91 (48.5)	1.42 (36)	2.05 (52)	2.36 (60)	0.85 (21.5)	1.575 (40)	0.394 (10)	— —	0.138x0.177 (3.5x4.5)	8.0 (230)
PW48	9.5	1.99 (50.5)	2.05 (52)	1.69 (43)	2.32 (59)	2.72 (69)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	14.0 (400)
PW54	15	2.22 (56.5)	2.09 (53)	1.93 (49)	2.72 (69)	3.15 (80)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	18.0 (510)

PWT54 and PW54 have same dimensions
* Request terminal layout sheet for pin locations.

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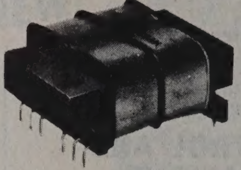

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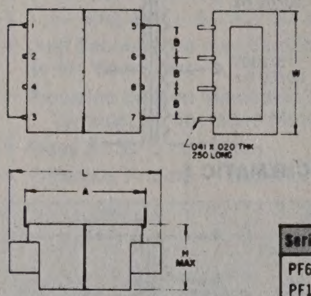
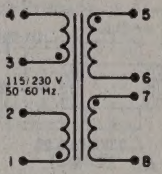
PF SERIES FOR POWER SUPPLIES, INSTRUMENTS, CONTROL EQUIPMENT

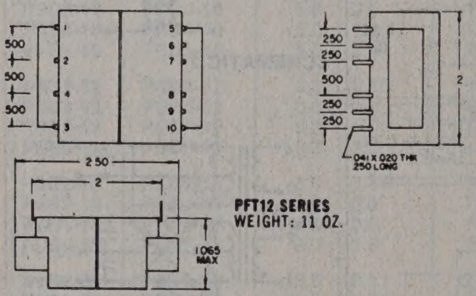




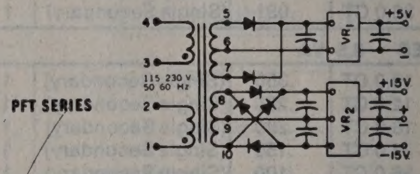
Series	L	W	H	A	B	Wt. Oz.
PF6-	1⅞	1 5/16	0.850	1.600	0.375	7
PF12-	2½	2	1.065	2.000	0.500	11

	SECONDARY			
	Parallel Connected		Series Connected	
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps
PF6 Series • 115/230V Primary • 6 VA				
PF6-10	5.0	1.200	10.0 CT	.600
PF6-12	6.3	.900	12.6 CT	.450
PF6-16	8.0	.700	16.0 CT	.350
PF6-24	12.0	.500	24.0 CT	.250
PF6-34	17.0	.340	34.0 CT	.170
PF6-56	28.0	.200	56.0 CT	.100
PF12 Series • 115/230V Primary • 12 VA				
PF12-10	5.0	2.400	10.0 CT	1.200
PF12-12	6.3	1.800	12.6 CT	.900
PF12-16	8.0	1.400	16.0 CT	.700
PF12-24	12.0	1.000	24.0 CT	.500
PF12-34	17.0	.680	34.0 CT	.340
PF12-56	28.0	.400	56.0 CT	.200

PFT SERIES FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES



PFT12 SERIES
WEIGHT: 11 OZ.



PFT12 Series • 115/230V Primary • 12 VA

	Secondary #1		Secondary #2		DC Output #1		DC Output #2	
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps	C.T.F.W. DC Volts	Cur. mA DC	C.T.F.W. DC Volts	Cur. mA DC
PFT12-35	16.0 CT	.360	35.0 CT	.150	+8.75†	300	±22†	85

† +8.75 and ±22 DC output volts are for inputs to +5V and ±12V or ±15V IC voltage regulators. See PFT schematic. Line input 115/230V, ±10%.

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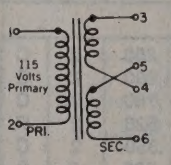
- COMPACT DESIGN FOR MINIATURIZED SOLID STATE CIRCUITRY
- FOR POWER SUPPLIES, INSTRUMENTS AND CONTROL APPLICATIONS
- DUAL SECONDARIES MAY BE PARALLEL OR SERIES CONNECTED

Top lugs on PC2000 series provide for 115/230V primary voltage options without changes in PC board. PC3000 series has 8 PC pins. 50/60 Hz.

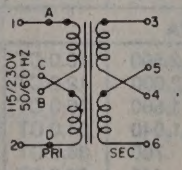
Primary						Secondary			
115V		115/230V				Parallel Connected		Series Connected	
Part No.	Fig.	Part No.	Fig.	Part No.	Fig.	AC Volts	RMS Amps	AC Volts	RMS Amps
PC6506	A	PC2506	C	PC3506	A	6.3 CT	.250	(Single Secondary)	
PC6512	A	PC2512	C	PC3512	A	12.6	.120	25.2 CT	.060
PC6524	A	PC2524	C	PC3524	A	40.0	.040	80.0 CT	.020
PC6528	A	PC2528	C	PC3528	A	58.0	.026	116.0 CT	.013
PC6608	B	PC2608	D	PC3608	B	6.3	.700	12.6 CT	.350
PC6616	B	PC2616	D	PC3616	B	28.0	.156	56.0 CT	.078
PC6624	B	PC2624	D	PC3624	B	40.0	.110	80.0 CT	.055
PC6628	B	PC2628	D	PC3628	B	58.0	.066	116.0 CT	.033
PC6632	B	PC2632	D	PC3632	B	115.0V @ .020A & 12.6V @ .150A			
PC6708	B	PC2708	D	PC3708	B	6.3	1.200	12.6 CT	.600
PC6712	B	PC2712	D	PC3712	B	12.6	.600	25.2 CT	.300
PC6715	B	PC2715	D	PC3715	B	20.0	.370	40.0 CT	.185
PC6716	B	PC2716	D	PC3716	B	28.0	.270	56.0 CT	.135
PC6724	B	PC2724	D	PC3724	B	40.0	.180	80.0 CT	.090
PC6728	B	PC2728	D	PC3728	B	58.0	.130	116.0 CT	.065
PC6732	B	PC2732	D	PC3732	B	115.0V @ .025A & 12.6V @ .250A			

Series	Watts	W	D	H	Wt. Oz.
PC2500/PC3500/PC6500	1½	1 25/64	1 5/32	1 11/64	3.2
PC2600/PC3600/PC6600†	4½	1 45/64	1¼	1 25/64	6.5
PC2700/PC3700/PC6700‡	7½	1 61/64	1 15/32	1 41/64	9.5

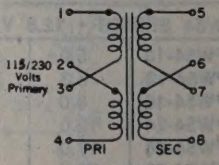
† Channel mounting 2″ M.C. ‡ 2⅜″ M.C.



PC6000 SERIES



PC3000 SERIES



PC2000 SERIES

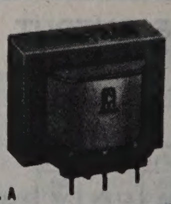


FIG. A

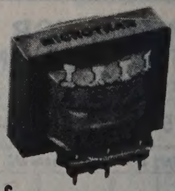


FIG. C

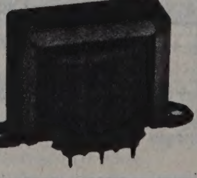


FIG. B

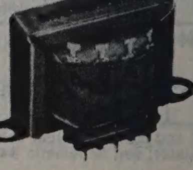


FIG. D

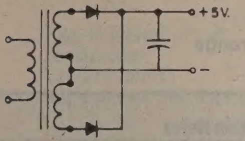
145 EAST MINEOLA AVE., BOX 236, VALLEY STREAM, NY 11582-0236 • (516) 561-6050 • TELEX II 510-225-8412

MICROTRAN company, Inc.

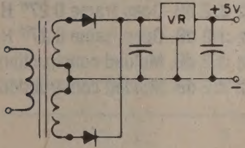
POWER TRANSFORMERS
PRINTED CIRCUIT

plug-in printed circuit power transformers
FOR DC POWER SUPPLIES

For Microprocessor Logic and OP AMP Power Supplies. For construction of low cost, miniaturized, regulated and unregulated DC power supplies for latest solid-state digital and linear circuitry. Permits packaging flexibility unobtainable with prepackaged power supplies. Low-profile, miniaturized construction permits close stacking of P.C. boards. Precision spaced molded-in terminals. All primaries 115 V 50/60 Hz except PCL6600 Series. 115 230V 50/60 Hz. **Transformers supplied with engineering bulletin providing schematics and suggested components.**



#1 — UNREGULATED

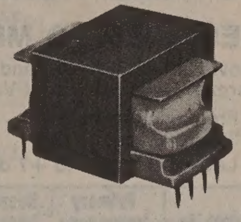


#2 — REGULATED

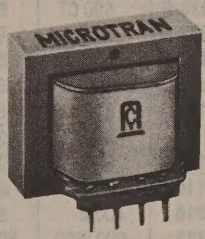
TRANSFORMERS FOR +5V DC UNREGULATED AND REGULATED POWER SUPPLIES

	SECONDARY				DC OUTPUT			
	Parallel Connected		Series Connected					
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps	C.T.F.W. DC Volts	Current mA DC	Schematic No.	Fig.
PC6205	4.50	0.18	9.0 CT	0.09	+5	75	1	A
PC6505	4.50	0.36	9.0 CT	0.18	+5	150	1	B
PC6605	4.50	1.10	9.0 CT	0.55	+5	450	1	D
PCL6605	4.50	1.10	9.0 CT	0.55	+5	450	1	C
PC6705	4.50	2.00	9.0 CT	1.00	+5	825	1	D
PC6905	4.50	5.00	9.0 CT	2.50	+5	2000	1	A
PC6210	7.75	0.12	15.5 CT	0.06	+8.5†	50	2	A
PC6510	7.75	0.22	15.5 CT	0.11	+8.5†	90	2	B
PC6610	7.75	0.64	15.5 CT	0.32	+8.5†	265	2	D
PCL6610	7.75	0.64	15.5 CT	0.32	+8.5†	265	2	C
PC6710	7.75	1.20	15.5 CT	0.60	+8.5†	500	2	D
PC6910	7.75	3.10	15.5 CT	1.55	+8.5†	1300	2	A

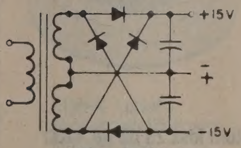
†+8.5 DC output volts for input to +5V IC Voltage Regulator, see Typical Schematic Regulated.



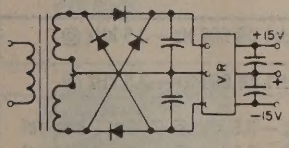
PC6200/PCT6200 SERIES
PC6900/PCT6900 SERIES
FIG. A



PC6500/PCT6500 SERIES
FIG. B



#3 — UNREGULATED

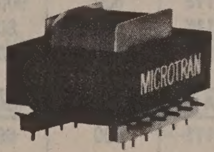


#4 — REGULATED

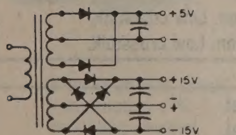
TRANSFORMERS FOR ±15V DC DUAL OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

	SECONDARY				DC OUTPUT			
	Parallel Connected		Series Connected					
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps	C.T.F.W. DC Volts	Current mA DC	Schematic No.	Fig.
PC6211	12.0	0.07	24.0 CT	0.035	±15	22	3	A
PC6511	12.0	0.13	24.0 CT	0.065	±15	40	3	B
PC6611	12.0	0.40	24.0 CT	0.200	±15	120	3	D
PCL6611	12.0	0.40	24.0 CT	0.200	±15	120	3	C
PC6711	12.0	0.76	24.0 CT	0.380	±15	220	3	D
PC6911	12.0	1.90	24.0 CT	0.950	±15	550	3	A
PC6214	16.0	0.05	32.0 CT	0.025	±20†	15	4	A
PC6514	16.0	0.10	32.0 CT	0.050	±20†	30	4	B
PC6614	16.0	0.30	32.0 CT	0.150	±20†	90	4	D
PCL6614	16.0	0.30	32.0 CT	0.150	±20†	90	4	C
PC6714	16.0	0.56	32.0 CT	0.280	±20†	165	4	D
PC6914	16.0	1.40	32.0 CT	0.700	±20†	410	4	A

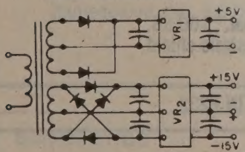
† ±20 DC output volts for input to ±15V IC Voltage Regulator, see Typical Schematic - Regulated.



PCL6600 SERIES
FIG. C



#5 — UNREGULATED

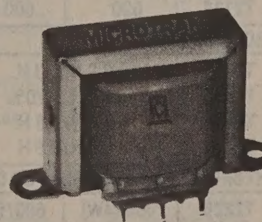


#6 — REGULATED

TRANSFORMERS FOR +5V AND ±15V DC TRIPLE OUTPUT UNREGULATED AND REGULATED POWER SUPPLIES

	SECONDARY #1		SECONDARY #2		DC OUTPUT #1		DC OUTPUT #2			
Part No.	AC Volts	RMS Amps	AC Volts	RMS Amps	C.T.F.W. DC Volts	Cur. mA DC	C.T.F.W. DC Volts	Cur. mA DC	Schematic No.	Fig.
PCT6230	9.0 CT	0.048	24.0 CT	0.020	+5	40	±15	12	5	A
PCT6530	9.0 CT	0.072	24.0 CT	0.032	+5	60	±15	20	5	B
PCT6630	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	5	D
PCL6630	9.0 CT	0.240	24.0 CT	0.080	+5	200	±15	50	5	C
PCT6730	9.0 CT	0.480	24.0 CT	0.160	+5	400	±15	100	5	D
PCT6930	9.0 CT	1.200	24.0 CT	0.440	+5	1000	±15	275	5	A
PCT6531	15.5 CT	0.048	32.0 CT	0.020	+8.5†	40	±20†	12	6	B
PCT6631	15.5 CT	0.140	32.0 CT	0.058	+8.5†	115	±20†	35	6	D
PCL6631	15.5 CT	0.140	32.0 CT	0.058	+8.5†	115	±20†	35	6	C
PCT6731	15.5 CT	0.300	32.0 CT	0.100	+8.5†	250	±20†	60	6	D
PCT6931	15.5 CT	0.690	32.0 CT	0.298	+8.5†	575	±20†	175	6	A

† +8.5 and ±20 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator, see Typical Schematic - Regulated.

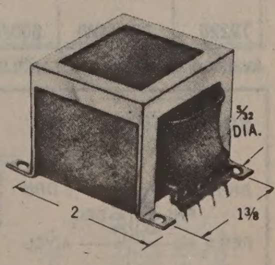


PC6600/PCT6600 SERIES
PC6700/PCT6700 SERIES
FIG. D

DIMENSIONAL CHART

Series	Watts	W (Inches)	D (Inches)	H (Inches)	Wt. Oz.
PC6200/PCT6200	1	1 1/64	1 3/8	27/32	2.3
PC6500/PCT6500	1½	1 25/64	1 5/32	1 11/64	3.2
PC6600/PCT6600†	4½	1 45/64	1¼	1 25/64	6.5
PCL6600	4½	1 51/64	1 13/32	1 3/16	6.6
PC6700/PCT6700‡	7½	1 61/64	1 15/32	1 41/64	9.5
PC6900/PCT6900	24	1 41/64	2¼	1 11/32	12.0

† Channel mounting 2″ M.C. ‡ 2⅜″ M.C.



SLIP-ON BRACKET
For PC6900 Series
Order as Part Number PC6900-FB
Max. Height 1 7/16″

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For More Information. Circle No. 498

TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, Inc.

line coupling-hybrid-holding coils

FOR INTERCONNECT OF VOICE/DATA MODEM TERMINALS TO TELEPHONE LINES

DESIGNED TO MEET FCC PART 68

Provides line isolation and matching — Prevents line imbalance — Wide dynamic signal capability — Low distortion
Permits Optimum use of Voice-Grade Telephone Lines for Broadband Data Signals

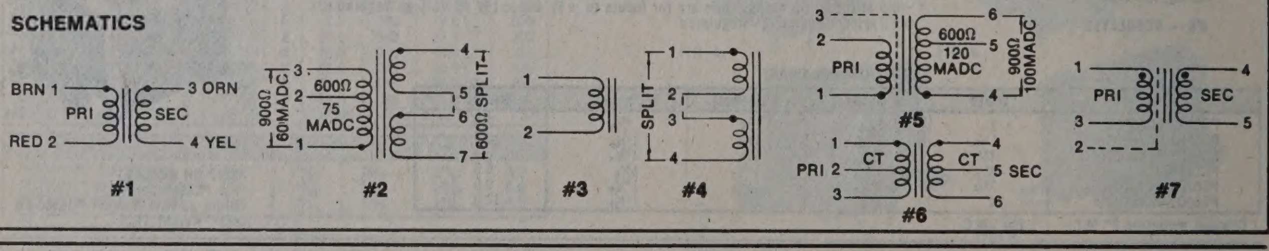
- Frequency Response: 300-3500 Hz ±0.5 dB
- Level: −45 dBm to +7 dBm
- Longitudinal Balance: Per FCC 68.310
- Distortion: 0.5% Max.
- Impedance Matching: ±10% over entire frequency range
- Return Loss: 26 dB Min.

Part No.	Primary Impedance	Secondary Impedance	Unbalance mA DC	Schematic	Page	Fig.	Page	Application Notes
VOICE/DATA COUPLING								
PM32-F	600	600	1.5	1	1134	O	1136	Freq. resp. 300 Hz — 100 kHz ±2 dB. Open frame 0.27″ H.
PM34-F	600 CT	600 CT	3	14	1136	P	1136	Freq. resp. 300 Hz — 100 kHz ±2 dB. Open frame 0.27″ H.
PM32-M	600	600	1.5	1	1134	R	1136	Freq. resp. 300 Hz — 100 kHz ±2 dB. Molded construction.
PM34-M	600 CT	600 CT	3	14	1136	S	1136	Freq. resp. 300 Hz — 100 kHz ±2 dB. Molded construction.
T1104	600	600	0	1	1134	A	1135	Low profile.
T2104	600	600	0	1	1134	B	1135	
T2106	600 CT	600 CT	0	6	1134	E	1135	
T2108	600	900	0	1	1134	B	1135	
T2110	900	900	0	7	1134	C	1135	Electrostatic shield.
T2316	4000	600	0	1	1134	B	1135	For bridging applications.
T4113	900/600	600 split	60/75 Pri.	2	1134	J	1135	Level −15 to +7 dBm.
T5114	600	600 split	75	8	1135	K	1136	
T5115	600	600 split	120	9	1135	L	1136	
T6112	600	900/600	100/120 Sec.	5	1134	G	1135	Electrostatic shield.
T9116	600 CT	600 CT	80	16	1136	N	1136	Low profile. Low crosstalk.
T9117	600 CT	600 CT	80	17	1136	N	1136	Low profile. Low crosstalk. Return loss 23 dB @ 440Ω +0.035 μF load in parallel.
DATA MODEM COUPLING — NON-VOICE APPLICATION — FOR 300/1200 BAUD MODEM BOARD FOR MICROCOMPUTERS								
T2111	600	600	90	12	1135	Q	1136	Low profile. Freq. resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz ref.
T2112	600	600 CT	90	13	1135	Q	1136	Low profile. Freq. resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz ref.
T2113	600	600	90	12	1135	B	1135	Freq resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz. ref.
T2114	600	600 CT	90	13	1135	E	1135	Freq resp. ±1 dB 660 Hz — 3.5 kHz @ 0 dBm, 2 kHz. ref.
HOLDING COILS								
T4415	2.0 H/1.3 H		60/100	3	1134	H	1135	DCR 180Ω.
T5415	1.4 H ±20%		120	4	1134	K	1136	Split winding. Total DCR 180Ω.
T5410	1.0 H/0.8 H		0/25	3	1134	D	1135	DCR 225Ω. Toroidal construction. Low crosstalk.
T8410	1.0 H/0.8 H		0/40	3	1134	D	1136	DCR 113Ω. Toroidal construction. Low crosstalk.
HYBRID — TWO REQUIRED FOR CONVENTIONAL HYBRID OPERATION								
T2220	600 (4W)	600/600	0	10	1135	E	1135	Trans-hybrid loss 45 dB typical.
T3220	600 (4W)	600/600	0	10	1135	F	1135	Trans-hybrid loss 45 dB typical.
T4220	600 (4W)	600/600	60 (2W)	11	1135	J	1135	Electrostatic shield.
T5220	600 (4W)	600/600	100 (2W)	15	1136	M	1136	Trans-hybrid loss and long. bal. >60 dB. Max. level +20 dBm. Electrostatic shield.
T9220	600 (4W)	600/600	80 (2W)	18	1136	N	1136	Low profile. Low crosstalk.

Available on special order with other ratings and constructions.

REQUEST ENGINEERING APPLICATION BULLETIN F232.

SCHEMATICS



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For More Information. Circle No. 498

MICROTRAN
company, Inc.

TELEPHONE INTERCONNECT TRANSFORMERS

OUTLINE DRAWINGS AND SCHEMATICS FOR PAGE 1134

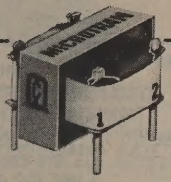
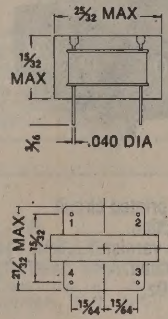

MICROTRAN
1

FIG. A


25/32 MAX
15/32 MAX
3/16
.040 DIA
1
2
4
3
27/32 MAX
15/32
15/64
15/64

Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 0.4 Oz.

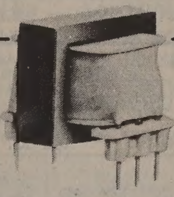


FIG. B

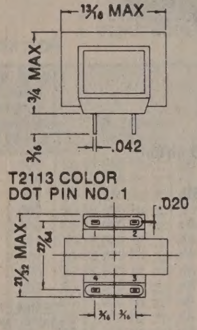
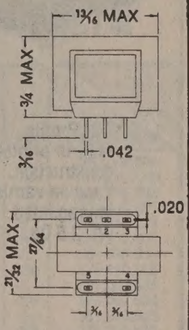
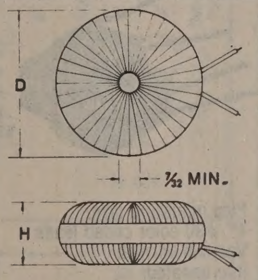

13/16 MAX
3/4 MAX
3/16
.042
T2113 COLOR DOT PIN NO. 1
.020
27/32 MAX
27/64
3/16
3/16

FIG. C


13/16 MAX
3/4 MAX
3/16
.042
.020
27/32 MAX
27/64
3/16
3/16

Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 0.5 Oz.

FIG. D



High-Q Toroid.
Microcrystalline wax impregnated.
Supplied with 4″ #28 leads.

Size Series	D	H	Wt. Oz.
T7400	1	13/32	3/4
T8400	1¼	5/8	2

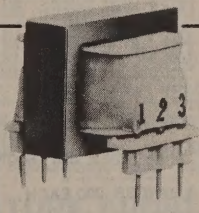


FIG. E
Wt. 0.5 Oz.

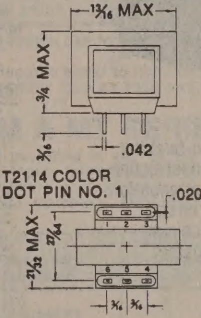
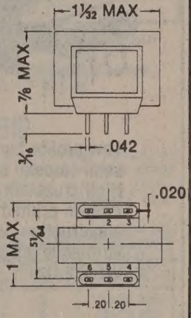

13/16 MAX
3/4 MAX
3/16
.042
T2114 COLOR DOT PIN NO. 1
.020
27/32 MAX
27/64
3/16
3/16

FIG. F
Wt. 1.2 Oz.


1 1/32 MAX
7/8 MAX
3/16
.042
.020
1 MAX
51/64
.20
.20

Plug-in printed circuit construction.
Vacuum varnish impregnated.

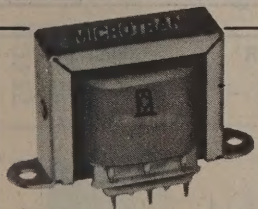
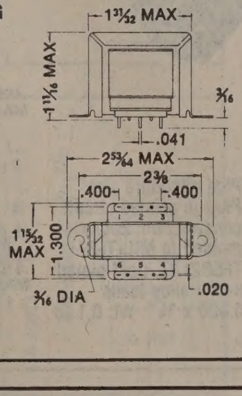


FIG. G


1 13/32 MAX
1 1/16 MAX
3/16
.041
2 53/64 MAX
2 3/8
.400
.400
1 15/32 MAX
1.300
3/16 DIA
.020

Plug-in printed circuit construction with mounting channel.
Vacuum varnish impregnated. Wt. 9.5 Oz.

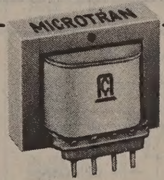


FIG. H

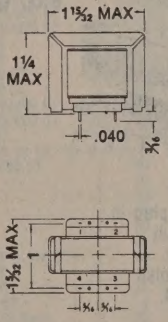
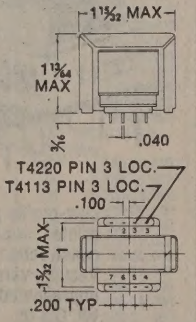
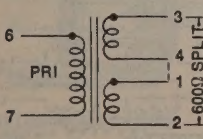

1 15/32 MAX
1 1/4 MAX
.040
3/16
1 15/32 MAX
1
3/16
3/16

FIG. J

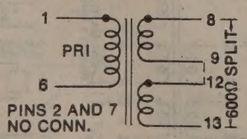

1 15/32 MAX
1 13/64 MAX
3/16
.040
T4220 PIN 3 LOC.
T4113 PIN 3 LOC.
.100
1 15/32 MAX
1
.200 TYP

Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 3.5 Oz.
Available with mounting flanges **on Special Order.**
3/16 Dia. holes, 1¾ mounting centers.
Add -FB to Part No.

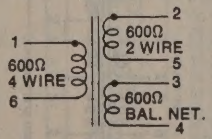
SCHEMATICS


6
PRI
7
3
4
1
2
600Ω SPLIT

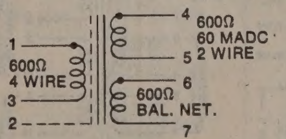
#8


1
PRI
6
8
9
12
13
600Ω SPLIT
PINS 2 AND 7 NO CONN.

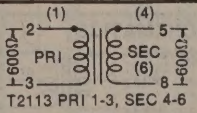
#9


1
600Ω 4 WIRE
6
2
600Ω 2 WIRE
5
3
600Ω BAL. NET.
4

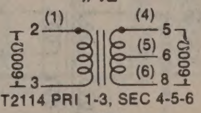
#10


1
600Ω 4 WIRE
3
2
4
600Ω 60 MADC 2 WIRE
5
6
600Ω BAL. NET.
7

#11


(1)
(4)
2
5
PRI
SEC
(6)
600Ω
600Ω
3
8

T2113 PRI 1-3, SEC 4-6
#12


(1)
(4)
2
5
(5)
6
(6)
8
3
600Ω
600Ω

T2114 PRI 1-3, SEC 4-5-6
#13

TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, Inc.

OUTLINE DRAWINGS AND SCHEMATICS FOR PAGE 1134

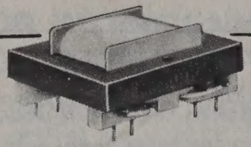
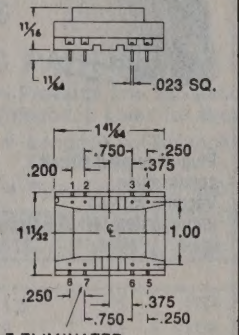


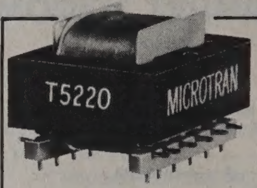
FIG. K



1⁹⁄₁₆
¹⁄₆₄
.023 SQ.
1⁴¹⁄₆₄
.750
.250
.375
.200
1 2 3 4
1¹¹⁄₃₂
℄
1.00
8 7 6 5
.250
.375
.750
.250

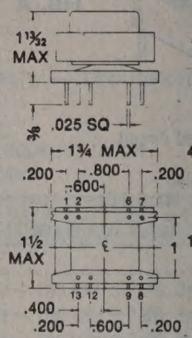
TERM. 7 ELIMINATED ON P/N T5415

Flat Profile.
Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 2.5 Oz.



T5220
MICROTRAN

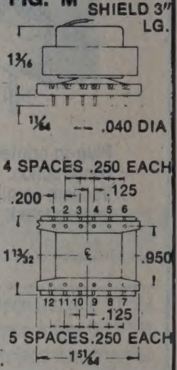
FIG. L



1¹³⁄₃₂ MAX
⅜
.025 SQ
1¾ MAX
.200
.800
.200
.600
1 2
6 7
1½ MAX
℄
1
13 12
9 8
.400
.200
.600
.200

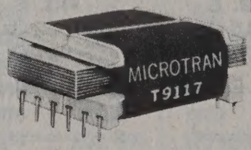
PINS 2 AND 7 NO CONN.

FIG. M SHIELD 3" LG.



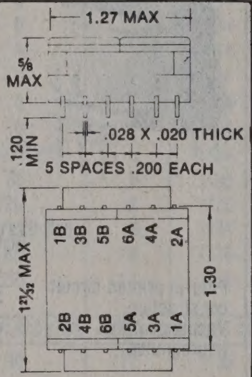
1³⁄₁₆
¹⁄₆₄
.040 DIA
4 SPACES .250 EACH
.200
.125
1 2 3 4 5 6
1¹³⁄₃₂
℄
.950
12 11 10 9 8 7
.125
5 SPACES .250 EACH
1⁵¹⁄₆₄

Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 5.5 Oz.



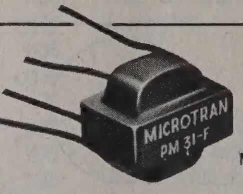
MICROTRAN
T9117

FIG. N



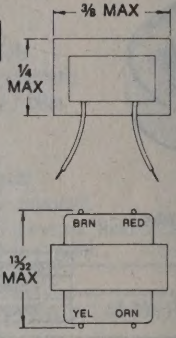
1.27 MAX
⅝ MAX
.120 MIN
.028 X .020 THICK
5 SPACES .200 EACH
1B 3B 5B 6A 4A 2A
1²³⁄₃₂ MAX
1.30
2B 4B 6B 5A 3A 1A

Low profile hum-bucking semi-toroidal construction.
High crosstalk attenuation.
Plug-in printed circuit construction. Vacuum varnish impregnated.
Wt. 2.2 Oz.



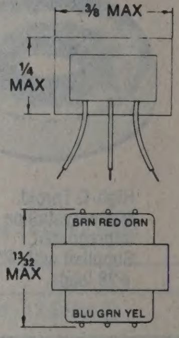
MICROTRAN
PM 31-F

FIG. O



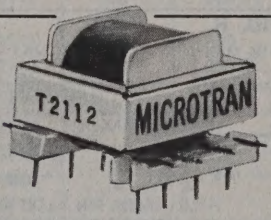
⅜ MAX
¼ MAX
BRN
RED
1³⁄₃₂ MAX
YEL
ORN

FIG. P



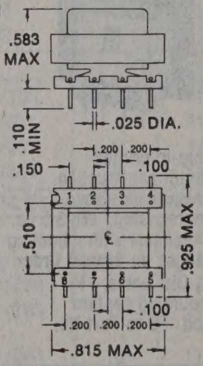
⅜ MAX
¼ MAX
BRN RED ORN
1³⁄₃₂ MAX
BLU GRN YEL

Pico miniature size.
4" #30 color coded leads.
Vacuum varnish impregnated.
Wt. 0.05 Oz.



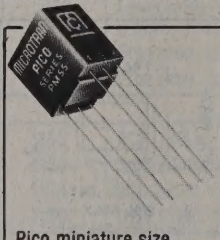
T2112
MICROTRAN

FIG. Q



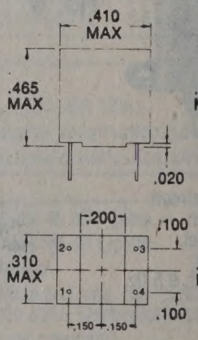
.583 MAX
.110 MIN
.025 DIA.
.200
.200
.150
.100
1 2 3 4
.510
℄
.925 MAX
8 7 6 5
.100
.200
.200
.200
.815 MAX

Low-profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.



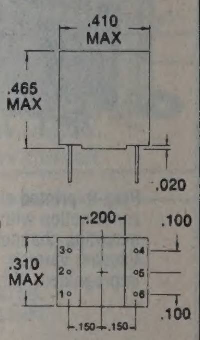
MICROTRAN
PICO
SERIES
PM55

FIG. R



.410 MAX
.465 MAX
.020
.200
.100
2
3
.310 MAX
1
4
.100
.150
.150

FIG. S

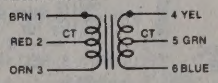


.410 MAX
.465 MAX
.020
.200
.100
3
4
2
5
.310 MAX
1
6
.100
.150
.150

Pico miniature size.
Plug-in printed circuit construction. Epoxy molded to MIL-T-27 TF5R21ZZ. Gold plated nickel alloy leads 0.020 x ¾". Wt. 0.1 Oz.

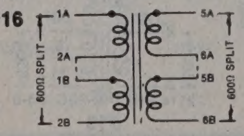
SCHEMATICS

#14



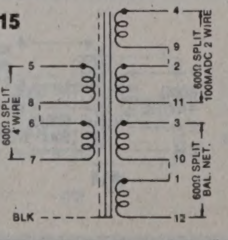
BRN 1
RED 2
ORN 3
CT
CT
4 YEL
5 GRN
6 BLUE

#16



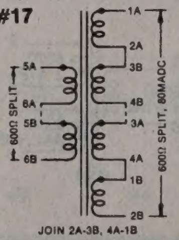
1A
2A
1B
2B
600Ω SPLIT
5A
6A
5B
6B
600Ω SPLIT

#15



5
8
6
7
600Ω SPLIT 4 WIRE
BLK
4
9
2
11
600Ω SPLIT 100MADC 2 WIRE
3
10
1
12
600Ω SPLIT BAL. NET.

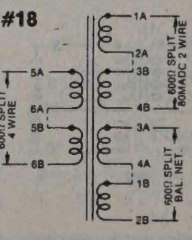
#17



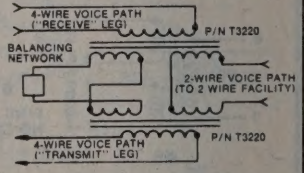
5A
6A
5B
6B
600Ω SPLIT
1A
2A
3B
4B
3A
4A
1B
2B
600Ω SPLIT, 80MADC

JOIN 2A-3B, 4A-1B

#18



5A
6A
5B
6B
600Ω SPLIT 4 WIRE
1A
2A
3B
4B
600Ω SPLIT 80MADC 2 WIRE
3A
4A
1B
2B
600Ω SPLIT BAL. NET.



4-WIRE VOICE PATH ("RECEIVE" LEG)
P/N T3220
BALANCING NETWORK
2-WIRE VOICE PATH (TO 2 WIRE FACILITY)
P/N T3220
4-WIRE VOICE PATH ("TRANSMIT" LEG)

TYPICAL HYBRID APPLICATION

For More Information. Circle No. 498

MICROTRAN company, Inc.

MINIATURIZED AUDIO TRANSFORMERS

MICROTRAN
S101-S

MICROTRAN
S101-SP

FIG. -S
SINGLE THREADED STUD MOUNTING
Double Mu-metal shielding. 3" color coded leads. 5/16"D. stud provided with nut. ⅝"D x 13/16" H. Wt. 0.55 oz.

FIG. -SP
PRINTED CIRCUIT MOUNTED
Double Mu-metal shielded. ¾" D x 1 1/16"H. 7-.040 pins ⅛" H. Wt. 0.62 oz.

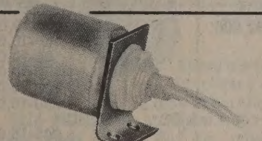
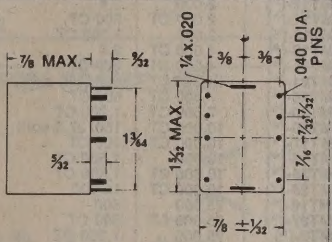
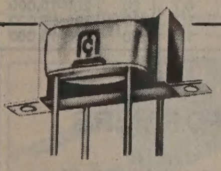
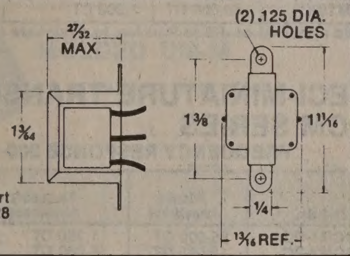


FIG. -FB
RIGHT ANGLE MOUNTING BRACKET
For mounting of -S series transformers. M.C. ⅜".

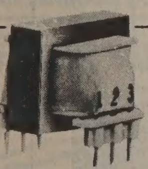


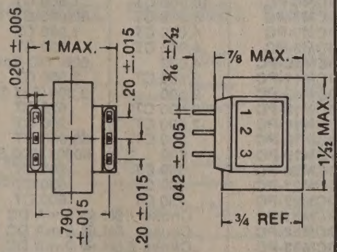
MOLDED M-M
To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. 1.75 oz.



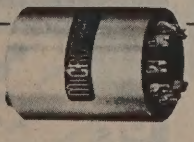


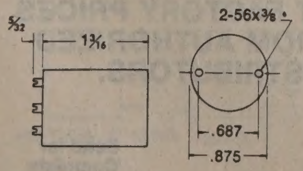
OPEN FRAME WITH CHANNEL M-FB
To order add -FB to Part No. Leads 4" long. #28 PVC Wt. 1.13 oz.





OPEN FRAME PRINTED CIRCUIT M-PC
To order add -PC to Part No. Units with more than 6 pins have 7 or 8 — .025 x .015 pins on .150 centers. Wt. 1.2 oz.





ALUMINUM CASED M-A
To order add -A to Part No. Supplied with 2-56 screws. Wt. 1.25 oz.

MICROPHONE/TRANSDUCER INPUT

FOR: PROFESSIONAL SOUND STUDIOS — BROADCAST MIXING CONSOLES — CONTROL AND INSTRUMENT AMPLIFIERS

EQUIVALENT TO IMPORTED EUROPEAN STUDIO GRADE TRANSFORMERS

- WIDE BANDWIDTH — BROAD FREQUENCY RESPONSE
- EXTREMELY LOW DISTORTION
- NEGLIGIBLE HUM PICK UP
- SUBMINIATURE SIZE
- EASE OF MOUNTING AND ORIENTATION
- POLARIZING VOLTAGE CONNECTION FOR CONDENSER MICROPHONES
- LOW MICROPHONICS
- ELECTROSTATIC SHIELDING

Part No.	Nom. Turns Ratio Pri:Sec	Nominal Impedance Ratio		Typ. Open Circuit Primary Impedance @ 50 Hz†	Frequency Response	Fig.	Replaces Beyer Part No.
		Primary	Secondary				
S101-S	1:20	12.5	5,000	100	30-15,000 Hz ±1 dB	-S	TR-BV35704
S101-SP	1:20	12.5	5,000	100	30-15,000 Hz ±1 dB	-SP	STR-BV37704
S105-S	1:15	200	45,000	2,000	30-15,000 Hz ±1 dB	-S	351.015.006
S105-SP	1:15	200	45,000	2,000	30-15,000 Hz ±1 dB	-SP	370.015.006
S107-S	1:15	200/50 split	45,000	2,000	30-15,000 Hz ±1 dB	-S	351.215.006
S107-SP	1:15	200/50 split	45,000	2,000	30-15,000 Hz ±1 dB	-SP	370.215.006
S108-S	1:10	200	20,000	2,000	30-15,000 Hz ±1 dB	-S	351.010.005
S108-SP	1:10	200	20,000	2,000	30-15,000 Hz ±1 dB	-SP	370.010.005
S111-S	1:7.1	200	10,000	2,000	30-15,000 Hz ±1 dB	-S	351.007.004
S111-SP	1:7.1	200	10,000	2,000	30-15,000 Hz ±1 dB	-SP	370.007.004
S116-S	1:5	200	5,000	2,000	30-15,000 Hz ±1 dB	-S	351.005.003
S116-SP	1:5	200	5,000	2,000	30-15,000 Hz ±1 dB	-SP	370.005.003
S118-S	1:5	200/50 split	5,000	2,000	30-15,000 Hz ±1 dB	-S	351.205.003
S118-SP	1:5	200/50 split	5,000	2,000	30-15,000 Hz ±1 dB	-SP	370.205.003
S126-S	1:1	600 CT	600	3,750	30-20,000 Hz ±.5 dB	-S	TR145/BV35508
S126-SP	1:1	600 CT	600	3,750	30-20,000 Hz ±.5 dB	-SP	STR-145/BV37508
S130-S	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-S	TR-145/BV35590
S130-SP	1:1	10,000	10,000	100,000	30-15,000 Hz ±1 dB	-SP	STR-145/BV37590
S100-FB	Right angle mounting bracket for S100-S series.					-FB	

† Designed for optional bridging termination use to provide additional 6 dB output voltage gain.

‡ Frequency response measured with source equal to nominal primary impedance and with unloaded secondary except 100k load on S105 and S107 series.

MINIATURE AUDIO M & MT SERIES

All items shown in charts below are available in any of the mechanical packages shown. These units can be used as input, interstage, output, isolation and other impedance matching applications. Primary and secondary windings may be interchanged to obtain required impedance matching. Also available in hermetic construction.

Part No.*	Primary Impedance	Secondary Impedance	Primary Unbalance mA DC	Operating Level dBm	Frequency Response ±2 dB
M3-(*)•	7.5/30	50,000	0	5	20-20,000
M12-(*)	50/250 CT	50/250/600 CT	0	8	20-20,000
M1-(*)•	50/250/600 CT	50,000	0	5	20-20,000
M1-S	Same as M1 above — with dual nickel alloy shield				
M2-(*)•	50/250/600 CT	50,000 CT	0	5	20-20,000
M14-(*)	200	½ Megohm	0	9	80-3,000
M15-(*)	10,000	1 Megohm	0	11	100-2,500
M8-(*)	15,000	50/250/600 CT	0	8	20-20,000
M9-(*)	15,000	50/250/600 CT	4	21	150-20,000
M4-(*)	15,000	60,000	0	6	20-15,000
M5-(*)	15,000	60,000	4	14	200-20,000
M6-(*)	15,000	95,000 CT	0	5	20-15,000
M7-(*)	15,000	95,000 CT	4	11	200-20,000
M10-(*)•	30,000 CT	50/250/600 CT	0	8	30-50,000
M11-(*)•	50,000	50/250/600 CT	0	5	20-20,000
M13-(*)	Reactor 300 hy. 0 DC	50 hy. @ 3 mA			6000Ω D.C.R.
M90	Magnetic Shield Mu-Metal slip on can for M-A Series 25 dB shielding				
MT2-(*)	100	10 CT/40 CT	100	27	200-20,000
MT30-(*)	250 CT	500	10	30	200-15,000
MT23-(*)	250 CT	1000	10	30	200-15,000
MT14-(*)	400	10	50	25	200-20,000
MT15-(*)	500 CT	210	30	27	300-20,000
MT1-(*)	600	600	10	23	200-15,000
MT35-(*)‡	600	600 CT & 600 CT	0	5	40-20,000
MT36-(*)†	600 CT	600 CT	0	15	50-15,000
MT26-(*)	600 OT	600 CT	20	23	200-15,000
MT9-(*)	600 CT	1,200 CT	4	23	200-15,000
MT33-(*)	600/150 Split	600/150 Split	20	23	200-20,000
MT22-(*)	600/150 Split	1,200 CT	4	23	200-15,000
MT29-(*)	1600 CT	450	15	30	200-15,000
MT12-(*)	2,000	3.4	10	32	200-15,000
MT24-(*)	2,500	600 CT	10	32	200-15,000
MT13-(*)	4,000 CT	3.4	3	32	200-15,000
MT11-(*)	4,000 CT	600 CT	3	32	200-15,000
MT21-(*)	4,000 CT	600/150 Split	3	32	200-15,000
MT25-(*)	7,500 CT	600 CT	8	32	200-15,000
MT34-(*)	10,000/2500 Split	2000/500 Split	4	20	200-20,000
MT10-(*)•	25,000	600	3	22	200-15,000
MT7-(*)•	25,000	1,200 CT	3	22	200-15,000
MT18-(*)•	25,000 CT	1,200 CT	6	22	200-15,000
MT5-(*)•	50,000	6	3	20	300-15,000
MT3-(*)	50,000	600	3	20	300-15,000
MT8-(*)•	50,000 CT	1,200 CT	3	20	300-15,000
MT20-(*)•	50,000 CT	1200/300 Split	3	20	300-15,000
MT6-(*)•	100,000	1,200 CT	1.4	17	200-15,000

* Add -M, -PC, -A, or -FB to Part No. to designate construction.
• These items not available in -PC construction.
‡ For telephone line coupling or hybrid telephone line.
† Broadcast fidelity line matching transformer. Frequency response ±0.5 dB.

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MINIATURIZED AUDIO TRANSFORMERS

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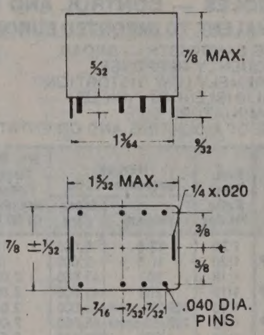
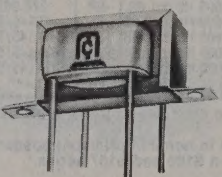
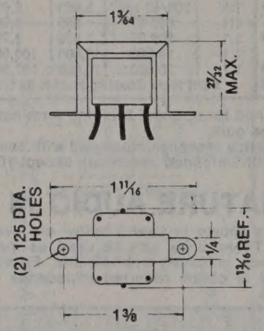
MICROTRAN
MMT18 M
1 2 3



MOLDED MM-M

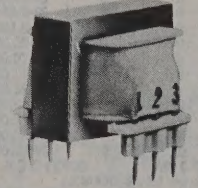
To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. .5 oz.

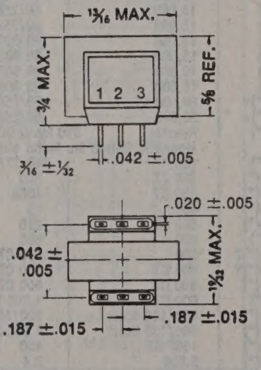




OPEN FRAME WITH CHANNEL MM-FB

To order add -FB to Part No. Leads #28 PVC 4" long. Wt. .36 oz.





PRINTED CIRCUIT — DCM SERIES

New Industrial/Commercial grade miniature printed circuit transformers. Rigid terminals provide fixed mounting centers usually found in expensive molded transformers. Wt. .5 oz.

MICRO-MINIATURE TRANSFORMERS MM & MMT SERIES

Primary and secondary windings may be interchanged to obtain required impedance matching. These units can be used as input, interstage, output, isolation and other impedance matching requirements. Also available in hermetic construction.
The low profile design of this series makes them ideal for use on plug-in printed circuit boards.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Oper. Level dBm	Frequency Response ±2 dB
MM1-(*)	200/50	250,000/62,500	0	4	200-10,000
MM3-(*)	10,000	200	3	20	150-10,000
MM2-(*)	10,000	90,000	0	4	150-10,000
MM4-(*)	30,000	50	1	20	150-10,000
MM7-(*)	30,000	1,200	0.5	20	200-10,000
MM6-(*)	100,000	60	0.5	20	250-10,000
MM5-(*)	Reactor 50H @ 1 mA DC 4,700 DCR				
MMT1-(*)	600	600	8	22	200-15,000
MMT26-(*)	600 CT	600 CT	16	22	200-15,000
MMT33-(*)	600 CT	600/150 Split	16	22	200-15,000
MMT9-(*)	600 CT	1,200 CT	16	22	200-15,000
MMT32-(*)	600 CT	1200/300 Split	16	22	200-15,000
MMT12-(*)	2,000	3.4	5	28	200-15,000
MMT31-(*)	2,000 CT	500 CT	10	28	200-15,000
MMT19-(*)	2,500	2,500 CT	2	23	200-15,000
MMT13-(*)	4,000 CT	3.4	5	28	200-15,000
MMT11-(*)	4,000 CT	600 CT	5	28	200-15,000
MMT21-(*)	4,000 CT	600/150-split	5	28	200-15,000
MMT25-(*)	7,500 CT	600 CT	4	22	200-15,000
MMT30-(*)	7,500 CT	1,200 CT	4	22	200-15,000
MMT35-(*)	10,000 CT	150/37.5 split	2	20	200-15,000
MMT17-(*)	10,000 CT	200 CT	6	20	200-15,000
MMT16-(*)	10,000	1,500 CT	1	20	200-15,000
MMT28-(*)	10,000 CT	1,500 CT	2	20	200-15,000
MMT29-(*)	10,000 CT	10,000	2	20	200-15,000
MMT10-(*)	25,000	600	1	20	200-15,000
MMT27-(*)	25,000 CT	600 CT	2	20	200-15,000
MMT7-(*)	25,000	1,200 CT	1	20	200-15,000
MMT18-(*)	25,000 CT	1,200 CT	2	20	200-15,000
MMT5-(*)	50,000	6	1	20	200-15,000
MMT3-(*)	50,000	600	0.7	20	200-15,000
MMT4-(*)	50,000 CT	600 CT	1.4	20	200-15,000
MMT8-(*)	50,000 CT	1,200 CT	1.4	20	200-15,000

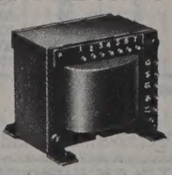
* Add either -M or -FB to Part No. to designate construction.

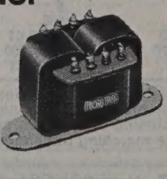
DECI-MINIATURE TRANSFORMERS DCM SERIES

FREQUENCY RESPONSE 200-15,000 Hz ±2 dB

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Operating Level dBm
DCM1-PC	25,000 CT	1,200 CT	2	18
DCM2-PC	15,000 CT	15,000 CT	3	19
DCM3-PC	15,000 CT	600 CT	3	19
DCM4-PC	10,000 CT	5,000 CT	4	20
DCM5-PC	10,000	2,500/625 Split	2	20
DCM6-PC	10,000 CT	1,500 CT	4	20
DCM7-PC	5,000 CT	80,000 CT	6	15
DCM8-PC	4,000 CT	1,200 CT	6	20
DCM9-PC	4,000 CT	600 CT	6	20
DCM10-PC	4,000	600/150 Split	3	20
DCM11-PC	2,500 CT	2,500 CT	8	20
DCM12-PC	2,500	2,500/625 Split	4	20
DCM13-PC	2,500 CT	625 CT	8	20
DCM14-PC	2,500 CT	200 CT	8	20
DCM18-PC	600 CT	50,000 CT	16	20
DCM19-PC	600	8000/2000 Split	8	20
DCM20-PC	600 CT	200 CT	16	20
DCM21-PC	600 CT	600 CT	16	20
DCM22-PC	250 CT	600 CT	25	20
DCM51-PC	Choke 10H @ 0 mA DC		5H @ 3 mA DC	300 DCR
DCM52-PC	Choke 5H @ 0 mA DC		2H @ 5 mA DC	155 DCR
DCM53-PC	Choke 2.5H @ 0 mA DC		1H @ 7 mA DC	75 DCR

MODIFIED CATALOG ITEMS AND CUSTOM DESIGNS AVAILABLE ON SPECIAL ORDER. CALL US WITH YOUR SPECIFICATIONS.





IMMEDIATE DELIVERY OF CATALOG ITEMS AT FACTORY PRICES FROM AUTHORIZED DISTRIBUTORS.

Send for Complete Catalog

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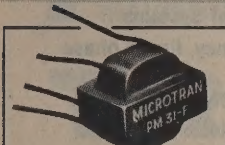
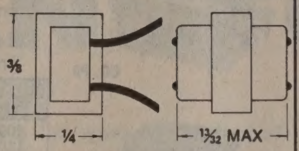
MINIATURIZED AUDIO TRANSFORMERS

PICO—ULTRA
VERI-MINIATURE

OPEN FRAME PM-F

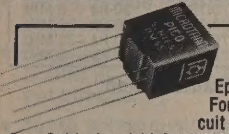


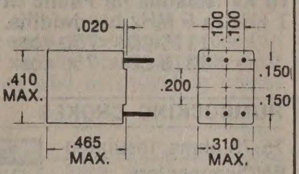


4 inch #30 Plastic color coded leads. Thorough resin impregnation and baking assures reliable life. To order add -F to Part No., i.e. PM33-F. Wt. .05 oz.

MIL Designation: TF6R21ZZ

MOLDED PM-M

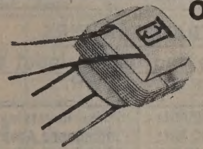


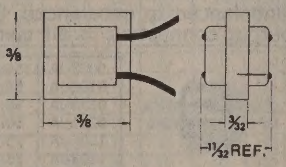


Epoxy molded. For printed circuit application. Gold plated high strength nickel alloy leads .020 x ¾″ for reliable soldered joints and high-density welded lead packaging. Wt. .1 oz. To order add -M to Part No., i.e. PM12-M.

MIL Designation: TF5R21ZZ

OPEN FRAME UM-F

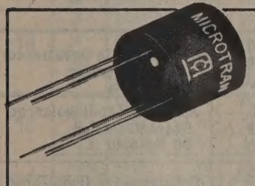


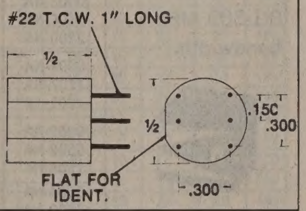


To order add -F to Part No., i.e. UM22-F. Wt. 0.08 oz. 4″ color coded leads.

MIL Designation: TF6R21ZZ

MOLDED UM-M

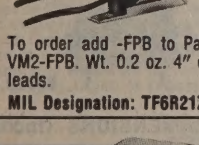


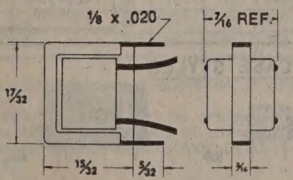


To order add -M to Part No., i.e. UM22-M. Wt. 0.14 oz.

MIL Designation: TF5R21ZZ

PLUG-IN TAB MOUNTED CHANNEL VM-FPB

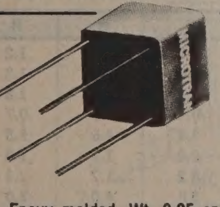


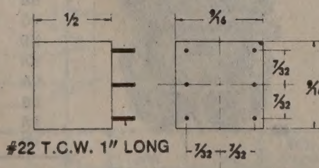


To order add -FPB to Part No., i.e. VM2-FPB. Wt. 0.2 oz. 4″ color coded leads.

MIL Designation: TF6R21ZZ

MOLDED VM-M





Epoxy molded. Wt. 0.25 oz. To order add -M to Part No., i.e. VM2-M.

MIL Designation: TF5R21ZZ

PICO-MINIATURE — PM SERIES

Frequency Response ±2 dB 300 Hz to 100 kHz†

For maximum utilization of space in miniaturized printed circuit board applications. Manufactured per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Power Level mW
PM37-(*)	120 CT	3.2	10	16	0.75	50
PM38-(*)	300 CT	600	7	41	98	50
PM35-(*)	500	50	3	60	8	50
PM36-(*)	500	500/125 split	3	72	85	50
PM32-(*)	600	600	3	75	105	50
PM34-(*)	600 CT	600 CT	3	75	105	50
PM33-(*)	1500 CT	600	3	170	95	50
PM31-(*)	2500	2500 CT	1	250	325	50
• PM29(*)	10,000 CT	500 CT	1	1050	80	50
PM27(*)	10,000	1200	0.5	1050	280	50
• PM23(*)	10,000 CT	1200 CT	1	1050	280	50
• PM25(*)	10,000	1200/300 split	0.5	1050	280	50
• PM19(*)	10,000 CT	2000 CT	1	1000	300	50
• PM21(*)	10,000	2000/500 split	0.5	1000	300	50
• PM17(*)	10,000 CT	10,000 CT	1	1000	1300	50
PM15(*)	25,000	1000	0.25	1700	110	40
• PM11(*)	25,000 CT	1000 CT	0.5	1700	110	40
• PM13(*)	25,000	1000/250 split	0.25	1700	110	40
• PM7(*)	50,000 CT	1000 CT	0	3300	75	10
• PM9(*)	50,000	1000/250 split	0	3300	75	10
• PM5(*)	200,000	1000	0	5300	110	10
• PM3(*)	200,000 CT	1000 CT	0	5300	110	10
PM41-(*)	Audio Choke	.3 H	4	43		
PM40-(*)	Audio Choke	3.5 H	2	700		
PM39-(*)	Audio Choke	6 H	2	1800		
PM90	Magnetic Shield Mu-metal slip-on can for PM-M series. 20dB shielding. 0.365″ x 0.465″ x 0.0500″ high.					

• These items not available in open frame construction.
* Add either -F, -M to Part No. See photos figures PM-M & PM-F. Frequency response measured as stated power level above.
† PM3 and PM5 — 45 kHz.

ULTRA-MINIATURE — UM SERIES

Frequency Response ±2 dB 300 to 10,000 Hz

Measured at level stated for 300 Hz. Miniaturized design offers a relatively high power level and printed circuit packaging. Response measured at level stated for 300 Hz. Mfg. per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW @ 300 Hz	Level mW @ 1 kHz
UM26-(*)	400	11	3	35	1.5	15	500
UM27-(*)	400 CT	11	6	35	1.5	15	500
UM25-(*)	400	50	3	35	5	15	500
UM29-(*)	600 CT	600 CT	7	45	60	5	400
UM24-(*)	1000	50	3	65	10	5	500
UM33-(*)	1000 CT	600	6	80	65	5	500
UM32-(*)	1500 CT	600	5	135	65	5	500
UM39-(*)	2500 CT	600 CT	2	250	50	5	500
UM34-(*)	10,000 CT	600 CT	2	850	40	5	500
UM31-(*)	10,000 CT	1200 CT	2	850	120	5	500
UM37-(*)	10,000	2000 CT	1	850	200	5	500
UM35-(*)	15,000 CT	15,000 CT	1	930	1210	5	300
UM36-(*)	20,000 CT	800 CT	0.5	1100	80	5	500
UM22-(*)	20,000	1000	0.5	1100	100	5	300
UM23-(*)	20,000	1200 CT	0.5	1100	110	5	300
UM21-(*)	100,000	1000	0	1900	135	5	70
UM30-(*)	Choke	1.5 H (0 mA) 0.7 H (2 mA) 100 DCR					
UM28-(*)	Choke	10 H (0 mA) 8 H (0.5 mA) 650 DCR					
UM90	Magnetic Shield Mu-metal slip-on can for UM-M series. 20 dB shielding. 19/32″D x 9/16″H.						

* Add either -F, or -M to Part No. to designate construction. See Photos. Power levels shown are for 7½% maximum distortion.

VERI-MINIATURE — VM SERIES

Frequency Response ±2 dB 200 to 10,000 Hz

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW
VM1-(*)	50	600	5.5	7	90	15
VM7-(*)	500	3.4	3.5	50	0.5	15
VM16-(*)	500 CT	250 CT	7.5	50	25	15
VM14-(*)	600 CT	600 CT	7.0	50	65	15
VM8-(*)	1250	3.4	2.0	135	0.5	15
VM9-(*)	1250	50	2.0	135	6.5	15
VM10-(*)	2500	2500 CT	1.5	225	215	3
VM17-(*)	10,000 CT	5000 CT	0	400	300	5
VM12-(*)	20,000	1000	0.16	625	85	5
VM13-(*)	20,000	1000 CT	0.16	625	85	5
VM3-(*)	25,000	600	0.15	720	45	5
VM5-(*)	50,000	600	0.1	830	55	5
VM15-(*)	50,000 CT	50,000 CT	0	2000	2600	5
VM6-(*)	100,000	1200 CT	0.07	2000	150	5
VM2-(*)	200,000	600	0.05	3000	110	2.5
VM4-(*)	200,000	1200	0.035	3100	165	5
VM11-(*)	Choke	20 H (0 mA)	12 H (0.5 mA)		1000	
VM90	Magnetic Shield Mu-metal slip-on can for VM-M series. 20 dB shielding. ⅝″ x ⅝″ x 17/32″ high.					

* Add either -FPB, or -M to Part No. to designate construction. See Photos.

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For More Information. Circle No. 498

WIDEBAND TRANSFORMERS

North Hills

UNBALANCED TO BALANCED TRANSFORMERS

Balanced secondaries center-tapped and dc-isolated from primaries. Mid-band insertion loss less than 0.5 dB. Bandwidth defined at low frequency end by 3 dB drop from mid-band response, at high end by max. VSWR of 1.25.

LOW POWER SERIES (1W)

Series	Radio Frequency		Medium Frequency		Video	
Cases	BA, BB, HB		BA, BB		LA, LB	
Unb./Bal. (Ω)	Type No.	Bandwidth MHz	Type No.	Bandwidth MHz	Type No.	Bandwidth MHz
50:50	0001	.1-125	0010	.01-80	0009	.001-25
50:75	0101	.1-125	0111	.01-80	0104	.001-25
50:90	0200	.1-125	0202	.01-60	0203	.001-20
50:100	0300	.1-100	0301	.01-60	0311	.001-20
50:124	0307	.1-100	0302	.01-60	0306	.001-20
50:135	0310	.1-100	0312	.01-60	0303	.001-18
50:150	0400	.1-100	0401	.01-60	0415	.001-15
50:200	0500	.1-100	0520	.01-60	0511	.001-15
50:300	0501	.1-100	0521	.01-50	0517	.001-12
50:450	0600	.1-65	0602	.01-40	0603	.001-10
50:600	0700	.1-65	0703	.01-32	0706	.001-8
50:800	0800	.1-60	0801	.01-25	0802	.001-7
50:1200	0900	.1-30	0902	.01-15	0904	.001-6
75:50	1000	.1-100	1001	.01-60	1002	.001-25
75:75	1100	.1-100	1112	.01-60	1102	.001-25
75:90	1200	.1-100	1201	.01-60	1202	.001-20
75:100	1300	.1-100	1310	.01-60	1314	.001-20
75:124	1302	.1-100	1311	.01-60	1301	.001-20
75:135	1317	.1-100	1315	.01-60	1312	.001-20
75:150	1400	.1-100	1405	.01-60	1404	.001-16
75:200	1500	.1-100	1513	.01-60	1516	.001-15
75:300	1501	.1-100	1514	.01-60	1502	.001-15
75:450	1600	.1-60	1601	.01-40	1602	.001-12
75:600	1700	.1-60	1707	.01-32	1704	.001-10
75:800	1800	.1-30	1801	.01-20	1802	.001-10
75:1200	1900	.1-30	1905	.01-15	1902	.001-9
75:1850	1906	.1-15	1901	.01-8	1903	.001-6

EXTENDED VIDEO SERIES Response down to 20 Hz

Type No.	Unb./Bal.	Bandwidth	Case Styles
0014	50:50	20 Hz-6 MHz	PB
0113	50:75	20 Hz-6 MHz	PB
0315	50:100	20 Hz-6 MHz	PB
0316	50:124	20 Hz-6 MHz	PB
0522	50:200	20 Hz-4 MHz	PB
1003	75:50	20 Hz-6 MHz	PB
1111	75:75	20 Hz-6 MHz	LA, LB
1307	75:110	20 Hz-6 MHz	PB
1309	75:124	20 Hz-9 MHz	PB
1408	75:150	20 Hz-6 MHz	PB
1520	75:300	20 Hz-4 MHz	PB

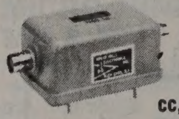
HIGH POWER SERIES

Power Level	10 W	25 W	100 W	1 kW
Cases	HB	BA, BB	BA, BB	KA
MHz Range	.1-30	.1-30	.5-30	2-32
Unb./Bal. (Ω)	Type No.	Type No.	Type No.	Type No.
50:50	0008	0011	0012	0013
50:75	0108	0109	0105	0107
50:100	0309	0308	0304	0314
50:150	0406	0402	0404	0407
50:200	0519	0512	0516	0515
50:300	0514	0518	0506	0513
50:450	0604	0605	0606	0601
50:600	0705	0701	0704	0702
75:75	1105	1110	1118	1108
75:100	1306	1304	1305	1316
75:150	1406	1401	1403	1407
75:200	1517	1519	1512	1518
75:300	1515	1510	1505	1511
75:450	1603	1604	1605	1606
75:600	1709	1703	1708	1705

MANY VARIATIONS, MIL SPEC, AND CUSTOM DESIGNS TO 1 GHz ALSO AVAILABLE

ISOLATION TRANSFORMERS UNBALANCED TO UNBALANCED

Ground Isolation in 50 and 75Ω Coaxial Systems



CC, PA

CD

- Flat frequency, linear phase response.
- Insulated BNC connectors.
- 140 dB isolation at power frequencies.

Type No.	Impedance Unb/Unb(Ω)	Bandwidth
0005-CC	50:50	1 kHz - 25 MHz
1103-CC	75:75	1 kHz - 25 MHz
0112-CC	50:75	1 kHz - 25 MHz
0017-CC	50:50	10 Hz - 5 MHz
1117-CC	75:75	10 Hz - 5 MHz
0016-PA	50:50	20 Hz - 20 MHz
1116-PA	75:75	20 Hz - 20 MHz
1121-TC	75:75	3.5 Hz - 8 MHz

10 KV Isolation for Public Utility Data Transmission
1 kHz to 6 MHz bandwidths.
1115-CD: 75Ω coax to 75Ω coax.
1313-CD: 75Ω coax to 124Ω balanced line.

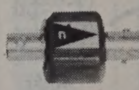
HUMBUCKING CHOKES

75:75 ohms, Insulated BNC connectors

Type	Bandwidth	Rejection at 60 Hz
1119-PA	DC to 15 MHz	50 dB min.
1120-CC	DC to 20 MHz	40 dB min.

ULTRA-WIDE COAXIAL MATCHING TRANSFORMERS

Unbalanced to unbalanced. BNC male and female input and output connectors in all combinations. Low VSWR.



0003-JA	50:50	.05-300 MHz	Phase Reversing
0102-JA	50:75	.05-300 MHz	Impedance Adapter
0114-JA	50:75	10-1000 MHz	Impedance Adapter
0201-JA	50:90	.05-300 MHz	Impedance Adapter
1106-JA	75:75	.05-300 MHz	Phase Reversing
1203-JA	75:90	.05-300 MHz	Impedance Adapter

SUBMINIATURE SERIES

NA molded case. 0.1-300 MHz bandwidth.

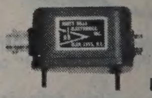
.6 x .6 x .4"

0003-NA	50: 50	Unbalanced to Unbalanced Phase Reversing DC Coupled
1106-NA	75: 75	
2200-NA	90: 90	
0007-NA	50: 50	Unbalanced to Unbalanced Phase Reversing DC Isolated
1107-NA	75: 75	
2201-NA	90: 90	
0002-NA	50: 12.5	Unbalanced to Unbalanced Non-Inverting DC Coupled
0508-NA	50:200	
1506-NA	75:300	
0004-NA	50: 50	Unbalanced to Balanced DC Coupled
0509-NA	50:200	
1101-NA	75: 75	
1507-NA	75:300	
2202-NA	100:100	
0510-NA	50:200	Balanced to Balanced DC Coupled
1508-NA	75:300	

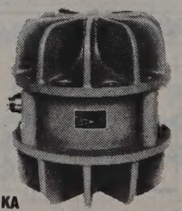
CASE STYLES

HB

BA, LA



BB, LB, PB



KA

OVERALL DIMENSIONS (Inches)

Case	L	W	H
BA	2.3	1.3	1.2
BB	2.6	1.3	1.2
CC	3.5	1.7	1.6
HB	0.9	0.9	0.7
KA	5.4	4.6	5.5
LA	2.9	1.7	1.3
LB	3.2	1.7	1.3
PA	3.0	4.0	2.0
PB	3.0	3.6	2.0

North Hills Electronics, INC.
GLEN COVE, N.Y. 11542 • 516-671-5700

OPT INDUSTRIES INC. 300 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865 • (201) 454-2600 • TWX 510-235-2920

TRANSFORMERS

CONSTANT VOLTAGE

- Designed and rated for use in a full wave center tapped rectifier circuit. (Fig. 1):
- OPT's unique insulation allows all units to be rated at 150°C and can be used in higher ambients with extended life.
- Excellent common mode noise suppression characteristics. Spikes as high as 2500 volts are kept from entering the output circuits.
- 100% solids custom formulated epoxy impregnant is used to provide a quieter unit than is usually obtained with most constant voltage transformers as well as providing cooler operation.
- Windings can be connected for dual (+ or −) output voltages by adding another set of diodes. The sum of the + and − currents equals the total rating of the winding.
- Double output voltage at one half of the rated current is possible with a bridge rectifier. (Fig. 2)
- Output voltage remains essentially constant over input line swings of plus and minus 15%.
- Nominal output voltage is set to +/− 2%.
- UL recognized insulation system (UL 1446).
- Will meet international safety standards.
- Resonant capacitor furnished with each unit.

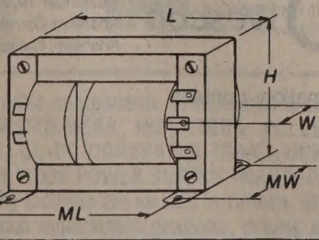
SINGLE OUTPUT

DC Output Volts†	Output DC Amps	Part No.	Load Regulation (AV)*			RMS Ripple Volts	Recommended Diodes		Filter Capacitor CP		Size VA
			10%	25%	50%		PIV	I/Cell	KMFD	DCWV	
5	12	CV8400	.60	.50	.40	.25	35	20	75	10	60
	24	CV8401	.55	.45	.35	.25	35	50	150	10	120
	48	CV8402	.50	.40	.25	.25	35	75	300	10	240
	96	CV8403	.40	.30	.17	.25	35	150	600	10	480
8	7.5	CV8404	.95	.80	.65	.4	35	15	30	10	60
	15	CV8405	.88	.72	.55	.4	35	35	60	10	120
	30	CV8406	.80	.65	.40	.4	35	75	120	10	240
	60	CV8407	.64	.48	.24	.4	35	100	240	10	480
12	5	CV8408	1.45	1.20	.46	.6	50	10	13	15	60
	10	CV8409	1.32	1.08	.84	.6	50	20	26	15	120
	20	CV8410	1.20	.96	.60	.6	50	35	52	15	240
	40	CV8411	.96	.72	.36	.6	50	75	104	15	480
15	4	CV8412	1.80	1.50	1.20	.75	50	10	8	20	60
	8	CV8413	1.65	1.25	1.05	.75	50	20	16	20	120
	16	CV8414	1.55	1.20	.75	.75	50	35	33	20	240
	32	CV8415	1.2	.90	.45	.75	50	75	67	20	480
18	3.3	CV8416	2.15	1.80	1.44	.9	75	10	6	20	60
	6.7	CV8417	1.98	1.62	1.26	.9	75	20	12	20	120
	13.3	CV8418	1.80	1.44	.90	.9	75	35	24	20	240
	26.6	CV8419	1.44	1.08	.54	.9	75	75	48	20	480
24	2.5	CV8420	2.88	2.40	1.92	1.2	100	5	3	25	60
	5	CV8421	2.64	2.16	1.68	1.2	100	10	6	25	120
	10	CV8422	2.40	1.92	1.20	1.2	100	20	12	25	240
	20	CV8423	1.92	1.44	.72	1.2	100	35	24	25	480
	40	CV8424	1.70	1.20	.50	1.2	100	70	48	25	960
28	2.2	CV8425	3.36	2.80	2.24	1.4	100	5	2.5	30	60
	4.3	CV8426	3.08	2.52	1.96	1.4	100	10	5	30	120
	8.6	CV8427	2.83	2.24	1.40	1.4	100	20	10	30	240
	17.2	CV8428	2.24	1.68	.84	1.4	100	35	20	30	480
48	20	CV8429	3.40	2.40	1.00	1.6	200	35	15	60	960

AV — Average Voltage

* Rise in DC Volts. If application has a complete no load condition, it may be necessary to use a Bleeder Resistor.

† Dual Complementary Outputs (e.g. ±12V, or ±15V) may be achieved by use of a center-tapped Bridge Rectifier. In this application, DC current for each side would be halved. Cf — ½ value in MFD, same DCWV, D_1, D_2 — ½ PIV, ½ I/Cell (4 Diode). (See Fig. 2)



Size (VA)	L	W	H	ML	MW	Lbs.	Mtg. Screw
60	4⅛	3	3⅝	$3\frac{9}{16}$	2	4.8	#8
120	$5\frac{1}{16}$	$3\frac{9}{16}$	$4\frac{7}{16}$	4⅜	2¼	8.7	#10
240	6¼	4¼	5¾	$5\frac{5}{16}$	2½	15.9	¼
480	6¼	6	5¾	$5\frac{5}{16}$	3⅞	28.7	¼
960	8	6⅝	7⅛	$5\frac{9}{16}$	4	4.8	¼

MULTI OUTPUT

VDC @ Amps Output	Part No.	RMS Ripple Volts	Recommended Diodes		Filter Capacitor		Size VA
			PIV	I/Cell	KMFD	DCWV	
8.5 @ 8 12.0 @ 2	CV8450	.45 .60	35 50	15 5	35 6	15 15	120
5.0 @ 5 8.5 @ 1 12.0 @ 1	CV8451	.25 .45 .60	35 35 50	10 5 5	35 4 3	10 15 15	60
5.0 @ 8 8.5 @ 4 12.0 @ 2	CV8452	.25 .45 .60	35 35 50	15 10 5	60 16 6	10 15 15	120
5.0 @ 12 8.5 @ 2 12.0 @ 2	CV8453	.25 .45 .60	35 35 50	20 5 5	8 8 6	10 15 15	120
8.5 @ 1 12.0 @ 1 24.0 @ 1.5	CV8454	.45 .60 1.20	35 50 100	5 5 5	4 3 2	15 15 30	60
8.5 @ 3 12.0 @ 2 24.0 @ 2	CV8455	.45 .60 1.20	35 50 100	10 5 5	12 6 3	15 15 30	120
8.5 @ 8 12.0 @ 2 24.0 @ 2	CV8456	.45 .60 1.20	35 50 100	10 5 5	35 6 3	15 15 30	240
8.5 @ 8 12.0 @ 4 24.0 @ 4	CV8457	.45 .60 1.20	35 50 100	15 10 10	35 12 6	15 15 30	240
8.5 @ 12 12.0 @ 2 24.0 @ 4	CV8458	.45 .60 1.20	35 50 100	35 5 10	50 6 6	15 15 30	240
5.0 @ 3 8.5 @ 1 12.0 @ 1 24.0 @ 1	CV8459	.25 .45 .60 1.20	35 35 50 100	10 5 5 2	20 4 3 1.5	10 15 15 30	60
5.0 @ 5 8.5 @ 2 12.0 @ 1 24.0 @ 2	CV8460	.25 .45 .60 1.20	35 35 50 100	10 5 5 5	35 8 5 3	10 15 15 30	120
5.0 @ 8 8.5 @ 4 12.0 @ 3 24.0 @ 4	CV8461	.25 .45 1.60 1.20	35 35 50 100	20 10 10 10	60 16 10 6	10 15 15 30	240
5.0 @ 12 8.5 @ 4 12.0 @ 4 24.0 @ 4	CV8462	.25 .45 .60 1.20	35 35 50 100	20 10 10 10	80 16 12 6	10 15 15 30	240

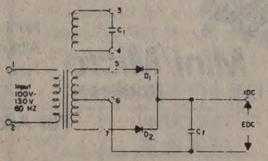


FIGURE 1

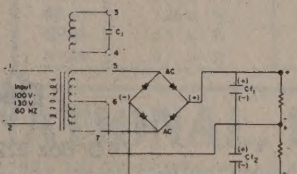


FIGURE 2

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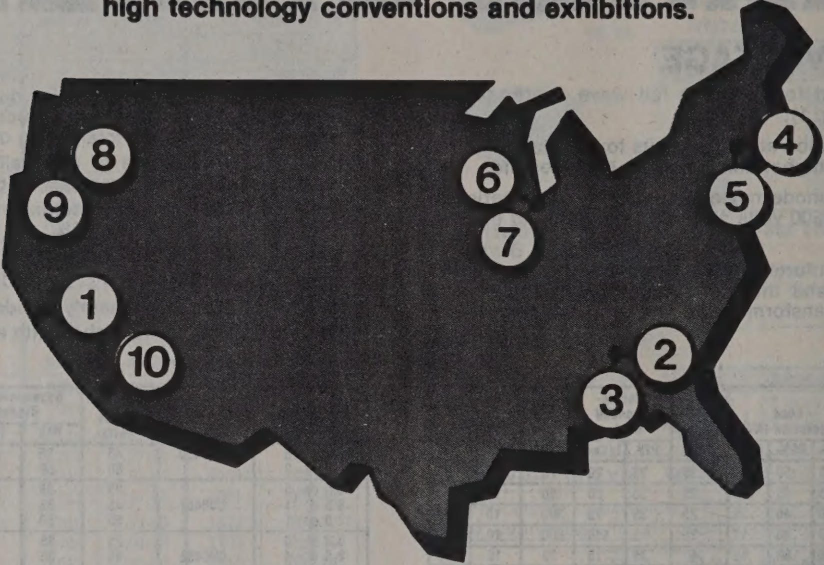

1	Mini/Micro West	February 5, 6, 7, 1985	Anaheim Hilton Exposition Center Anaheim, California
2	Southcon	March 5, 6, 7, 1985	Georgia World Congress Center Atlanta, Georgia
3	Mini/Micro Southeast	March 5, 6, 7, 1985	Georgia World Congress Center Atlanta, Georgia
4	Electro	April 23, 24, 25, 1985	New York Coliseum New York
5	Mini/Micro Northeast	April 23, 24, 25, 1985	Albert Hall New York
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7	Mini/Micro Midwest	September 10, 11, 12, 1985	Rosemont Exposition Center Chicago, Illinois
8	Northcon	October 22, 23, 24, 1985	Portland Memorial Coliseum Portland, Oregon
9	Mini/Micro Northwest	October 22, 23, 24, 1985	Portland Memorial Coliseum Portland, Oregon
10	Wescon	November 19, 20, 21, 22, 1985	Anaheim Convention Center Anaheim, California

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For More Information. Circle No. 21

TTC SERIES

COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

The **TTC SERIES** has been developed to meet telephone interconnect, coupling, matching and bridging requirements for use in voice, instrumentation and modem applications. **This series meets FCC PART 68 requirements.**

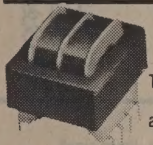
For details see Page 1145

DP SERIES

ENCAPSULATED AUDIO TRANSFORMERS

The **DP SERIES** is cost effective for applications involving severe environments. This series is tested to the requirements of **MIL-T-27** and several part numbers meet **FCC PART 68.**

For details see Page 1144

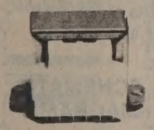


3F SERIES

3-FLANGE BOBBIN POWER TRANSFORMERS

The **3F SERIES** offers 2500V RMS dielectric breakdown testing primary-to-secondary (side-by-side winding type). They are available with single and dual primary connections for 115V, or 115/230V, 50/60 Hz circuits.

For details see Page 1148



PEP SERIES

UL-1411 RECOGNIZED POWER TRANSFORMERS

This series complies with the safety requirements of most **WORLDWIDE AGENCIES** (UL, CSA, Europe-IEC 65 and Japan-MITI) including 4000V RMS dielectric breakdown testing primary-to-secondary.

For details see Page 1147

FILE NUMBER
E59673
TAMRADIO

STT SERIES

ENCAPSULATED SCR AND TRIAC TRIGGER TRANSFORMERS

The **STT SERIES** provides line isolation in SCR and Triac controlled circuits. **STT TRIGGER** transformers pass **2600V RMS** dielectric breakdown testing and are completely encapsulated for applications involving severe environments.

For details see Page 1144

POWER AND NOISE ABSORBING INDUCTORS

The **SKC SERIES** of toroidal power inductors are gapped for energy storage circuits with DC ratings from **5 to 50A DC.**

The **SKL SERIES** is functionally gapped for circuits requiring high ''L'' at low DC amps and nominal ''L'' at rated DC amps.

The **SKP SERIES** is designed on powered iron toroidal cores for RFI and EMI filtering and noise absorbing applications.

For details see Page 1148

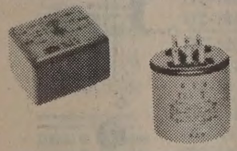
WALL PLUG-IN AC TO DC POWER SOURCES

This series of wall plug-in AC-to-DC battery chargers, battery eliminators and power supplies are available in a complete variety of input plug-in styles and comply with worldwide safety agency requirements.

AC-to-AC Wall Plug-in Transformers Are Available

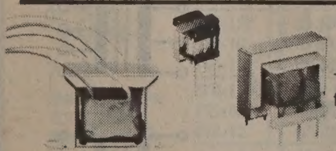
For details see Page 1149

FILE NUMBERS
UL E82180
CSA LR36236
VDE F-7969-331
TAMRADIO



PROFESSIONAL AUDIO TRANSFORMER SERIES

This series is widely used in high performance applications and meets most requirements of communications, broadcasting, recording and measuring apparatus. Available in solder lug, lead and printed circuit mounting styles; these transformers are metal cased. Several part numbers are electrostatic and MU-metal shielded.



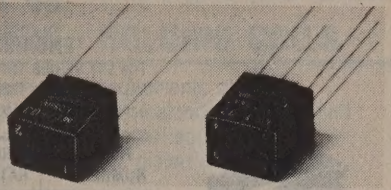
ATT SERIES

AUDIO TRANSFORMERS

These cost effective, volume produced transformers are available for impedance matching circuits and sound distribution systems. They are available as printed circuit, solder lug and lead styles.

Quality magnetic components at competitive prices . . . including COILS, POWER & AUDIO TRANSFORMERS, INDUCTORS, PULSE TRANSFORMERS, NOISE SUPPRESSION COILS, DC-DC CONVERTER TRANSFORMERS, PLUG-IN BATTERY CHARGERS and SWITCH-MODE POWER SUPPLY TRANSFORMERS & INDUCTORS. Our diversified manufacturing facilities are located in Taiwan, Malaysia and Japan. For details on standard and special requirement products, pricing and delivery—contact our headquarters.

MINIATURE ENCAPSULATED TRANSFORMERS



Small Size . . . . .0.310" × 0.410" X 0.465"
Gold Plated Leads . . . . .0.020" Nickel
Response . . . . ± 2dB, 300 Hz to 100 KHz
Impedance Range . . . . .3.2 to 200K Ohms
Meets Requirements of MIL-T-27 as TF5S21ZZ

TRANSFORMERS-MET SERIES

PART NO.	MATCHING IMPEDANCE		DCMA (Max) Primary
	Primary	Secondary	
MET-01	200KCT	1KCT	0
MET-02	100KCT	1KCT	0
MET-03	50KCT	1KCT	0
MET-04	50K	1KCT or 250*	0
MET-05	25KCT	1KCT	0.5
MET-06	25K	1KCT or 250*	0.25
MET-07	25KCT	600CT	0.5
MET-08	20KCT	800CT	0.5
MET-09	10KCT	10KCT	1.0
MET-10	10KCT	4KCT	1.0
MET-11	10KCT	2KCT	1.0
MET-12	10K	2KCT or 500*	0.5
MET-13	10KCT	1.5CT	1.0
MET-14	10KCT	1.2KCT	1.0
MET-15	10K	1.2KCT or 300*	0.5
MET-16	10KCT	600CT	1.0
MET-17	10KCT	500CT	1.0
MET-18	10KCT	4.0	1.0
MET-19	10K	3.2	0.5
MET-20	8KCT	3.2	1.0
MET-21	5KCT	2KCT	1.0
MET-22	2.5KCT	2.5KCT	1.0
MET-23	1.6KCT	3.2	2.5
MET-24	1.5KCT	600	3.0
MET-25	1.2KCT	3.2	3.0
MET-26	1KCT	1KCT	3.0
MET-27	1KCT	600CT	3.0
MET-28	1K	50	3.0
MET-29 +	900CT	600	3.0
MET-30	800CT	3.2	3.0
MET-31 +	600CT	600CT	3.0
MET-32 +	600	600CT or 150*	3.0
MET-33	600CT	250CT	3.0
MET-34	600CT	12	4.5
MET-35	600CT	8	4.5
MET-36	600CT	3.2	4.5
MET-37	500CT	600	3.0
MET-38	500	500CT or 125*	3.0
MET-39	500	50	3.0
MET-40	320CT	3.2	6.0
MET-41	300CT	600	7.0
MET-42	150	12	10.0
MET-43	120CT	3.2	10.0
MET-44	300CT	12.0	7.0
MET-45	10K	10KCT or 2.5K*	1.0
MET-46 +	600	600	3.0
MET-48	200K	1K	0
METC-99	Mu-Metal Magnetic Shield		

*As parallel or split winding connection

+Meets **FCC PART 68** requirements and 1000V RMS Pri to Sec Hipot Test

INDUCTORS-MEI SERIES

PART NO.	INDUCTANCE Hy @ 300Hz	DCR ohms	DCMA
MEI-01	6 at 15V	1800	2.0
MEI-02	3.5 at 5V	1200	2.0
MEI-03	1.25 at 3V	180	2.0
MEI-04	0.3 at 3V	40	4.0
MEI-05	0.1 at 3V	15	5.0

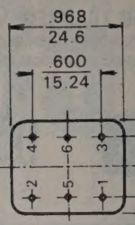
PAN-MAGNETICS INTERNATIONAL, INC.

455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

STT SERIES
ENCAPSULATED SCR & TRIAC TRIGGER TRANSFORMERS

The **STT SERIES TRIGGER TRANSFORMERS** are designed for low cost source isolation in half and full wave **SCR** or **TRIAC** control circuits. The **STT TRIGGER TRANSFORMERS** are encapsulated for environmental protection and pass **2600 V RMS** dielectric breakdown testing.

PART NUMBER	TURNS RATIO	PRIMARY "L" MH	LEAKAGE "L" μH	WDG. "C" PF	E.T. V-μSEC	D.C.R. OHMS (Max.)	DIA. NO.
STT-101	1:1	> 1.0	< 15	80	> 90	2.5/2.5	1
STT-102	1:1	> 5.0	< 50	80	>200	5.0/5.0	1
STT-103	1:1	>10.0	<100	80	>280	7.0/7.0	1
STT-104	1:1:1	> 1.0	< 25	80	> 90	2.5/2.5/2.5	2
STT-105	1:1:1	> 5.0	<100	80	>200	5.0/5.0/5.0	2
STT-106	1:1:1	>10.0	<200	80	>280	7.0/7.0/7.0	2
STT-107	2:1	> 1.0	< 20	80	> 90	2.5/1.5	1
STT-108	2:1	> 5.0	< 60	80	>200	5.0/2.5	1
STT-109	2:1	>10.0	<130	80	>280	7.0/3.5	1
STT-110	2:1:1	> 1.0	< 30	80	> 90	2.5/1.5/1.5	2
STT-111	2:1:1	> 5.0	<130	80	>200	5.0/2.5/2.5	2
STT-112	2:1:1	>10.0	<200	80	>280	7.0/3.5/3.5	2



DIMENSIONS IN INCH / MM

MAX. HT. = .775 / 19.7

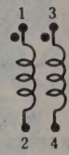


DIAGRAM 1

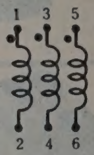


DIAGRAM 2

DP SERIES ENCAPSULATED AUDIO TRANSFORMERS

The **DP SERIES** of encapsulated audio transformers are cost effective for applications involving severe environments. Completely encapsulated, these small audio transformers eliminate environmental and board washing problems associated with open style transformers. The environmental quality of the **DP SERIES** is established through testing for humidity, immersion, solvent resistance and temperature cycling to the exacting reqirements of MIL-T-27. Several part numbers meet the requirements of **FCC PART 68** for telephone or modem applications. All **DP SERIES** audio transformers have frequency response characteristics within ±2dB from 200 Hz to 20 KHz.

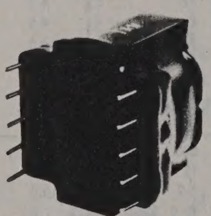
EI 19 DP SERIES

PART NUMBER	IMPEDANCE (Ω) PRI	IMPEDANCE (Ω) SEC	D.C.R. (Ω) PRI	D.C.R. (Ω) SEC	LEVEL (MAX.)	DCMA (MAX.)	REFER FIG	REFER DIA
DP-101+	600CT	600CT	38	48	15dbm	5	A	1
DP-103+	600CT	1.2KCT	38	84	15dbm	5	A	1
DP-105+	4KCT	600CT	277	35	15dbm	1	A	1
DP-107	300	600CT	19	48	15dbm	5	A	2
DP-108+	600	600CT	38	48	15dbm	5	A	2
DP-111	1K	2KCT	53	152	15dbm	2	A	2
DP-114	2.5K	2.5KCT	172	220	15dbm	2	A	2
DP-116	4K	2KCT	277	160	15dbm	1	A	2
DP-118	8K	2KCT	500	143	15dbm	0.5	A	2
DP-119	10K	600CT	370	90	15dbm	0.5	A	2
DP-122	10K	10KCT	695	900	15dbm	0.5	A	2
DP-124	20K	4KCT	1900	305	15dbm	0.5	A	2
DP-126	1KCT	8	55	0.62	15dbm	2	A	3
DP-128+	600	600CT×2	37	42×2	15dbm	0	B	4
DP-129+*	600CT	600CT	26	34	15dbm	0	B	1*

+Meets requirements of **FCC PART 68**

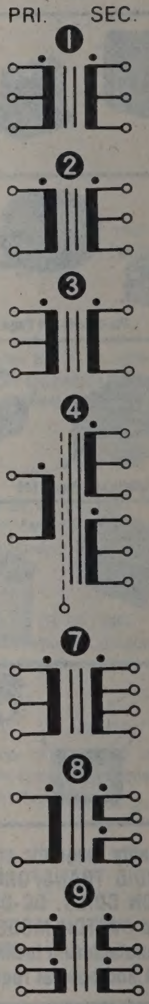
*Insertion loss 0.9db typical and frequency response ±0.1db, 300 to 3400 Hz and with electrostatic shield.

EI 28 DP SERIES



PART NUMBER	IMPEDANCE (Ω) PRI	IMPEDANCE (Ω) SEC	D.C.R. (Ω) PRI	D.C.R. (Ω) SEC	LEVEL (MAX.)	DCMA (MAX.)	REFER FIG	REFER DIA
DP-204+	600	600CT	36	50	28dbm	10	C	2
DP-208	4K	2KCT	250	145	28dbm	3	C	2
DP-210	200CT	4, 8, 16	10	0.4, 0.5, 0.7	28dbm	10	C	7
DP-214	600CT	4, 8, 16	32	0.4, 0.5, 0.7	28dbm	10	C	7
DP-220	1.3K	600/150	72	19×2	28dbm	6	C	8
DP-222+	500/125	500/125	19×2	22×2	28dbm	10	C	9
DP-222+	600/150	600/150	19×2	22×2	28dbm	10	C	9
DP-225+	4K/1K	600/150	63×2	20×2	28dbm	3	C	9
DP-226+	600	600CT×2	41	36×2	28dbm	0	C	4

SCHEMATIC DIAGRAMS



DP SERIES MECHANICAL DIAGRAMS

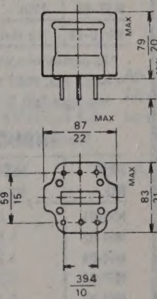


FIGURE A

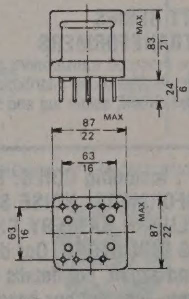


FIGURE B

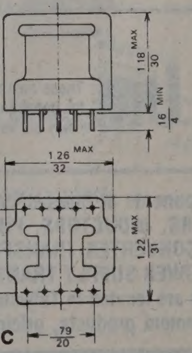


FIGURE C

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For More Information. Circle No. 501

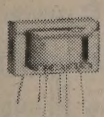
TTC SERIES — MEETS FCC PART 68
COUPLING TRANSFORMERS - HYBRID TRANSFORMERS - HOLDING COILS

TTC SERIES transformers and holding coils are designed to meet the performance requirements of telephone connected apparatus. They are widely used in the voice, data, isolation, bridging, matching, balancing, hybrid, and holding coil circuits of central office, PABX, subscriber telephone, modem and computer terminal equipments.

TTC Series transformers provide optimum insertion loss, frequency response, longitudinal balance, distortion, return loss, impedance matching and isolation characteristics.

THESE TRANSFORMERS MEET REQUIREMENTS OF FCC PART 68

1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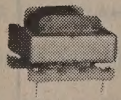
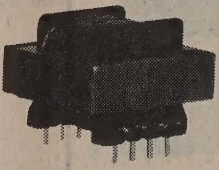
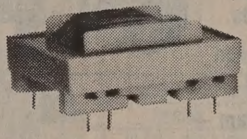
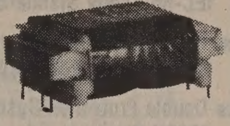

6H

6


9H


11H


LP

SCHEMATIC DIAGRAMS

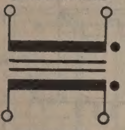


FIGURE 1.

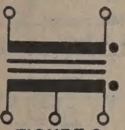


FIGURE 2.

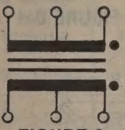


FIGURE 3.

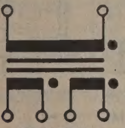


FIGURE 4.

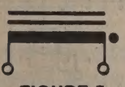


FIGURE 5.

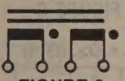


FIGURE 6.

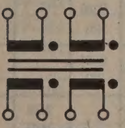


FIGURE 7.

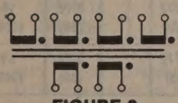


FIGURE 8.

PART NUMBER	APPLICATION	IMPEDANCE (OHMS) PRI.	IMPEDANCE (OHMS) SEC.	SIZE (INCH) L	SIZE (INCH) W	SIZE (INCH) HT.	STYLE NO.	SCHEMATIC FIG. NO.	TYPICAL CROSS REF. OR (COMMENTS)**
MET-46	DRY COUPLING	600	600	0.41	0.31	0.46	1	1	TRIAD SP-70
TTC-02	DRY COUPLING	600	600	0.78	0.67	0.50	5	1	—
TTC-118	DRY COUPLING	600	600	0.78	0.67	0.50	5	1	MICROTRAN T1104
TTC-105	90 MADC COUPLING	600	600	0.80	0.59	0.73	6	1	(For Smart Modem)
TTC-108-1	LOW COST COUPLING	600	600	0.78	0.55	0.71	6	1	—
TTC-109	90 MADC COUPLING	600	600	0.80	0.96	0.55	6H	1	(For Smart Modem)
TTC-110	DRY COUPLING	600	600	0.78	0.55	0.71	6	1	PREM SPT-128
TTC-114	LOW COST COUPLING	600	600	0.78	0.55	0.71	6	1	—
TTC-111-1	WIDE BAND MATCHING	600	600	1.40	1.20	1.05	9H	1	(40 to 20,000 Hz)
TTC-126-2	90 MADC COUPLING	600	600	1.40	1.20	1.05	9H	1	(300 to 4000 Hz)
TTC-130	90 MADC COUPLING	600	600	1.40	1.20	0.67	9H	1	(1200 Baud Modem)
TTC-131	90 MADC COUPLING	600	600	1.40	1.20	0.67	9H	1	(w/Shield for Europe)
TTC-106	80 MADC COUPLING	600	600	1.63	1.33	0.65	11H	1	(Min. Crosstalk-Type)
TTC-122	80 MADC COUPLING	600	600	1.63	1.33	0.65	11H	1	PREM SPT-109
TTC-125	90 MADC COUPLING	600	600	1.63	1.27	0.60	LP	7	PREM SPT-101
MET-32	DRY COUPLING	600	600CT*	0.41	0.31	0.46	1	4	STANCOR PCT-27
TTC-103	LOW COST COUPLING	600	600CT*	0.78	0.65	0.62	5	4	—
TTC-113-1	DRY COUPLING	600CT	600	0.78	0.65	0.71	6	2	(Plus electrostatic shield)
TTC-105-1	90 MADC COUPLING	600	600CT	0.80	0.59	0.73	6	2	—
TTC-108-2	LOW COST COUPLING	600	600CT	0.78	0.55	0.71	6	2	—
TTC-109-1	90 MADC COUPLING	600	600CT	0.80	0.96	0.55	6H	2	(Low Profile)
TTC-109-2	90 MADC COUPLING	600	600CT*	0.80	0.96	0.55	6H	4	(Low Profile)
TTC-126-1	90 MADC COUPLING	600	600CT	1.40	1.20	1.05	9H	2	(300 to 4000 Hz)
TTC-121	75 MADC COUPLING	600	600CT*	1.63	1.33	0.65	11H	4	MICROTRAN T5114
TTC-124	90 MADC COUPLING	600CT*	600CT	1.63	1.27	0.62	LP	8	PREM SPT-125
MET-31	DRY COUPLING	600CT	600CT	0.41	0.31	0.46	1	3	STANCOR PCT-77
TTC-03	DRY COUPLING	600CT	600CT	0.78	0.67	0.50	5	3	—
TTC-09	DRY COUPLING	600CT	600CT	0.78	0.55	0.71	6	3	TRIAD TY304P
TTC-100	DRY COUPLING	600CT	600CT*	0.78	0.65	0.62	5	4	(Pri. as in Fig. 3)
TTC-108	DRY COUPLING	600CT	600CT	0.78	0.55	0.71	6	3	TRIAD TY145P
TTC-126	90 MADC COUPLING	600CT*	600CT*	1.40	1.20	1.05	9H	7	(300 to 4000 Hz)
TTC-127	80 MADC COUPLING	600CT*	600CT*	1.63	1.33	0.65	11H	7	—
TTC-04	DRY COUPLING	600	900	0.78	0.67	0.50	5	1	—
TTC-112	DRY COUPLING	600	900	0.78	0.55	0.71	6	1	TRIAD TY301P
MET-29	DRY COUPLING	900CT	600	0.41	0.31	0.46	1	2	TRIAD SP-51
TTC-107	LOW COST COUPLING	900	600	0.78	0.55	0.71	6	1	(Low Cost TTC-112)
TTC-123	80 MADC COUPLING	900	600	1.63	1.33	0.65	11H	1	PREM SPT-111
TTC-10	HYBRID	600	600/600	0.78	0.65	0.71	6	4	MICROTRAN T2220
TTC-101	HYBRID	600	600/600	1.02	0.94	0.84	6	4	TRIAD TY302P
TTC-115	LOW COST HYBRID	600	600/600	1.02	0.88	0.78	5	4	(with PC Frame)
TTC-05	BRIDGING	4000	600	0.78	0.67	0.50	5	1	—
TTC-13	BRIDGING	4000	600	0.78	0.55	0.71	6	1	TRIAD TY303P
TTC-128	CENTRAL OFFICE LINE MATCHING	PRI-1200-600-150CT SEC-600CT		1.02	0.85	0.78	6H	Contact Factory	—
TTC-129	HYBRID	PRI-600CT/600CT SEC-600CT		1.63	1.27	0.62	LP	8	(Interconnected on PCB)
TTC-119	HOLDING COIL	1.3HY @ 100 MADC		1.42	1.14	1.20	6	5	TRIAD TY350P
TTC-120	HOLDING COIL	1.4HY @ 120 MADC		1.63	1.33	0.65	11H	6	MICROTRAN T5415

*Windings can be connected as 600 ohm with CT or as 2 isolated 300 ohm windings.

**Cross referenced part numbers are offered as equivalents, but user should first determine complete suitability for the particular application.

PAN-MAGNETICS INTERNATIONAL, INC.

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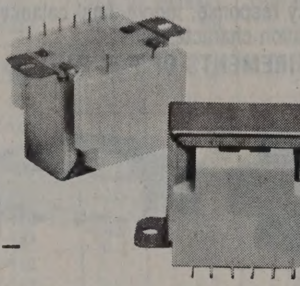
PRINTED CIRCUIT BOARD POWER TRANSFORMERS THAT MEET INTERNATIONAL AND U.S. SAFETY REQUIREMENTS

PEP Series

FILE NO.
TAMRADIO
E59673



- **UL Recognized — Meets IEC-65 Safety Standards.**
- **Physical Barriers Between Primary and Secondary.**
- **Double Protection System — 4000V Hipot.**

PEP Series • 115V/230V • 50/60Hz Primary

FOR USE IN CONTROL AND POWER SUPPLY APPLICATIONS

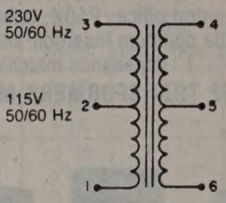
PART NO.	SECONDARY				CIRCUIT NO.	FIG. NO.
	PARALLEL CONNECTED		SERIES CONNECTED			
	V AC	A RMS	V AC	A RMS		
PEP28 x 0.7 VA SERIES						
10A006	(Single Secondary)		10.0 CT	.050	1-115V*	A
10A009			10.0 CT	.050	1-230V*	
10A007			16.0 CT	.031	1-115V*	
10A010			16.0 CT	.031	1-230V*	
10A008			24.0 CT	.021	1-115V*	
10A011			24.0 CT	.021	1-230V*	
*PEP28 Series is not available in Dual Primary versions.						
PEP35 x 2.0 VA SERIES						
10B004	(Single Secondary)		10.0 CT	.110	1	A
10B005			12.6 CT	.090		
10B006			16.0 CT	.070		
11B001H			24.0 CT	.046		
11B002H			36.0 CT	.031		
PEP41 x 5.0 VA SERIES						
10C009	(Single Secondary)		10.0 CT	.350	1	B
10C010			12.6 CT	.280		
10C011			16.0 CT	.220		
10C012			24.0 CT	.150		
11C005H			36.0 CT	.100		
PEP48 x 9.5 VA SERIES						
11D014H	5.0	1.900	10.0 CT	.950	2	B
11D015H	6.3	1.500	12.6 CT	.750		
11D016H	8.0	1.200	16.0 CT	.600		
11D017H	12.0	.800	24.0 CT	.400		
11D018H	18.0	.520	36.0 CT	.260		
11D019H	28.0	.340	56.0 CT	.170		
PEP54 x 15 VA SERIES						
11E006H	5.0	2.500	10.0 CT	1.250	2	C
11E007H	6.3	2.000	12.6 CT	1.000		
11E008H	8.0	1.560	16.0 CT	.780		
11E009H	12.0	1.040	24.0 CT	.520		
11E010H	17.0	.700	36.0 CT	.350		
11E011H	28.0	.446	56.0 CT	.223		

PEP54 SERIES FOR 3-OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

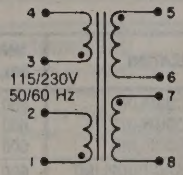
PART NO.	SECONDARY 1		SECONDARY 2		DC OUTPUT 1		DC OUTPUT 2		CIR. NO.	FIG. NO.
	V AC	A RMS	V AC	A RMS	CTFW Vdc	I mAdc	CTFW Vdc	I mAdc		
11E012H	9 CT	.800	24 CT	.300	+5	670	±15	170	3	C
11E013H	16 CT	.550	33 CT	.180	+9†	470	±21†	120	4	C

† +9Vdc and ±21 Vdc outputs are for input to +5 Vdc and ±15 Vdc IC Voltage Regulation (See Circuit 4)

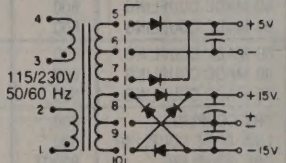
CIRCUIT SCHEMATICS



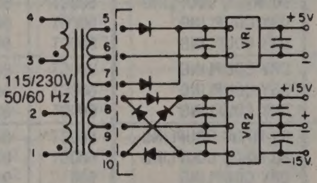
CIRCUIT 1



CIRCUIT 2



CIRCUIT 3



CIRCUIT 4

DIMENSIONS

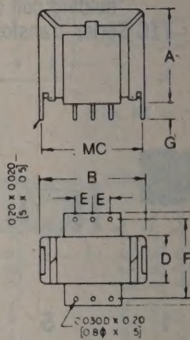


FIGURE A

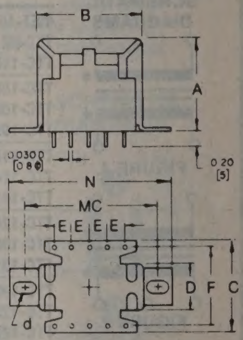


FIGURE B

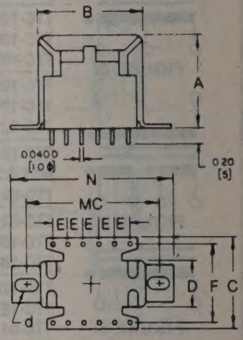


FIGURE C

DIMENSIONS • Inches (mm) WT • Oz. (Gm)

TYPE	A	B	C	MC	D	E	F	G	N	WT.
10A	1.10 (28)	1.16 (29.5)	1.32 (33.5)	1.12 (28.5)	0.50 (12.5)	.197 (5)	0.984 (25)	0.20 (5)	--	2.5 (70)
10B OR 11B	1.26 (32)	1.44 (36.5)	1.69 (43)	1.40 (35.5)	0.61 (15.5)	.295 (7.5)	1.380 (35)	0.24 (6)	--	4.5 (130)
10C OR 11C	1.42 (36)	1.67 (42.5)	1.91 (48.5)	2.05 (52)	0.85 (21.5)	.394 (10)	1.575 (40)	--	2.36 (60)	8 (230)
11D	1.69 (43)	1.99 (50.5)	2.05 (52)	2.32 (59)	1.08 (27.5)	.295 (7.5)	1.772 (45)	--	2.72 (69)	16 (450)
11E	1.93 (49)	2.22 (56.5)	2.09 (53)	2.72 (69)	1.08 (27.5)	.295 (7.5)	1.772 (45)	--	3.15 (80)	19 (540)

Note: d = PEP41 Series; 0.138 x 0.177 (3.5 x 4.5)
d = PEP48 and PEP54 Series; 0.177 x 0.256 (4.5 x 6.5)

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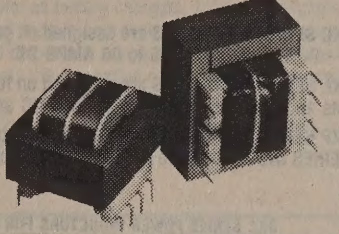
For More Information. Circle No. 501

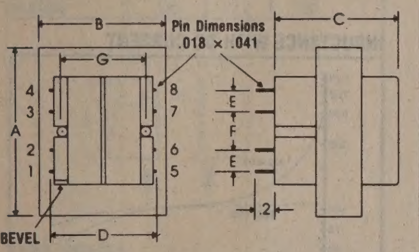
3F SERIES — 3 FLANGE BOBBIN PRINTED CIRCUIT BOARD POWER TRANSFORMERS

The **3F SERIES POWER TRANSFORMERS** are designed to include the most desirable features required for printed circuit board mounted applications. The 3F Series is constructed on a three flanged bobbin which is molded with UL listed material providing low capacitive coupling without electro-static shielding.

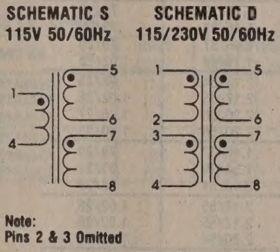


- 2500 VAC HIPOT, PRIMARY TO SECONDARY ISOLATION
- 115V SINGLE OR 115/230V DUAL PRIMARY
- TERMINAL NUMBERS ARE MOLDED ON BOBBIN
- COMPLIES WITH MOST UL SAFETY STANDARDS

®



NOTE: #4 Clearance Hole — 2 Places



Note:
Pins 2 & 3 Omitted

3F SERIES PART NUMBER	DIMENSIONS							
	A	B	C	D	E	F	G	WT
3F(*)-2XX	1.38 35.0	1.16 29.5	0.94 23.9	1.200 30.48	0.250 6.350	0.250 6.350	N/A	0.17LB 77.4GM
3F(*)-3XX	1.38 35.0	1.16 29.5	1.18 30.0	1.200 30.48	0.250 6.350	0.25 6.35	N/A	0.25LB 114GM
3F(*)-4XX	1.62 41.0	1.31 33.0	1.31 33.3	1.280 32.51	0.250 6.350	0.350 8.890	1.062 26.97	0.44LB 200GM
3F(*)-5XX	1.89 48.0	1.58 40.0	1.44 36.6	1.410 35.81	0.300 7.62	0.400 10.16	1.250 31.75	0.70LB 319GM

DIMENSIONS SHOWN IN: INCH / MM

PART NUMBER	SECONDARY RATINGS - R.M.S.		VA
	SERIES	PARALLEL	
3F(*)-210	10.0VCT @ 0.110A	5.0V @ 0.220A	1.1
3F(*)-310	10.0VCT @ 0.250A	5.0V @ 0.500A	2.4
3F(*)-410	10.0VCT @ 0.600A	5.0V @ 1.200A	6.0
3F(*)-510	10.0VCT @ 1.200A	5.0V @ 2.400A	12.0
3F(*)-212	12.6VCT @ 0.090A	6.3V @ 0.180A	1.1
3F(*)-312	12.6VCT @ 0.200A	6.3V @ 0.400A	2.4
3F(*)-412	12.6VCT @ 0.500A	6.3V @ 1.000A	6.0
3F(*)-512	12.6VCT @ 1.000A	6.3V @ 2.000A	12.0
3F(*)-216	16.0VCT @ 0.070A	8.0V @ 0.140A	1.1
3F(*)-316	16.0VCT @ 0.150A	8.0V @ 0.300A	2.4
3F(*)-416	16.0VCT @ 0.400A	8.0V @ 0.800A	6.0
3F(*)-516	16.0VCT @ 0.800A	8.0V @ 1.600A	12.0
3F(*)-220	20.0VCT @ 0.055A	10.0V @ 0.110A	1.1
3F(*)-320	20.0VCT @ 0.120A	10.0V @ 0.240A	2.4
3F(*)-420	20.0VCT @ 0.300A	10.0V @ 0.600A	6.0
3F(*)-520	20.0VCT @ 0.600A	10.0V @ 1.200A	12.0
3F(*)-224	24.0VCT @ 0.045A	12.0V @ 0.090A	1.1
3F(*)-324	24.0VCT @ 0.100A	12.0V @ 0.200A	2.4
3F(*)-424	24.0VCT @ 0.250A	12.0V @ 0.500A	6.0
3F(*)-524	24.0VCT @ 0.500A	12.0V @ 1.000A	12.0
3F(*)-228	28.0VCT @ 0.040A	14.0V @ 0.080A	1.1
3F(*)-328	28.0VCT @ 0.085A	14.0V @ 0.170A	2.4
3F(*)-428	28.0VCT @ 0.200A	14.0V @ 0.400A	6.0
3F(*)-528	28.0VCT @ 0.420A	14.0V @ 0.840A	12.0
3F(*)-236	36.0VCT @ 0.030A	18.0V @ 0.060A	1.1
3F(*)-336	36.0VCT @ 0.065A	18.0V @ 0.130A	2.4
3F(*)-436	36.0VCT @ 0.170A	18.0V @ 0.340A	6.0
3F(*)-536	36.0VCT @ 0.350A	18.0V @ 0.700A	12.0
3F(*)-248	48.0VCT @ 0.023A	24.0V @ 0.046A	1.1
3F(*)-348	48.0VCT @ 0.050A	24.0V @ 0.100A	2.4
3F(*)-448	48.0VCT @ 0.125A	24.0V @ 0.250A	6.0
3F(*)-548	48.0VCT @ 0.250A	24.0V @ 0.500A	12.0
3F(*)-256	56.0VCT @ 0.020A	28.0V @ 0.040A	1.1
3F(*)-356	56.0VCT @ 0.045A	28.0V @ 0.090A	2.4
3F(*)-456	56.0VCT @ 0.110A	28.0V @ 0.220A	6.0
3F(*)-556	56.0VCT @ 0.220A	28.0V @ 0.440A	12.0
3F(*)-2120	120.0VCT @ 0.010A	60.0V @ 0.020A	1.1
3F(*)-3120	120.0VCT @ 0.020A	60.0V @ 0.040A	2.4
3F(*)-4120	120.0VCT @ 0.050A	60.0V @ 0.100A	6.0
3F(*)-5120	120.0VCT @ 0.100A	60.0V @ 0.200A	12.0

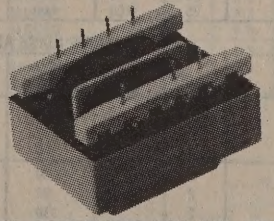
NOTE (*) Insert S for Single Primary 3F Series Transformer
Insert D for Double Primary 3F Series Transformer

3 FLANGE BOBBIN TRANSFORMER FOR UNREGULATED & REGULATED POWER SUPPLIES

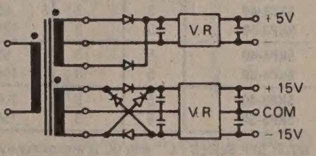
The **LPP SERIES LOW-PROFILE PLUG-IN POWER TRANSFORMERS** offer the circuit designer a variety of options including dual output which may be connected in series or parallel, secondary voltages for unregulated or regulated power supplies, and dual output voltages.

PART NUMBER	SECONDARY RATINGS - R.M.S.		DC OUTPUT	
	SERIES	PARALLEL	VDC	mADC
LPP-401	9.00VCT @ 0.50A	4.5V @ 1.00A	+5.0	600*
LPP-402	15.5V @ 0.33A	7.75V @ 0.66A	+5.0	380**
LPP-403	27.00VCT @ 0.19A	13.5V @ 0.38A	±15.0	115*
LPP-404	36.00VCT @ 0.14A	18.0V @ 0.28A	±15.0	70**
LPP-405	9.00VCT @ 0.24A	—	+5.0	200*
	24.00VCT @ 0.08A	—	±15.0	50*
LPP-406	15.50VCT @ 0.14A	—	+5.0	100**
	34.00VCT @ 0.06A	—	±15.0	25**
LPP-408†	15.5V @ 0.33A	7.75V @ 0.66A	—	—
LPP-411‡	11.00V @ 0.15A	(Single Secondary)	—	—
LPP-426‡	26.00V @ 0.10A	(Single Secondary)	—	—

*Unregulated DC Output **Regulated DC Output (MADC, typ., depends on regulator efficiency).
†115/230V-Series/Parallel Primary Winding.
‡115V input-connect line to Primary 1 with Primary 2 Open.
‡230V input-connect line across Primary 1 and 2 with Primary 1 and 2 in series.
‡These part numbers have thermal fuse internally connected to Primary 1.



TYPICAL SCHEMATIC FOR LPP-406



PRIMARY
115V ±10%
50/60Hz

PAN-MAGNETICS INTERNATIONAL, INC.
455-A CARSON PLAZA DRIVE, CARSON, CA 90746 • (213) 532-1790 • TELEX: 664759 (PAN-MAG CRSN)

INDUCTORS FOR SWITCH-MODE POWER REGULATOR, CONTROL AND NOISE FILTERING CIRCUITS

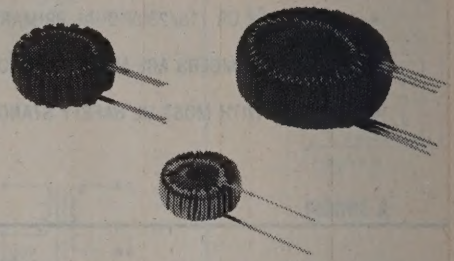
The **SKC SERIES INDUCTORS** are designed on gapped toroidal tape wound cores for DC switching power supply, regulator and energy storage circuits — DC current ratings **5 to 50 AMPS DC.**

The **SKL SERIES INDUCTORS** are designed on functional gapped toroidal tape wound cores for power circuits requiring high inductance at low DC currents and nominal inductance at rated DC amps.

The **SKP SERIES INDUCTORS** are designed on powered iron toroidal cores for RFI and EMI filtering and other noise absorbing applications. Also, **SKP SERIES INDUCTORS** are most useful in DC circuit applications, available in a wide range of "L" values and DC current ratings to **40 AMPS DC.**

SKC SERIES POWER INDUCTORS FOR DC SWITCH-MODE CIRCUITS

PART NUMBER	AMPS (DC)	"L" (μH)	DCR (OHMS)	DIMENSIONS (inch/mm)	
				OD (max.)	HT (max.)
SKC-101	5 to 10	30	0.009	1.26/32	.71/18
SKC-102	5 to 10	50	0.011	1.26/32	.71/18
SKC-103	5 to 10	100	0.017	1.26/32	.71/18
SKC-104	5 to 10	150	0.023	1.26/32	.71/18
SKC-105	5 to 10	200	0.024	1.46/37	.79/20
SKC-106	5 to 7.5	400	0.048	1.46/37	.79/20
SKC-107	5 to 7.5	600	0.056	1.73/44	1.02/26
SKC-108	5 to 7.5	800	0.044	2.13/54	.98/25
SKC-109	5 to 6	1200	0.081	2.17/55	1.02/26
SKC-110	5 to 6	1800	0.099	2.17/55	1.02/26
SKC-201	10 to 15	30	0.005	1.26/32	.71/18
SKC-202	10 to 15	50	0.007	1.46/37	.79/20
SKC-203	10 to 15	100	0.012	1.46/37	.79/20
SKC-204	10 to 15	150	0.014	1.73/44	1.02/26
SKC-205	10 to 15	200	0.011	2.13/54	.98/25
SKC-206	10 to 12	400	0.024	2.17/55	1.02/26
SKC-207	10 to 12	600	0.032	2.20/56	1.06/27
SKC-208	10 to 12	800	0.032	2.20/56	1.30/33
SKC-301	15 to 25	30	0.004	1.46/37	.79/20
SKC-302	15 to 25	50	0.006	1.54/39	.83/21
SKC-303	15 to 25	100	0.006	2.13/54	.98/25
SKC-304	15 to 20	150	0.009	2.17/55	1.02/26
SKC-305	15 to 20	200	0.011	2.17/55	1.02/26
SKC-306	15 to 20	400	0.016	2.20/56	1.30/33
SKC-401	20 to 30	30	0.004	1.61/41	.91/23
SKC-402	20 to 30	50	0.005	1.81/46	.98/25
SKC-403	20 to 28	100	0.006	2.17/55	1.02/26
SKC-404	20 to 25	150	0.008	2.20/56	1.06/27
SKC-405	20 to 25	200	0.008	2.20/56	1.30/33
SKC-501	25 to 35	30	0.003	1.77/45	.95/24
SKC-502	25 to 35	50	0.003	2.17/55	1.02/26
SKC-503	25 to 35	100	0.004	2.17/55	1.30/33
SKC-504	25 to 30	150	0.006	2.24/57	1.34/34
SKC-601	30 to 40	30	0.002	2.13/54	.98/25
SKC-602	30 to 40	50	0.003	2.17/55	1.02/26
SKC-603	30 to 35	100	0.004	2.20/56	1.30/33
SKC-801	40 to 50	30	0.002	2.17/55	1.30/33
SKC-802	40 to 50	50	0.002	2.24/57	1.34/34



SKL SERIES POWER INDUCTORS WITH HIGH "L" AT LOW DC

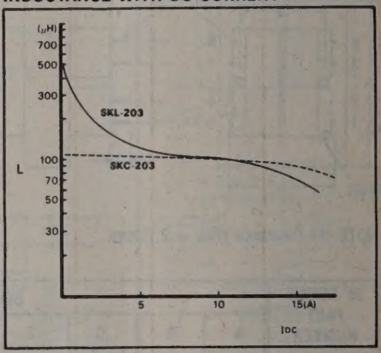
PART NUMBER	AMPS (DC)	"L" (μH)		DCR (OHMS)	DIMENSIONS (inch/mm)	
		with DC	0 DC		OD (max.)	HT (max.)
SKL-103	5	100	450	0.017	1.26/32	.71/18
SKL-105	5	200	1000	0.025	1.26/32	.71/18
SKL-203	10	100	500	0.011	1.69/43	.91/23
SKL-205	10	200	1000	0.015	2.13/54	1.15/29
SKL-303	15	100	500	0.008	2.17/55	1.02/26
SKL-305	15	200	1000	0.011	2.20/56	1.06/27
SKL-403	20	100	500	0.008	2.17/55	1.02/26
SKL-404	20	150	750	0.009	2.20/56	1.06/27
SKL-502	25	50	250	0.006	2.17/55	1.02/26
SKL-503	25	100	600	0.007	2.24/57	1.34/34

SKP SERIES NOISE ABSORBING INDUCTORS

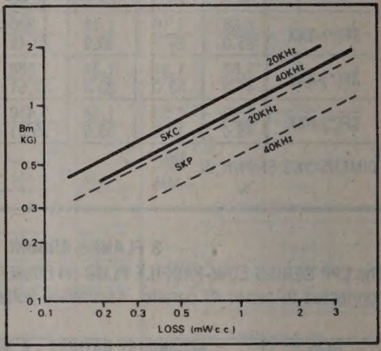
PART NUMBER	AMPS		"L" (μH)	DCR (OHMS)	DIMENSIONS (inch/mm)	
	(AC)	(DC)			OD (max.)	HT (max.)
SKP1-30	2	1	30	0.039	.62/16	.31/8
SKP1-40	2	1	55	0.050	.62/16	.31/8
SKP1-50	2	1	80	0.061	.62/16	.33/8.5
SKP2-30	2	1	50	0.051	.62/16	.43/11
SKP2-40	2	1	90	0.066	.62/16	.43/11
SKP2-50	2	1	130	0.082	.62/16	.45/11.5
SKP3-30	3	2	40	0.028	.83/21	.43/11
SKP3-40	3	2	80	0.037	.83/21	.43/11
SKP3-50	3	3	120	0.045	.85/21.5	.45/11.5
SKP4-40	5	3	65	0.023	.98/25	.47/12
SKP4-50	5	3	100	0.028	1.02/26	.47/12
SKP5-40	5	3	100	0.033	1.08/27.5	.55/14
SKP5-50	5	3	150	0.041	1.10/28	.59/15

NOTE: SKP SERIES "L" with DC is approximately 50% of value shown.

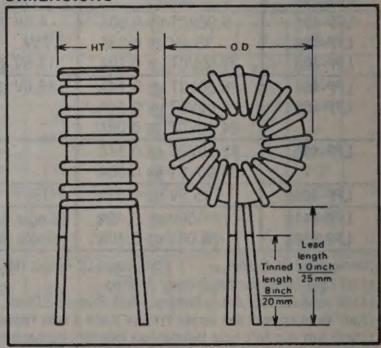
INDUCTANCE WITH DC CURRENT



CORE LOSS VS. INDUCTION



DIMENSIONS



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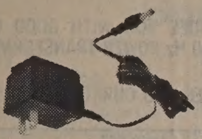
UL, CSA AND VDE LISTED WALL PLUG-IN AC-TO-DC BATTERY CHARGERS AND ELIMINATORS

These AC-to-DC plug-in power sources are useful as battery chargers, battery eliminators and DC power supplies. They are available in direct plug-in and desk top styles with a variety of output connectors. Most have capacitor filtered outputs. A complete variety of worldwide input plug-in styles are available and each style meets the respective safety agency requirements.

Special order options include:

Multiple listing and your logo; multiple or regulated outputs; UL-1244 for instruments floating above ground; and AC-to-AC direct plug-in transformers.

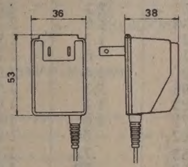
*Indicates File Numbers under TAMRADIO name.



UL FILE No. E82180*
CSA FILE No. LR38236*

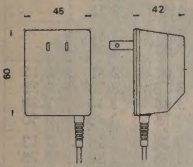
216A SERIES

PART NO.	INPUT	OUTPUT	
	(VAC)	(Vdc)	(mAdc)
216A2211	120	3.0	200
216A2214	120	3.0	400
216A2219	120	4.5	200
216A4222	120	4.5	350
216A2226	120	6.0	150
216A4229	120	6.0	300
216A2134	120	7.5	200
216A4139	120	9.0	200
216A4046	120	12.0	150



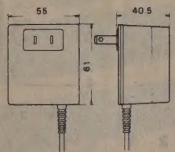
318A SERIES

PART NO.	INPUT	OUTPUT	
	(VAC)	(Vdc)	(mAdc)
318A2210	120	3.0	300
318A2213	120	3.0	600
318A2218	120	4.5	300
318A4220	120	4.5	500
318A2225	120	6.0	200
318A4227	120	6.0	400
318A2134	120	7.5	300
318A4140	120	9.0	300
318A4146	120	12.0	200



420A SERIES

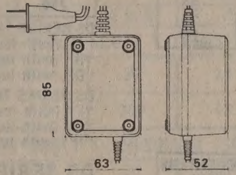
PART NO.	INPUT	OUTPUT	
	(VAC)	(Vdc)	(mAdc)
420A2210	120	3.0	800
420A2212	120	3.0	1200
420A2214	120	4.5	600
420A2216	120	4.5	800
420A2221	120	6.0	500
420A2223	120	6.0	700
420A2127	120	7.5	400
420A2128	120	7.5	500
420A2132	120	9.0	300
420A4134	120	9.0	500
420A2139	120	12.0	300
420A4141	120	12.0	500



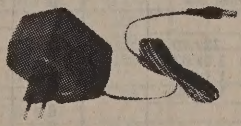
UL FILE No. E50290*
CSA FILE No. LR38236*

521A SERIES

PART NO.	INPUT	OUTPUT	
	(VAC)	(Vdc)	(mAdc)
521A4310	120	9.0	800
521A4312	120	9.0	1200
521A4315	120	12.0	600
521A4317	120	12.0	1000
521A4320	120	13.5	600
521A4322	120	13.5	1000

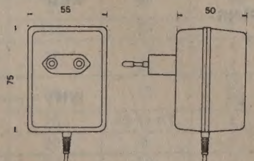


Complies with VDE Requirements

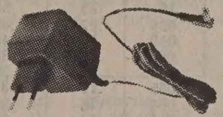


818F SERIES

PART NO.	INPUT	OUTPUT	
	(VAC)	(Vdc)	(mAdc)
818F4310	220	3.0	800
818F4312	220	3.0	1200
818F4313	220	4.5	600
818F4315	220	4.5	1000
818F4216	220	6.0	600
818F4217	220	6.0	800
818F4118	220	7.5	500
818F4119	220	7.5	700
818A4120	220	9.0	500
818F4121	220	9.0	600
818F4022	220	12.0	350
818F4023	220	12.0	450

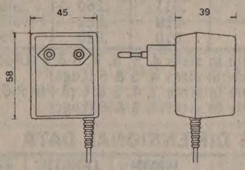


EUROPE
VDE FILE No. F-7969-331*



26D SERIES

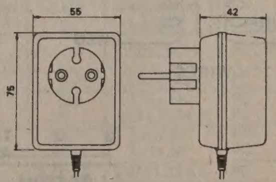
PART NO.	INPUT	OUTPUT	
	(VAC)	(Vdc)	(mAdc)
26D3853	220	3.0	150
26D3860	220	3.5	200
26D3856	220	4.5	200
26D3611	220	6.0	200



VDE FILE No. F-7969-331*

34D SERIES

PART NO.	INPUT	OUTPUT	
	(VAC)	(Vdc)	(mAdc)
34D4307	220	3.0	300
34D4301	220	4.5	400
34D4302	220	6.0	300
34D4303	220	7.5	300
34D4304	220	9.0	300
34D4305	220	12.0	200



DIMENSIONS SHOWN IN MILLIMETERS

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PARALINE

TRANSFORMER SPECIALISTS

PARALINE SS SERIES

THE PARALINE SS SERIES PROVIDES YOU WITH A WIDE RANGE OF SELECTION IN SMALL 117V PRIMARY POWER TRANSFORMERS (50-60 Hz) FROM SHELF STOCK.

AVAILABLE VOLTAGES CENTER TAPPED AND CURRENT RATINGS IN AMPS OF ALL SERIES SS TRANSFORMERS

VOLTS C/T	AMPERES						
	SIZE 3	SIZE 4	SIZE 5	SIZE 6	SIZE 7	SIZE 8	SIZE 9
4	.100	.50	1.2	2.8	5.2	10	14
6.3	.060	.32	.80	1.7	3.5	7.0	10
8	.050	.28	.60	1.4	2.8	5.0	7.0
10	.045	.20	.50	1.0	2.0	4.0	5.6
12.6	.040	.17	.40	.90	1.7	3.6	4.5
14	.040	.15	.35	.80	1.5	3.2	4.0
16	.038	.13	.32	.70	1.3	3.0	3.7
18	.035	.12	.30	.60	1.2	2.8	3.5
20	.032	.11	.27	.55	1.1	2.6	3.2
22	.030	.10	.25	.50	1.0	2.4	3.0
24	.027	.095	.22	.45	.95	2.2	2.7
26	.025	.090	.20	.40	.90	2.0	2.5
28	.022	.080	.18	.38	.85	1.8	2.2
30	.020	.070	.17	.36	.80	1.7	2.0
32	.018	.065	.16	.34	.75	1.6	1.9
34	.017	.060	.15	.32	.70	1.5	1.8
36	.016	.055	.14	.30	.65	1.4	1.7
40	.015	.050	.13	.27	.55	1.3	1.6
44	.014	.050	.12	.25	.50	1.2	1.5
48	.013	.045	.11	.22	.47	1.1	1.3
52	.012	.040	.10	.20	.45	1.0	1.2
56	.011	.040	.09	.19	.42	.90	1.1
60	.010	.035	.08	.18	.40	.80	1.0
66	.009	.030	.077	.17	.37	.75	.90
72	.008	.027	.070	.15	.35	.70	.85
80	.007	.025	.066	.14	.28	.65	.80
88	.007	.024	.060	.13	.25	.60	.70
96	.006	.022	.055	.11	.23	.55	.65
104	.006	.020	.050	.10	.22	.50	.60
120	.005	.017	.040	.09	.20	.40	.50
140		.014	.035	.08	.17	.35	.40
160		.012	.030	.07	.14	.30	.35
180		.011	.260	.06	.12	.26	.30
200		.010	.022	.05	.11	.22	.28
230		.010	.020	.05	.10	.20	.26

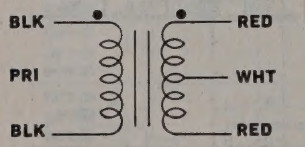
Case A Available in sizes 4, 5, 6, 7, 8 & 9 (Lead Wires)
Case B Available in sizes 4, 5 & 6 (Lugs)
Case C Available in sizes 3, 4, 5 & 6 (6 Pin P.C.)
Case D Available in sizes 4, 5 & 6 (Lugs)

SS SERIES DIMENSIONAL DATA

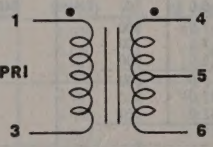
CASE	SIZE	WIDTH (A)	LENGTH (B)	HEIGHT (C)	MOUNTING CENTERS (D)	PIN CENTERS (JXK)
A	4	1.20	2.10	1.19	1.75	
A	5	1.37	2.38	1.38	2.00	
A	6	1.42	2.83	1.63	2.38	
A	7	1.70	3.25	1.94	2.83	
A	8	2.00	3.88	2.25	3.13	
B	4	1.07	1.83	1.42	1.50	
B	5	1.25	2.00	1.68	1.72	
B	6	1.38	2.38	1.93	2.00	
C	3	0.93	1.10	0.88		.78x.40
C	4	1.15	1.38	1.19		1.0x.63
C	5	1.25	1.63	1.38		1.1x.80
C	6	1.44	1.88	1.63		1.3x.80
D	4	1.07	2.10	1.19	1.75	
D	5	1.25	2.38	1.38	2.00	
D	6	1.38	2.83	1.63	2.38	

REFER TO SS SERIES TRANSFORMERS BY PART NUMBERS. CASES ARE ILLUSTRATED ON LAST PAGE.
SAMPLE: SS-A-4-12.6

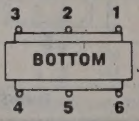
SCHEMATICS



WIRES



LUGS & PC PINS



LOCATOR

PARALINE DS SERIES

THE PARALINE DS SERIES PROVIDES YOU WITH GOOD OFF THE SHELF SELECTION OF 115/230 VOLT 50-60 Hz POWER TRANSFORMERS WITH DUAL SECONDARIES.

AVAILABLE TOTAL SERIES VOLTAGES AND CURRENT RATINGS OF SECONDARIES

VOLTS (SERIES)	AMPERES					
	SIZE 8	SIZE 9	SIZE 10	SIZE 11	SIZE 12	SIZE 13
8	6.0	8.5	12	17	24	30
10	5.0	7.0	10	14	20	24
12.6	4.0	5.6	8.0	11	16	19
14	3.5	5.0	7.0	10	14	17
16	3.0	4.4	6.2	8.7	12	15
18	2.8	3.9	5.5	7.7	11	13
20	2.5	3.5	5.0	7.0	10	12
22	2.3	3.2	4.5	6.3	9.0	11
24	2.0	2.9	4.1	5.8	8.3	10
26	1.9	2.7	3.8	5.4	7.8	9.2
28	1.8	2.5	3.6	5.0	7.1	8.5
30	1.7	2.3	3.3	4.6	6.6	8.0
32	1.6	2.2	3.1	4.3	6.2	7.5
34	1.5	2.0	2.9	4.1	5.8	7.0
36	1.4	1.9	2.7	3.8	5.5	6.6
40	1.3	1.7	2.5	3.5	5.0	6.0
44	1.1	1.6	2.2	3.1	4.5	5.4
48	1.0	1.4	2.1	2.9	4.1	5.0
52	1.0	1.3	1.9	2.7	3.8	4.6
56	.90	1.2	1.8	2.5	3.5	4.2
60	.80	1.1	1.7	2.3	3.3	4.0
66	.75	1.0	1.5	2.1	3.0	3.6
72	.70	1.0	1.4	1.9	2.7	3.3
80	.63	.90	1.2	1.7	2.5	3.0
88	.56	.80	1.1	1.6	2.2	2.7
96	.52	.70	1.0	1.4	2.0	2.5
104	.48	.66	.95	1.3	1.9	2.3
120	.42	.58	.83	1.1	1.6	2.0
140	.36	.50	.71	1.0	1.4	1.7
160	.31	.43	.62	.87	1.2	1.5
180	.28	.38	.55	.77	1.1	1.3
200	.25	.35	.50	.70	1.0	1.2
230	.22	.30	.43	.60	.86	1.0

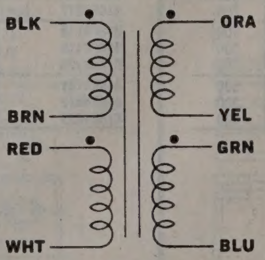
DS SERIES TRANSFORMER SIZES 8 AND 9 ARE AVAILABLE IN STYLES:
"A" (with lead wires)
"B" (with lugs)
"D" (with lugs)

DS SERIES TRANSFORMER SIZES 10 THRU 13 ARE AVAILABLE IN STYLES:
"F" (with lead wires)
"G" (with lugs)
"H" (with lugs)

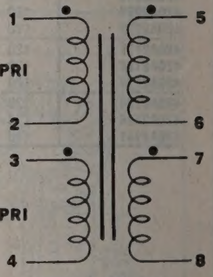
DS SERIES DIMENSIONAL DATA

CASE	SIZE	A	B	C	D	E	F	G
A	8	2.00	3.70	2.25	3.13		2.70	.19
A	9	2.30	4.00	2.56	3.56		3.06	.19
B	8	2.00	3.13	2.70	2.81		2.27	.19
B	9	2.30	3.56	3.06	3.13		2.56	.19
D	8	2.00	3.70	2.25	3.13		2.70	.19
D	9	2.30	4.00	2.56	3.56		3.06	.19
F	10	3.38	2.50	2.81	2.81	2.13	2.69	.2x.37
F	11	3.75	2.80	3.13	3.13	2.25	2.81	.2x.37
F	12	4.13	3.00	3.44	3.44	2.38	2.94	.2x.37
F	13	4.50	3.30	3.75	3.75	2.50	3.06	.2x.37
G	10	2.81	2.50	3.38	2.25	2.13	2.69	.2x.37
G	11	3.13	2.80	3.75	2.50	2.25	2.81	.2x.37
G	12	3.44	3.00	4.13	2.75	2.38	2.94	.2x.37
G	13	3.75	3.30	4.50	3.00	2.50	3.06	.2x.37
H	10	3.38	2.50	2.81	2.81	2.13	2.69	.2x.37
H	11	3.75	2.80	3.13	3.13	2.25	2.81	.2x.37
H	12	4.13	3.00	3.44	3.44	2.38	2.94	.2x.37
H	13	4.50	3.30	3.75	3.75	2.50	3.06	.2x.37

SCHEMATICS

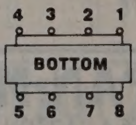


WIRES



LUGS & PC PINS

LOCATOR



PARALINE, 511 South Palm Avenue, Alhambra, CA 91803 • Telephone (818) 281-0222

For More Information. Circle No. 502

PERKIN-ELMER

PRECISION TOROIDAL TRANSFORMERS

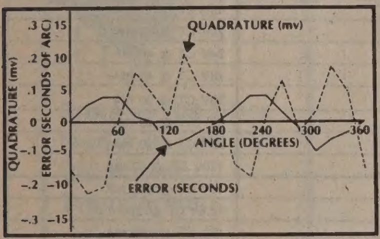
- INPUT SCOTT T
- REFERENCE ISOLATION
- OUTPUT SCOTT T
- DIGITALLY TAPPED
- COMBINATION
- PRECISION RATIO
- RESOLVER ISOLATION
- CUSTOM DESIGNS

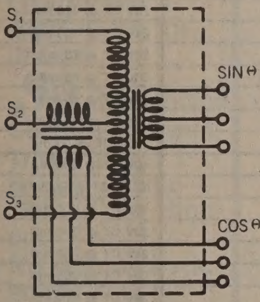
The Electronic Products Department of the Perkin-Elmer Corporation is in a unique position to provide Custom Precision Signal Transformers as a result of 20 years of experience designing and manufacturing very special transformers for the Vernistat® a.c. potentiometer and allied products. **High Performance in small size has always been a successful objective.** Our State of The Art Winding Equipment and Techniques enable close control of turns and taps for close matching of windings and repeatibility of product.

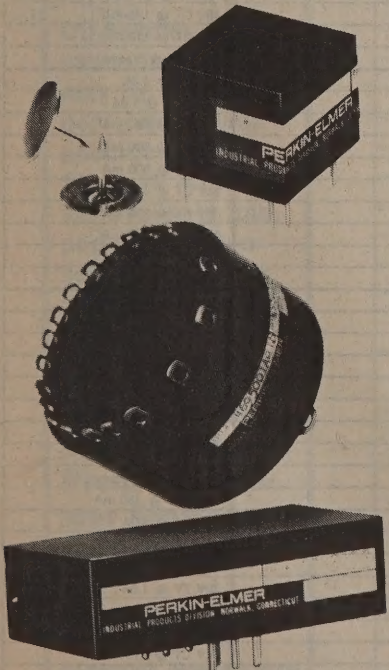
Perkin-Elmer can provide Custom Signal Transformers with high accuracies over the full MIL temperature range. For example, exponential function units with 80 taps to an accuracy of ±0.003% can be provided. SCOTT T Transformers have been built to an accuracy of 5 seconds of arc with a null of 0.1 millivolt. The transformers are fully encapsulated toroidal units and are available with contact pins for PC board mounting. They are manufactured in accordance with MIL-T-27C Grade 5. High input impedance and low output impedance can be matched to specifications. Operating frequency can also be per specifications.

SCOTT T TRANSFORMERS

The SCOTT T input transformers converts 3 wire synchro inputs to 4 wire resolver outputs (sin θ and cos θ) with high transformation accuracy and minimum quadrature. SCOTT T Transformers for converting 4 wire resolver inputs to 3 wire synchro outputs can also be supplied. Our output SCOTT T Transformers maintain high accuracies even under heavy load conditions. These units are useful in solid state synchro to digital and digital to synchro converter applications and are particularly applicable in multiplexed conversion systems.






PERKIN-ELMER
INDUSTRIAL PRODUCTS DIVISION
PERKIN-ELMER
INDUSTRIAL PRODUCTS DIVISION NORWALK, CONNECTICUT

INPUT SCOTT T TRANSFORMERS (SYNCHRO TO RESOLVER)

Input V rms L-L	Output V rms	Load K Ω	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	2.5	25	45	1.0	40	8	2x1x.625	PC 2x6-32	403-2187
	5.0	20	30	1.0	50	75	2x1x.6	PC 2x4-40	403-2064
	7.2 CT	10 to CT	60	1.0	20	10 to CT	2x1x.6	PC 2x4-40	403-2065
	10.2	10	60	2.0	50	50	2x1x.6	PC 2-4-40	403-2066
12	7.5	10	15	1.0	50	75	2x1x.6	PC 2x4-40	403-2055
90	1.1	10	15	0.03	300	1	2x1x1.1	PC 2x4-40	403-2078
	4.25	10	30	1.0	1000	11	2.5x1.25x.65	PC 2x4-40	403-2034
	4.25 CT	10	30	1.0	1000	11	2.78x1.41x.8	PC 2x4-40	403-2033
	17.8 CT	2.3 to CT	30	.7	100	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2019
	26.0 CT	10 to CT	30	1.4	100	15 to CT	2.78x1.41x.8	PC 2x4-40	403-2051
90 (60 Hz)	14 CT	100 to CT	360	12.0	45	15 to CT	4x2.25x1.15	2x6-32	403-2058
96	14.4 CT	10 to CT	15	.25	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2067
			45	.75	200	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2068
			180	5.0	30	12 to CT	2.78x1.41x.8	PC 2x4-40	403-2069
	20 CT	10 to CT	15	.25	200	10 to CT	2.78x1.41x.8	PC 2x4-40	403-2007

COMBINATION INPUT SCOTT T TRANSFORMERS

11.8 2 channel	5.0	20	30	1.0	50	45	2x1x.8	PC 2x4-40	403-2042
11.8 3 channel	3.2	300	45	.5	50	20	2.94x1.06x.8	PC 2x4-40	403-2048

COMBINATION SCOTT T / RESOLVER ISOLATION

Scott T 11.8	6.0	20	30	1.0	35	20	2x1x.6	PC 2x4-40	403-2070
OR									
Resolver 26	6.0	20	30	1.0	300	20			

OUTPUT SCOTT T TRANSFORMERS (RESOLVER TO SYNCHRO)

Output V rms	Input V rms L-L	Load Ω L-L	Trans. Accuracy Arc. Min.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
11.8	4.7	150	1	15	.25	7	2.78x1.41x.8	PC 2x4-40	403-2027
	6	150	2	8	.5	8	2.78x1.41x.61	PC 2x4-40	403-2071
	5 F.B. 2.5	100	3	8	.35	8	2.78x1.41x.61	PC 2x4-40	403-2075
	11.8 F.B. 6 CT	25	6	12	.8	2	2.78x1.41x.61	PC 2x4-40	403-2056
90	7	6000	1.5	50	3.0	600	2x1x1.1	PC 2x4-40	403-2077
	F.B. 2.8	6000	1.5	80	3.0	500	2.3x1.3x1	PC 4x4-40	403-2176

F.B. = Feedback winding.

RESOLVER ISOLATION TRANSFORMERS

Output V rms L-L	Input V rms L-L	Load K Ω L-L	Trans. Accuracy Arc. Sec.	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
7	7 (5 KHz)	10	.5	2	50	25	2x1x.6	PC 2x4-40	403-2072
9 CT	11.8	25 to CT	.3	1	80	50 to CT	1.63x.81x.5	PC	403-2063
11.1	6	.4	2	36	6	14	2.5x1.25x.65	PC 2x4-40	403-2003
26	6	6	3	36	.2	10	2.78x1.41x.61	PC 2x4-40	403-2073

PRECISION REFERENCE ISOLATION TRANSFORMERS

Output V rms	Input V rms	Load K Ω	Trans. Accuracy %	Output Quadrature Null mV	Z in K Ω	Z out Ω	Dimensions L x W x H	Mount	Part Number
3	115 26	90	.05	2.5 5	40 4.5	.7	1.5x1.5x.75	PC 1x6-32	403-2061
	115	10	.1	1.3	180	2.75	.814x.814x.5	PC	403-2166
5	26	.4	.1	1	100	5.5	1x1x.58	PC	403-2026
		20	2	6	100	30	.813x.813x.5	PC	403-2189
6	26	10	.01	2.5	70	15	1x1x.58	PC	403-2040
			.02	2.5	70	15	1x1x.58	PC	403-2041
6 CT	26	45 to CT	.1	1.5	100	4 to CT	1.25x1.25x.5	PC	403-2015
20	20	5	.2	2	50	140	1x1x.5	PC	403-2062
30	7.5	50	.2	200	.5	225	.88x.88x.88	2x2-56	403-2047

Operating Temperature Range −55°C to +125°C.
Frequencies 400 Hz except as otherwise stated.

Manufactured in accordance with MIL-T-27 Grade 5.
Specified transformation accuracies are with stated load.

For information on price, delivery and other standard or custom designed transformers call or write
THE PERKIN-ELMER CORPORATION • ELECTRONIC PRODUCTS DEPT. • Main Avenue, Norwalk, Connecticut 06856 • Telephone (203) 762-6574 or 762-4786
Contact us about our **VERNISTAT® a.c. Potentiometers, Adjustable Function Generators and Digital Converters.**

Prem PC Power Transformers

The New Kid on the Board is a Price Fighter

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PC Power Transformers

Prem — the price leader in PC Power Transformers

- Small board area — $1^3/_8$'' x $1^1/_8$'' in 2.4 VA design
- ® UL Recognized Class B system*
- Three flange bobbin design — 1500 VRMS High-pot

*Recognized under the component program of Underwriters Laboratory, Inc., under file #E85315, yellow card available upon request.

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McHenry, IL 60050
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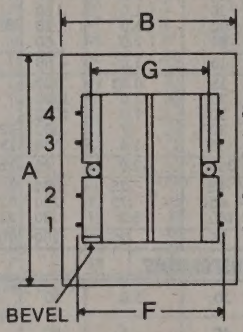
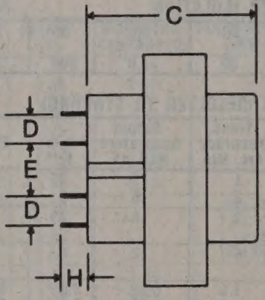
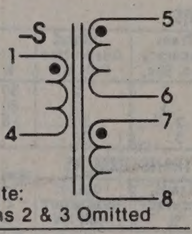
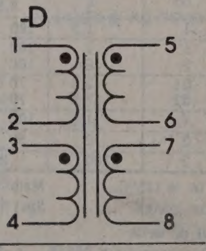
PIN DIMENSION
.020 x .041







Note:
Pins 2 & 3 Omitted



	SPW-350	SPW-400	SPW-500	SPW-600	SPW-610	SPW-620
VA	1.1	2.4	6.0	12.0	20.0	36.0
A	1.375	1.375	1.625	1.875	2.250	2.625
B	1.125	1.125	1.312	1.5625	1.875	2.187
C	.9375	1.187	1.290	1.4375	1.410	1.562
D	.250	.250	.250	.300	.300	.400
E	.250	.250	.350	.400	.400	.400
F	1.200	1.200	1.270	1.410	1.600	1.850
G	N/A	N/A	1.0625	1.250	1.50	NOTE
H	.28	.20	.20	.20	.20	.20

PC Power Transformers

Part No.	Parallel Secondaries	Series Secondaries
SPW-350-*	5V @ 220 mA	10V CT @ 110 mA
SPW-351-	6.3V @ 180 mA	12.6V CT @ 90 mA
SPW-352-	8V @ 140 mA	16V CT @ 70 mA
SPW-353-	10V @ 110 mA	20V CT @ 55 mA
SPW-354-	12V @ 90 mA	24V CT @ 45 mA
SPW-355-	14V @ 80 mA	28V CT @ 40 mA
SPW-356-	18V @ 60 mA	36V CT @ 30 mA
SPW-357-	24V @ 46 mA	48V CT @ 23 mA
SPW-358-	28V @ 40 mA	56V CT @ 20 mA
SPW-359-	60V @ 20 mA	120V CT @ 10 mA
SPW-400-	5V @ 500 mA	10V CT @ 250 mA
SPW-401-	6.3V @ 400 mA	12.6V CT @ 200 mA
SPW-402-	8V @ 300 mA	16V CT @ 150 mA
SPW-403-	10V @ 240 mA	20V CT @ 120 mA
SPW-404-	12V @ 200 mA	24V CT @ 100 mA
SPW-405-	14V @ 170 mA	28V CT @ 85 mA
SPW-406-	18V @ 130 mA	36V CT @ 65 mA
SPW-407-	24V @ 100 mA	48V CT @ 50 mA
SPW-408-	28V @ 90 mA	56V CT @ 45 mA
SPW-409-	60V @ 40 mA	120V CT @ 20 mA
SPW-500-	5V @ 1.2A	10V CT @ 600 mA
SPW-501-	6.3V @ 1.0A	12.6V CT @ 500 mA
SPW-502-	8V @ 800 mA	16V CT @ 400 mA
SPW-503-	10V @ 600 mA	20V CT @ 300 mA
SPW-504-	12V @ 500 mA	24V CT @ 250 mA
SPW-505-	14V @ 400 mA	28V CT @ 200 mA
SPW-506-	18V @ 340 mA	36V CT @ 170 mA
SPW-507-	24V @ 250 mA	48V CT @ 125 mA
SPW-508-	28V @ 220 mA	56V CT @ 110 mA
SPW-509-	60V @ 100 mA	120V CT @ 50 mA
SPW-600-	5V @ 2.4A	10V CT @ 1.2A
SPW-601-	6.3V @ 2.0A	12.6V CT @ 1.0A
SPW-602-	8V @ 1.6A	16V CT @ 800 mA
SPW-603-	10V @ 1.2A	20V CT @ 600 mA
SPW-604-	12V @ 1.0A	24V CT @ 500 mA
SPW-605-	14V @ 840 mA	28V CT @ 420 mA
SPW-606-	18V @ 700 mA	36V CT @ 350 mA
SPW-607-	24V @ 500 mA	48V CT @ 250 mA
SPW-608-	28V @ 440 mA	56V CT @ 220 mA
SPW-609-	60V @ 200 mA	120V CT @ 100 mA
SPW-610-	5V @ 4.0A	10V CT @ 2.0A
SPW-611-	6.3V @ 3.2A	12.6V CT @ 1.6A
SPW-612-	8V @ 2.5A	16V CT @ 1.25A
SPW-613-	10V @ 2.0A	20V CT @ 1.0A
SPW-614-	12V @ 1.6A	24V CT @ 800 mA
SPW-615-	14V @ 1.4A	28V CT @ 700 mA
SPW-616-	18V @ 1.1A	36V CT @ 550 mA
SPW-617-	24V @ 800 mA	48V CT @ 400 mA
SPW-618-	28V @ 700 mA	56V CT @ 350 mA
SPW-619-	60V @ 320 mA	120V CT @ 160 mA
SPW-620-	5V @ 7.2A	10V CT @ 3.6A
SPW-621-	6.3V @ 5.7A	12.6V CT @ 2.85A
SPW-622-	8V @ 4.5A	16V CT @ 2.25A
SPW-623-	10V @ 3.6A	20V CT @ 1.8A
SPW-624-	12V @ 3.0A	24V CT @ 1.5A
SPW-625-	14V @ 2.6A	28V CT @ 1.3A
SPW-626-	18V @ 2.0A	36V CT @ 1.0A
SPW-627-	24V @ 1.5A	48V CT @ 750 mA
SPW-628-	28V @ 1.3A	56V CT @ 650 mA
SPW-629-	60V @ 600 mA	120V CT @ 300 mA

*Primary Voltage — S (115V)
— D (115/230V)

NOTE: 4 corner mounting holes 2.187 x 1.750 centers clearance for #6 screw on SPW-620 series.

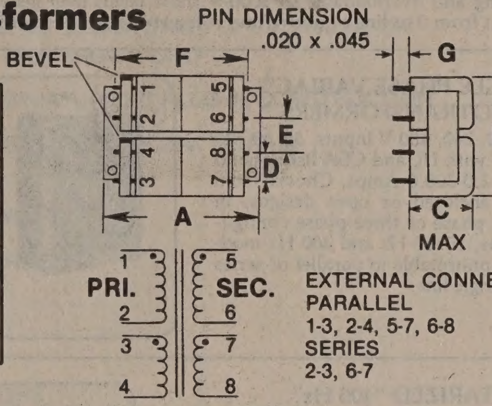
For More Information. Circle No. 504

Prem PC Power Transformers

EVERLAST
PREM

The New Kid on the Board is a Price Fighter

Low Profile Power Transformers



EXTERNAL CONNECTIONS
PARALLEL
1-3, 2-4, 5-7, 6-8
SERIES
2-3, 6-7

	SPW 050	SPW 100	SPW 300
VA	2.5	6	12
A	1.875	1.875	2.500
B	1.562	1.562	2.000
C	.660	.850	1.065
D	.375	.375	.500
E	.375	.375	.500
F	1.600	1.600	2.000
G	.200	.200	.200

Prem — the price leader in Low Profile Power Transformers.

- Low profile — .660" in 2.5 VA design
- ®UR Recognized Class B system*
- Three flange bobbin design — 1500 VRMS High-pot
- No electro-static shield needed

Other primary and secondary voltages may be custom-designed to your specifications. Since 12 terminals are available, tapped primaries or secondaries may also be utilized.

For further information and pricing, contact Prem's Customer Service Department.

PREM
MAGNETICS, INCORPORATED
3521 North Chapel Hill Road
McHenry, IL 60050
TWX 910/642-3763
(815) 385-2700

LOW PROFILE POWER TRANSFORMERS

115/230V DUAL PRIMARIES	SECONDARY	
Part No.	Parallel	Series
SPW-050	5V @ 500 mA	10V CT @ 250 mA
SPW-051	6.3V @ 400 mA	12.6V CT @ 200 mA
SPW-052	8V @ 300 mA	16V CT @ 150 mA
SPW-053	10V @ 250 mA	20V CT @ 125 mA
SPW-054	12V @ 200 mA	24V CT @ 100 mA
SPW-055	17V @ 150 mA	34V CT @ 75 mA
SPW-056	20V @ 120 mA	40V CT @ 60 mA
SPW-057	28V @ 90 mA	56V CT @ 45 mA
SPW-058	44V @ 56 mA	88V CT @ 28 mA
SPW-059	60V @ 40 mA	120V CT @ 20 mA
SPW-060	115V @ 20 mA	230V CT @ 10 mA
SPW-061	15V @ 170 mA	30V CT @ 85 mA
SPW-100	5V @ 1.2A	10V CT @ 600 mA
SPW-101	6.3V @ 900 mA	12.6V CT @ 450 mA
SPW-102	8V @ 700 mA	16V CT @ 350 mA
SPW-103	10V @ 600 mA	20V CT @ 300 mA
SPW-104	12V @ 500 mA	24V CT @ 250 mA
SPW-105	17V @ 340 mA	34V CT @ 170 mA
SPW-106	20V @ 300 mA	40V CT @ 150 mA
SPW-107	28V @ 200 mA	56V CT @ 100 mA
SPW-108	44V @ 130 mA	88V CT @ 65 mA
SPW-109	60V @ 100 mA	120V CT @ 50 mA
SPW-110	115V @ 50 mA	230V CT @ 25 mA
SPW-111	15V @ 400 mA	30V CT @ 200 mA
SPW-300	5V @ 2.4A	10V CT @ 1.2A
SPW-301	6.3V @ 1.8A	12.6V CT @ 900 mA
SPW-302	8V @ 1.4A	16V CT @ 700 mA
SPW-303	10V @ 1.2A	20V CT @ 600 mA
SPW-304	12V @ 1.0A	24V CT @ 500 mA
SPW-305	17V @ 680 mA	34V CT @ 340 mA
SPW-306	20V @ 600 mA	40V CT @ 300 mA
SPW-307	28V @ 400 mA	56V CT @ 200 mA
SPW-308	44V @ 260 mA	88V CT @ 130 mA
SPW-309	60V @ 200 mA	120V CT @ 100 mA
SPW-310	115V @ 100 mA	230V CT @ 50 mA
SPW-311	15V @ 800 mA	30V CT @ 400 mA

*Recognized under the component program of Underwriters Laboratory, Inc., under file #E85315, yellow card available upon request.

For More Information. Circle No. 504

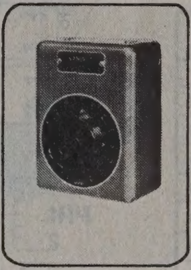
TECHNIPOWER® A Penril COMPANY

VARIAC® VARIABLE AUTOTRANSFORMERS

The Industry's Standard for Quality, Performance Reliability and Efficiency. Available in 700 models with more than 1000 possible custom variations to individual "spec." Durable, cool running and overloadable to 1000% short term, they generate output from 0 to line or above line voltages independent of load size or power factors. In single and three phase models, manual and motor driven, with 120, 208, 240 and 480 V outputs plus many current ranges. A special group of militarized "400 Hz" units featuring excellent regulation are included.

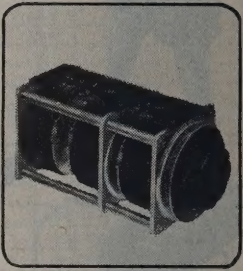
SINGLE PHASE VARIAC® AUTOTRANSFORMERS

In 120, 240, 480 V inputs, 50/60 Hz, many with UL and CSA listings and from 2.0-300.0 Amps. Choose from fully enclosed or open designs, in single phase or three phase configurations, 50/60 Hz and 400 Hz models. Connectable in parallel or series and single line.



MANUAL 3-PHASE GANGED VARIAC® AUTOTRANSFORMERS

Control 3-phase power requiring 208, 240 or 480 V inputs. These Variacs come in 208, 240 and 50/60 Hz ratings and in 7.1, 8.5 and 10 Amps. 29 other units permit overvoltage use on an open Delta connection. 14 other models are Y connected. Ball bearings are also included.

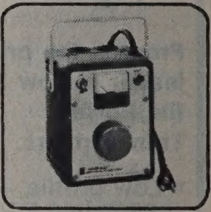


MILITARIZED "400 Hz" VARIAC® AUTOTRANSFORMERS

For ruggedized use from 350 to 1200 Hz. With excellent regulation, smaller and lighter than 60 Hz units, they conform to most mil-specs for harsh environments. Single Phase and 3-Phase configurations.

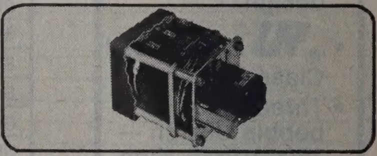
PORTABLE VARIAC® AUTOTRANSFORMERS

Metered, encased and available in 20 models featuring an autotransformer and overload protection. Some have Voltmeters, Ammeters, and Wattmeters. 120 V and 240 V models to 18.0A; 2 and 3 wire versions also offered.



MOTOR DRIVEN VARIAC® AUTOTRANSFORMERS

More than 60 motor driven models, single or ganged. Motors are fully enclosed, 2 phase, gear-reduction, servo types with motor speeds of 2, 4, 8, 16, 32, 64 and 128 secs at 60 Hz. All have ball bearings and adjustable limit switches.



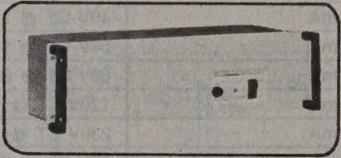
TECHNIPOWER® A Penril COMPANY

VARIAC® AUTOMATIC VOLTAGE REGULATORS

Control Industrial Loads, Encourage Peak Performance While You Protect Sensitive Equipment e.g. computers, Variac Voltage Regulators offer smooth voltage control, have fast response and function up to 10 times the rating for transient surges without power factor restrictions. Particularly suitable to offset brown-out effects and do not introduce distortion or noise. Offered in 5 basic models with over 100 custom variation possibilities.

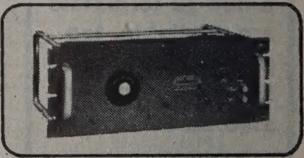
TYPE 1591

Compact 1 kVA with 115 V ratings. Low cost, small and available in portable and rack mounted models.



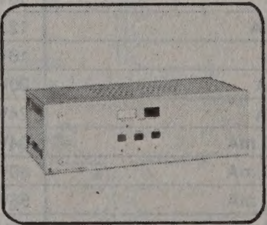
TYPE 1571

Militarized, in 4 models, for use where shock or vibration is encountered. Available in 400 Hz or 50/60 Hz with 115 V outputs, rack mountable. 5.8 kVA.



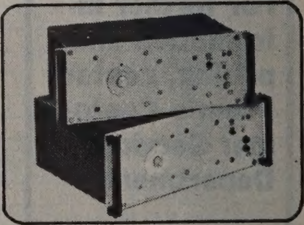
TYPE 1592

Provides proper voltage for long term operation — remotely programmable. In 2 models, capacity to 5.3 kVA, handle 120-480 V and are used in single and three-phase applications.



TYPES 1581 and 1582

High capacity. Automatically compensate for line voltage fluctuations. 115 V and 230 V models, 19.7 kVA capacities. For industrial and lab use e.g. computers, transmitters and critical processes.



POWER SUPPLIES

See Gold Book Page 750. For Technipower Mil–Qual Encapsulated and Open Frame Modular Power Sources — Companion Models to Variac® Autotransformers and Voltage Regulators.

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P.O. Box 222, Commerce Park, Danbury, CT 06810
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For More Information. Circle No. 505

PICO Catalog Contents

28 PAGES OF MINIATURIZED TRANSFORMERS OPERATING OVER THE FREQUENCY RANGE OF 20 Hz TO 250 KHz, WITH PULSE TRANSFORMERS OPERATING TO 32MHz.

AUDIO TRANSFORMERS ARE ARRANGED ACCORDING TO SIZE WITH 1/4" X 1/4" (400 Hz-250 KHz) SHOWN FIRST, AND THE 3/4" X 13/16" (20 Hz-25 KHz) SHOWN LAST.

PULSE TRANSFORMERS .05μSEC TO 100μSEC WITH MINIATURIZED PLUG-IN CONSTRUCTION.

400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. PLUG-IN CONSTRUCTION. ULTRA-MINIATURE SIZE.

ULTRA MINIATURE D C —D C CONVERTER TRANSFORMERS.

MICROPHONE/TRANSDUCER AUDIO INPUT TRANSFORMERS.

MINIATURIZED POWER INDUCTORS

EMI COMMON MODE SUPPRESSION INDUCTORS

ULTRA MINIATURE AND MINIATURE HIGH "Q" INDUCTORS

Description	Page	
1/4" X 1/4"; 2 OHM TO 30K OHM; 400 Hz TO 250 KHz 100 MILLIWATT AT 1 KHz	1156	1157
.35" X .32"; 2 OHM TO 40K OHM; 400 Hz TO 100 KHz 400 MILLIWATT AT 1 KHz	1158	1159
.35" X .46"; 2 OHM TO 100K OHM; 300 Hz TO 100 KHz 600 MILLIWATT AT 1 KHz	1160	1161
.5" X .35"; 2 OHM TO 100K OHM; 300 Hz TO 75 KHz 600 MILLIWATT AT 1 KHz	1162	1163
.5" X .5"; 2 OHM TO 250K OHM; 150 Hz TO 75 KHz 1 WATT AT 1 KHz	1164	1165
.75" X .375"; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz 1.5 WATT AT 1 KHz	1166	1167
.75" X .52"; 2 OHM TO 135K OHM; 50 Hz TO 30KHz 2 WATT AT 1 KHz	1168	1169
.75" X .82"; 2 OHM TO 80K OHM; 20 Hz TO 25 KHz 3 WATT AT 1 KHz	1170	1171
PULSE TRANSFORMERS .05μSEC TO 100μSEC WITH MINIATURIZED PLUG-IN CONSTRUCTION.	1172	1173
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ULTRA MINIATURE AND MINIATURE HIGH "Q" INDUCTORS	1179, 1180, 1181	
MICROPHONE/TRANSDUCER AUDIO INPUT TRANSFORMERS ***Interchangeable with transformers made by Beyer Dynamic of Germany.***	1182	

Delivery—
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PICO Electronics, Inc.

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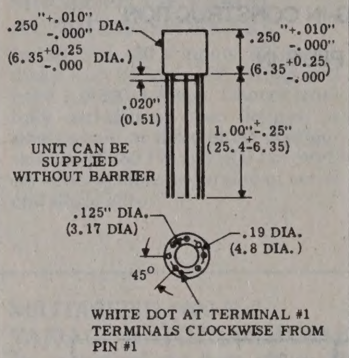
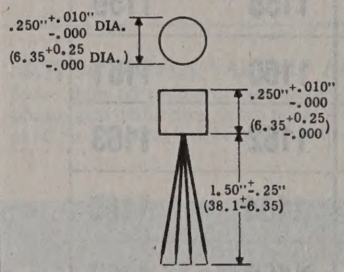
1/4"x1/4" PICO's ultra-miniature transformers

F SERIES Plug-In



G SERIES Insulated Leads



DIMENSIONS ARE IN INCHES (MM)

PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER MILLIWATTS				SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PRICES 1-9 ***	
F Series Plug-In	G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SER	PAR	1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	F-Series	G-Series
F-28003	G-29003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	.34	1:1	2:1	16.41	15.60
F-28005	G-29005	20 ct	8 ct	2	125	20	8	2.1	1.28	.32	1.58:1	3.16:1	16.41	15.60
F-28010	G-29010	20 ct	20 ct	5	125	20	8	2.1	2.56	.64	1:1	2:1	16.41	15.60
F-28015	G-29015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2:1	16.41	15.60
F-28020	G-29020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1:1	2:1	16.28	15.60
F-28025	G-29025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	.58	1.73:1	3.46:1	14.91	14.20
F-28030	G-29030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1:1	2:1	14.91	14.20
F-28035	G-29035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	16.28	14.20
F-28040	G-29040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	16.28	14.20
F-28045	G-29045	100 ct	100 ct	25	125	20	3.6	12.1	12	3	1:1	2:1	14.91	14.20
F-28050	G-29050	120 ct	12.8 c	3.2	125	20	3.3	13.2	1.6	.4	3.06:1	6.12:1	14.91	14.20
F-28055	G-29055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83:1	17.83	14.20
F-28060	G-29060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1:1	2:1	17.83	16.92
F-28065	G-29065	150 ct	12 ct	3	125	20	3	15	1.56	.39	3.54:1	7.07:1	17.25	15.42
F-28070	G-29070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73:1	3.46:1	17.83	15.42
F-28075	G-29075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	17.83	16.92
F-28080	G-29080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	17.83	16.92
F-28085	G-29085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	17.83	16.92
F-28090	G-29090	200 ct	200 ct	50	125	20	2.5	22	26.8	6.7	1:1	2:1	17.83	16.92
F-28095	G-29095	300 ct	12 ct	3	125	20	2	33	1.56	.39	5:1	10:1	17.83	16.92
F-28100	G-29100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	17.83	16.92
F-28105	G-29105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1.41:1	2.83:1	17.83	16.92
F-28110	G-29110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2:1	17.83	16.92
F-28115	G-29115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	16.20	15.42
F-28120	G-29120	320 ct	12.8ct	3.2	125	20	2	34	1.6	0.4	5:1	10:1	19.11	18.15
F-28125	G-29125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16:1	6.32:1	19.11	18.15
F-28130	G-29130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83:1	3.65:1	19.11	18.15
F-28135	G-29135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41:1	2.83:1	19.11	18.15
F-28140	G-29140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2:1	17.37	16.54
F-28145	G-29145	400 ct	1000 ct	250	125	20	1.8	49	120	30	1:1.58	1.26:1	19.11	18.15
F-28150	G-29150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1:2.24	1:1.12	19.11	18.15
F-28155	G-29155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1:3.16	1:1.58	19.11	18.15
F-28160	G-29160	500 ct	12.8ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	17.37	16.54
F-28165	G-29165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6:1	11.2:1	17.37	16.54
F-28170	G-29170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32:1	17.37	16.54
F-28175	G-29175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83:1	3.65:1	17.37	16.54
F-28180	G-29180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	19.11	18.15
F-28185	G-29185	*500 ct	500 ct	-	125	20	1.6	54	65	-	1:1	-	19.11	18.15
F-28190	G-29190	500 ct	600 ct	150	125	20	1.6	54	72	18	1:1.1	1.83:1	19.11	18.15
F-28195	G-29195	600 ct	12.8 c	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7:1	19.11	18.15
F-28200	G-29200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47:1	8.94:1	17.37	16.54
F-28205	G-29205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54:1	7.07:1	17.37	16.54
F-28210	G-29210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73:1	3.46:1	17.37	16.54
F-28215	G-29215	600 ct	600 ct	150	125	20	1.5	59	72	18	1:1	2:1	17.37	16.54
F-28220	G-29220	*600 ct	600 ct	-	125	20	1.5	59	72	-	1:1	-	19.11	18.15
F-28225	G-29225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1:1.41	1.41:1	17.37	16.54
F-28230	G-29230	640 ct	12.8 c	3.2	125	20	1.5	62	1.6	0.4	7.07:1	14.14:1	17.37	16.54
F-28235	G-29235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65:1	5.29:1	17.37	16.54
F-28240	G-29240	800 ct	12.8 c	3.2	125	20	1.3	88	16	4	7.9:1	15.8:1	19.11	18.15
F-28245	G-29245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08:1	8.16:1	17.83	16.97
F-28250	G-29250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1:1	2:1	17.83	16.97
F-28255	G-29255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22:1	2.45:1	17.83	16.97
F-28260	G-29260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	19.61	18.62
F-28265	G-29265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47:1	8.94:1	19.61	18.62
F-28270	G-29270	1000 ct	1000 ct	250	125	20	1.2	120	120	30	1:1	2:1	17.83	16.97
F-28275	G-29275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.1:1	18.2:1	19.61	18.62
F-28280	G-29280	1200 ct	12.8 ct	3.2	125	20	1	133	1.6	0.4	9.68:1	19.4:1	19.61	18.62
F-28285	G-29285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55:1	3.1:1	19.61	18.62
F-28290	G-29290	1200 ct	1200 ct	300	125	20	1	133	160	40	1:1	2:1	19.61	18.62
F-28295	G-29295	*1200 ct	1200 ct	-	125	20	1	133	160	-	1:1	-	19.61	18.62
F-28300	G-29300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	19.61	18.62
F-28305	G-29305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73:1	3.46:1	17.83	16.97
F-28310	G-29310	*1500 ct	600 ct	-	125	20	1	180	73	-	1.58:1	-	17.83	16.97
F-28315	G-29315	*1500 ct	1500 ct	-	125	20	1	180	215	-	1:1	-	19.61	18.62
F-28320	G-29320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11:2:1	22.4:1	19.61	18.62
F-28325	G-29325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	19.61	18.62
F-28330	G-29330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1:1	2:1	19.61	18.62
F-28335	G-29335	*2000 ct	2000 ct	-	125	20	0.8	218	260	-	1:1	-	19.61	18.62
F-28340	G-29340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1:2	1:1	19.11	18.19

*INCLUDES ELECTROSTATIC SHIELD

*** **Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

SPECIFICATIONS

- **MIL-T-27:** . . . . All Units Meet MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** . . . . ±3dB, 400 Hz-250 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** . . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** . . . All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** . . . Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** . . . . 1.1 Grams.
- **OPERATING TEMPERATURE:** . . -55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** . . . . Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Delivery— stock to one week

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER MILLIWATTS		PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PRICES 1-9 ***	
F Series Plug-In	G Series Insulated Leads		SER	PAR	1 KHz and higher	400 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	F-Series	G-Series
F-28345	G-29345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1:1	2:1	19.11	18.19
F-28350	G-29350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1:1	2:1	19.11	18.19
F-28355	G-29355	*3000 ct	3000 ct	-	125	20	0.65	330	330	-	1:1	-	19.61	18.62
F-28360	G-29360	3600 ct	3600 ct	900	125	20	0.6	370	450	112.5	1:1	2:1	19.11	18.19
F-28365	G-29365	4000 ct	16 ct	4	125	20	0.57	400	2.3	0.58	15.8:1	31.6:1	19.11	18.19
F-28370	G-29370	4000 ct	600 ct	150	125	20	0.57	400	73	18.25	2.58:1	5.16:1	19.11	18.19
F-28375	G-29375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2:1	4:1	19.11	18.19
F-28380	G-29380	*4000 ct	8000 ct	-	125	20	0.57	400	1070	-	1:1.41	-	21.01	19.97
F-28385	G-29385	5000 ct	500 ct	125	125	20	0.5	540	65	16.25	3.16:1	6.32:1	19.11	18.19
F-28390	G-29390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162.5	1:1	2:1	21.01	19.97
F-28395	G-29395	7500 ct	50 ct	12.5	125	20	0.5	835	6.6	1.65	12.2:1	24.5:1	21.01	19.97
F-28400	G-29400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8.66:1	17.3:1	19.56	18.62
F-28405	G-29405	7500 ct	600 ct	150	125	20	0.4	835	72	18	3.54:1	7.07:1	19.56	18.62
F-28410	G-29410	7500 ct	2500 ct	625	125	20	0.4	835	280	70	1.73:1	3.46:1	19.56	18.62
F-28415	G-29415	*7500 ct	7500 ct	-	125	20	0.4	835	1020	-	1:1	-	19.56	18.62
F-28420	G-29420	8000 ct	12.8 ct	3.2	125	20	0.4	865	1.6	0.4	25:1	50:1	21.01	19.97
F-28425	G-29425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2.83:1	5.66:1	21.01	19.97
F-28430	G-29430	*8000 ct	1200 ct	-	125	20	0.4	865	160	-	2.58:1	-	21.01	19.97
F-28435	G-29435	*9000 ct	9000 ct	-	125	20	0.4	1160	1160	-	1:1	-	21.01	19.97
F-28440	G-29440	10,000 ct	12.8 ct	3.2	125	20	0.36	1200	1.6	0.4	28:1	56:1	21.01	19.97
F-28445	G-29445	10,000 ct	16 ct	4	125	20	0.36	1200	1.77	0.44	25:1	50:1	19.56	18.62
F-28450	G-29450	10,000 ct	100 ct	25	125	20	0.36	1200	12	3	10:1	20:1	19.56	18.62
F-28455	G-29455	10,000 ct	200 ct	50	125	20	0.36	1200	27	6.75	7.07:1	14.14:1	19.56	18.62
F-28460	G-29460	10,000 ct	500 ct	125	125	20	0.36	1200	65	16.25	4.47:1	8.94:1	19.56	18.62
F-28465	G-29465	10,000 ct	600 ct	150	125	20	0.36	1200	72	18	4.08:1	8.16:1	19.56	18.62
F-28470	G-29470	10,000 ct	1000 ct	250	125	20	0.36	1200	120	30	3.16:1	6.32:1	19.56	18.62
F-28475	G-29475	10,000 ct	1200 ct	300	125	20	0.36	1200	160	40	2.88:1	5.77:1	19.56	18.62
F-28480	G-29480	10,000 ct	1500 ct	375	125	20	0.36	1200	215	53.8	2.58:1	5.16:1	19.97	19.97
F-28485	G-29485	10,000 ct	2000 ct	500	125	20	0.36	1200	260	65	2.24:1	4.47:1	19.56	18.62
F-28490	G-29490	10,000 ct	5000 ct	1250	125	20	0.36	1200	650	162.5	1.41:1	2.83:1	19.56	18.62
F-28495	G-29495	10,000 ct	7500 ct	1875	125	20	0.36	1200	1020	255	1.15:1	2.3:1	19.56	18.62
F-28500	G-29500	10,000 ct	10,000 ct	2500	125	20	0.36	1200	1200	300	1:1	2:1	17.83	16.97
F-28505	G-29505	*10,000 ct	10,000 ct	-	125	20	0.36	1200	1440	-	1:1	-	21.01	19.97
F-28510	G-29510	15,000 ct	400 ct	100	100	15	0.35	1420	43	10.75	6.12:1	12.24:1	19.61	18.62
F-28515	G-29515	15,000 ct	500 ct	125	100	15	0.35	1420	49	12.25	5.48:1	10.95:1	19.61	18.62
F-28520	G-29520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5:1	10:1	19.61	18.62
F-28525	G-29525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45:1	19.61	18.62
F-28530	G-29530	*15,000 ct	15,000 ct	-	100	15	0.35	1420	1730	-	1:1	-	21.01	19.97
F-28535	G-29535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2:1	19.61	18.62
F-28540	G-29540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	19.61	18.62
F-28545	G-29545	20,000 ct	500 ct	125	100	15	0.3	1600	60	15	6.33:1	12.65:1	21.01	19.97
F-28550	G-29550	20,000 ct	600 ct	150	100	15	0.3	1600	66	16.5	5.77:1	11.55:1	21.01	19.97
F-28555	G-29555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10:1	21.01	19.97
F-28560	G-29560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4.47:1	8.94:1	21.01	19.97
F-28565	G-29565	20,000 ct	5000 ct	1250	100	15	0.3	1600	600	150	2:1	4:1	21.01	19.97
F-28570	G-29570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1.41:1	2.83:1	21.01	19.97
F-SHIELD	MU-METAL SHIELD .285" d X .268" h (7.24 mm d X 6.73 mm h) SINGLE SHIELD												1.80	
FYY-SHIELD	MU-METAL SHIELD .315" d X .275" h (8.0 mm d X 6.99 mm h) USE WITH F-SHIELD FOR DOUBLE SHIELDING												1.80	
G-SHIELD	MU-METAL SHIELD .285" d X .335" h (7.24 mm d X 8.51 mm h) SINGLE SHIELD													1.79
GYY-SHIELD	MU-METAL SHIELD .315" d X .40" h (8.00 mm d X 10.16 mm h) USE WITH G-SHIELD FOR DOUBLE SHIELDING													1.79
GXX-SHIELD	MU-METAL SHIELD .35" d X .465" h (8.89 mm d X 11.81 mm h) USE WITH G-SHIELD AND GYY SHIELD FOR TRIPLE SHIELDING													1.79

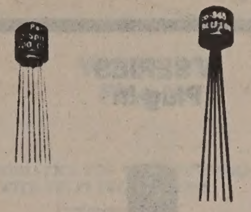
*INCLUDES ELECTROSTATIC SHIELD

** **Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

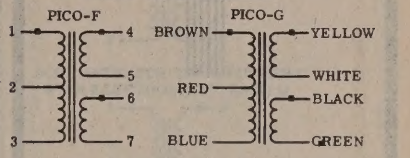
INDUCTORS

PART NUMBER F-SERIES	G-SERIES	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9*** F SERIES	G SERIES
F-5825	G-6125	SERIES 10.0 2.75 PARALLEL 2.5 .65	0 2 0 4	2250 560	16.20	15.42
F-5830	G-6130	SERIES 5.5 1.5 PARALLEL 1.3 .40	0 2 0 4	1000 250	16.20	15.42
F-5835	G-6135	SERIES .85 .25 PARALLEL .21 .06	1 6 2 12	240 60	16.20	15.42
F-5840	G-6140	SERIES .6 .15 PARALLEL .15 .04	0 5 0 10	144 36	16.20	15.42

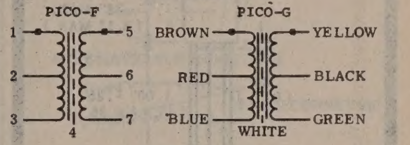
F SERIES Plug-In G SERIES Insulated Leads



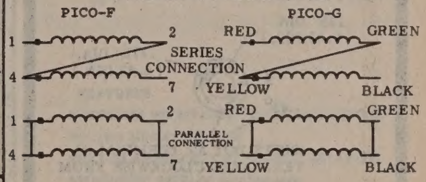
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES
- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- 5 MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

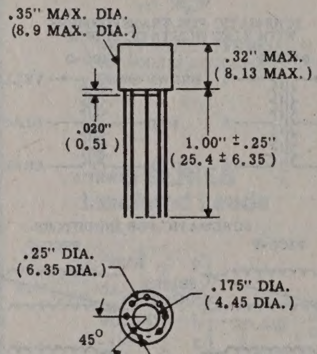
Delivery—
stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO's ultra-miniature transformers

W SERIES Plug-In



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- **MIL-T-27:** . . . . All Units Meet MIL-T-27. Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** . . . . ±3dB, 400 Hz-100 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** . . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** . . . . All Units Tested at 200 V RMS.

INSULATION RESISTANCE: . . . Greater Than 10,000 Megohms at 300 V DC.

- **WEIGHT:** . . . . 2.5 Grams.
- **OPERATING TEMPERATURE:** . . -55° c to +105° c (All Units Can Be Supplied to Class S Requirements, +130° c)
- **TERMINALS:** . . . . Solid .016 Diameter Conductor. Conductor is Copper Clad Steel. Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS		PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9*** W-Series
		SER	PAR	1KHz and higher	400 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	
W-26003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	12.11
W-26005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	12.11
W-26010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	12.11
W-26015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	12.11
W-26020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	12.11
W-26025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	12.84
W-26030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	12.84
W-26035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	15.24
W-26040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	12.84
W-26045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	12.84
W-26050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	11.55
W-26055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	15.24
W-26060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	15.24
W-26065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	11.55
W-26070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	12.84
W-26075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	12.84
W-26080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	15.24
W-26085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	12.84
W-26090	200 ct	200 ct	50	.4	.075	7	20	24	6	1:1	2:1	12.84
W-26095	300 ct	12 ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	11.55
W-26100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	12.84
W-26105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	12.84
W-26110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	15.24
W-26115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	11.55
W-26120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10:1	11.55
W-26125	400 ct	40 ct	10	.4	.075	5	40	4.5	1.1	3.16:1	6.32:1	15.24
W-26130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	15.24
W-26135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	12.84
W-26140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	15.24
W-26145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	17.49
W-26150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	17.49
W-26155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	15.79
W-26160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	13.38
W-26165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	13.38
W-26170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	13.38
W-26175	500 ct	150 ct	37.5	.4	.075	4.5	50	18	4.5	1.83:1	3.65:1	13.38
W-26180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	13.38
W-26185	*500 ct	500 ct	-	.4	.075	4.5	50	60	-	1:1	-	13.38
W-26190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	13.38
W-26195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	11.55
W-26200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	12.11
W-26205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	12.11
W-26210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	12.11
W-26215	600 ct	600 ct	150	.4	.075	4.1	60	72	18	1:1	2:1	12.11
W-26220	*600 ct	600 ct	-	.4	.075	4.1	60	72	-	1:1	-	13.38
W-26225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	12.11
W-26230	640 ct	12.8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.14:1	12.11
W-26235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	12.11
W-26240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9 :1	15.8:1	12.11
W-26245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4.08:1	8.16:1	13.38
W-26250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	12.11
W-26255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	12.11
W-26260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9.13:1	18.3:1	12.11
W-26265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	13.38
W-26270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	13.38
W-26275	1060 ct	12.8 ct	3.2	.4	.075	3.1	106	1.5	.38	9.1:1	18.2:1	12.11
W-26280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	10.90
W-26285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	10.90
W-26290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	10.90
W-26295	*1200 ct	1200 ct	-	.4	.075	2.9	120	140	-	1:1	-	14.90
W-26300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11 2:1	22.4:1	12.11
W-26305	1500 ct	500 ct	125	4	.075	2.6	150	60	15	1.73:1	3.46:1	13.38
W-26310	*1500 ct	600 ct	-	.4	.075	2.6	150	72	-	1.58:1	-	13.38
W-26315	*1500 ct	1500 ct	-	.4	.075	2.6	150	180	-	1:1	-	13.38
W-26320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	12.11
W-26325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	15.79
W-26330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	15.79
W-26335	*2000 ct	2000 ct	-	.4	.075	2.2	200	240	-	1:1	-	17.49
W-26340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	15.79
W-26345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	15.79

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

*INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

Delivery—
stock to one week

"For Immediate Action please use return card, Vol. 4, or ***call 800-431-1064."***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS		PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9*** W-Series
		SER	PAR	1KHz and higher	400 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	
W-26350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	12.84
W-26355	*3000 ct	3000 ct	-	.4	.075	1.8	300	360	-	1:1	-	17.49
W-26360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	12.84
W-26365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	15.79
W-26370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	15.79
W-26375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4:1	17.49
W-26380	*4000 ct	8000 ct	-	.4	.075	1.6	400	960	-	1:1.41	-	17.49
W-26385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	13.38
W-26390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	13.38
W-26395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2:1	24.5:1	13.38
W-26400	7500 ct	100 ct	25	.33	.075	1.2	750	12	3	8.66:1	17.3:1	13.38
W-26405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	14.90
W-26410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	14.90
W-26415	*7500 ct	7500 ct	-	.33	.075	1.2	750	900	-	1:1	-	17.49
W-26420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50:1	13.38
W-26425	8000 ct	1000 ct	250	.3	.075	1.1	800	120	30	2.83:1	5.66:1	14.90
W-26430	*8000 ct	1200 ct	-	.3	.075	1.1	800	144	-	2.58:1	-	17.49
W-26435	*9000 ct	9000 ct	-	.27	.075	1.1	900	1080	-	1:1	-	17.49
W-26440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	12.11
W-26445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	12.11
W-26450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	13.38
W-26455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	13.38
W-26460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	13.38
W-26465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	13.38
W-26470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3.16:1	6.32:1	13.38
W-26475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	15.79
W-26480	10,000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	15.79
W-26485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	15.47
W-26490	10,000 ct	5000 ct	1250	.25	.075	1.0	1000	600	150	1.41:1	2.83:1	15.75
W-26495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	15.79
W-26500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	15.24
W-26505	*10,000 ct	10,000 ct	-	.25	.075	1.0	1000	1200	-	1:1	-	17.49
W-26510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	15.24
W-26515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48:1	10.95:1	15.24
W-26520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10:1	15.24
W-26525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	15.24
W-26530	*15,000 ct	15,000 ct	-	.16	.075	.82	1500	1800	-	1:1	-	17.49
W-26535	15,000 ct	15,000 ct	3750	.16	.075	.82	1500	1800	450	1:1	2:1	15.79
W-26540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4:1	8:1	15.79
W-26545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	15.24
W-26550	20,000 ct	600 ct	150	.125	.075	.7	2000	72	18	5.77:1	11.55:1	15.24
W-26555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	13.93
W-26560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	17.49
W-26565	20,000 ct	5000 ct	1250	.125	.075	.7	2000	600	150	2:1	4:1	15.24
W-26570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	15.24
W-26575	*20,000 ct	20,000 ct	-	.125	.075	.7	2000	2400	-	1:1	-	17.49
W-26580	25,000 ct	500 ct	125	.1	.075	.63	2500	60	15	7.07:1	14.14:1	15.79
W-26585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	15.79
W-26590	30,000 ct	50 ct	12.5	.083	.075	.58	3000	6	1.5	24.5:1	49:1	15.79
W-26595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	15.79
W-26600	30,000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	15.79
W-26605	30,000 ct	200 ct	50	.083	.075	.58	3000	24	6	12.25:1	24.5:1	15.79
W-26610	30,000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	15.79
W-26615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3.46:1	15.79
W-26620	*30,000 ct	30,000 ct	-	.083	.075	.58	3000	3600	-	1:1	-	17.49
W-26625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	17.49
W-SHIELD	MU-METAL SHIELD .37"D x .32"H (9.4mmD x 8.1mmH) SINGLE SHIELD											1.80
WXX-SHIELD	MU-METAL SHIELD .395"D x .33"H (10mmD x 8.4mmH) USE WITH W SHIELD FOR DOUBLE SHIELDING											1.80

*INCLUDES ELECTROSTATIC SHIELD

*** Discount Prices: 1-9 Net;
10-24 less 10%; 25-49 less 16%;
50-99 less 23%; 100-499 less 30%

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York.
P.O. Box 1206

INDUCTORS

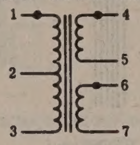
ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE. EACH AT A PARTICULAR VALUE OF D.C. CURRENT. ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER		INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICE*** 1-9
W-26705	SERIES	0.1 08	4 10	25	12.11
	PARALLEL	.025 .02	8 20	6.5	
W-26710	SERIES	0.9 0.5	2 6	105	12.11
	PARALLEL	.23 .13	4 12	26	
W-26715	SERIES	2.5 0.9	2 4	630	12.11
	PARALLEL	0.6 0.23	4 8	160	
W-26720	SERIES	4.5 1.2	2 4	2300	12.85
	PARALLEL	1.1 0.3	4 8	575	

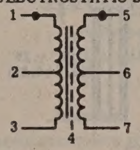
PICO's ultra-miniature transformers

W SERIES Plug-In

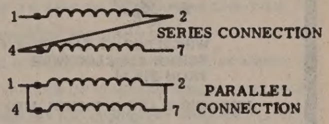
SCHEMATICS FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- •EXTREME RESISTANCE TO THERMAL SHOCK
- •ULTRA MINIATURE SIZE
- •PICO IS APPROVED QPL SOURCE (MIL-T-27)
- •MAGNETIC SHIELDS AVAILABLE
- •ELECTROSTATIC SHIELDING CAN BE ADDED
- •VARIATION OF STANDARD DESIGNS AVAILABLE
- •SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- •EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

Delivery—
stock to one week

"For Immediate
Action
please use
return card,
Vol. 4,
or call
800-431-1064."

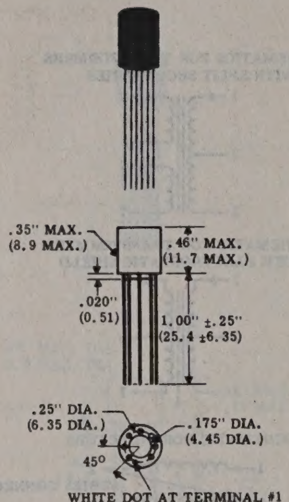
PICO
Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

phone
914-699-5514

PICO's ultra-miniature transformers

Y SERIES Plug-In



DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- MIL-T-27: . . . .
All Units Meet MIL-T-27, Military Designation is TF5R21ZZ, for Transformers, TFR20ZZ for Inductors.

- FREQUENCY RESPONSE: . . .
±3db, 300 Hz - 100 KHz at 1.0 Milliwatt.

o MAXIMUM DISTORTION: . . .
5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz.

- DIELECTRIC STRENGTH: . . .
All Units Tested at 200 V RMS.

- INSULATION RESISTANCE: . .
Greater Than 10,000 Megohms at 300 V DC.

- WEIGHT: . . . .
3 Grams

- OPERATING TEMPERATURE: .
-55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°C).

- TERMINALS: . . . .
Solid .016 Diameter Conductor.
Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.

- THERMAL SHOCK: . . . . . .
25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

PICO Electronics, Inc.

453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552

phone
914-699-5514

Delivery—
stock to one week

PICO PART NUMBER Y Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 *** Y-Series
		SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	
Y-27003	10 ct	10 ct	2.5	.6	.2	.1	31.6	1	1.25	.32	1:1	2:1	12.11
Y-27005	20 ct	8 ct	2	.6	.2	.1	22.3	2	.9	.23	1.58:1	3.16:1	12.11
Y-27010	20 ct	20 ct	5	.6	.2	.1	22.3	2.1	2.25	.56	1:1	2:1	12.11
Y-27015	32 ct	32 ct	8	.6	.2	.1	17.6	3.4	4	1	1:1	2:1	12.11
Y-27020	40 ct	40 ct	10	.6	.2	.1	15.8	4.2	4.5	1.13	1:1	2:1	12.11
Y-27025	48 ct	16 ct	4	.6	.2	.1	14.4	5	1.8	.45	1.73:1	3.46:1	12.11
Y-27030	50 ct	50 ct	12.5	.6	.2	.1	14.1	5.25	5.6	1.4	1:1	2:1	12.11
Y-27035	80 ct	32 ct	8	.6	.2	.1	11.1	8.4	4	1	1.58:1	3.16:1	15.23
Y-27040	100 ct	40 ct	10	.6	.2	.1	10	10	4.5	1.13	1.58:1	3.16:1	15.23
Y-27045	100 ct	100 ct	25	.6	.2	.1	10	11	11.25	2.8	1:1	2:1	15.23
Y-27050	120 ct	12.8 ct	3.2	.6	.2	.1	9.1	14.4	1.8	.45	3.06:1	6.12:1	11.55
Y-27055	120 ct	60 ct	15	.6	.2	.1	9.1	14.4	8.4	2.1	1.41:1	2.83:1	15.23
Y-27060	120 ct	120 ct	30	.6	.2	.1	9.1	14.4	16.8	4.2	1:1	2:1	15.23
Y-27065	150 ct	12 ct	3	.6	.2	.1	8.2	15	1.5	.38	3.54:1	7.08:1	11.55
Y-27070	150 ct	50 ct	12.5	.6	.2	.1	8.2	15	6	1.5	1.73:1	3.46:1	12.83
Y-27075	150 ct	100 ct	25	.6	.2	.1	8.2	15	12	3	1.22:1	2.45:1	12.83
Y-27080	150 ct	150 ct	37.5	.6	.2	.1	8.2	15	18	4.5	1:1	2:1	15.13
Y-27085	150 ct	600 ct	150	.6	.2	.1	8.2	15	72	18	1:2	1:1	12.83
Y-27090	200 ct	200 ct	50	.6	.2	.1	7	22	24	6	1:1	2:1	12.83
Y-27095	300 ct	12 ct	3	.6	.2	.1	5.8	30	1.4	.35	5:1	10:1	11.55
Y-27100	300 ct	50 ct	12.5	.6	.2	.1	5.8	30	6	1.5	2.45:1	4.9:1	12.83
Y-27105	300 ct	150 ct	37.5	.6	.2	.1	5.8	30	18	4.5	1.41:1	2.83:1	12.83
Y-27110	300 ct	300 ct	75	.6	.2	.1	5.8	30	36	9	1:1	2:1	15.23
Y-27115	300 ct	600 ct	150	.6	.2	.1	5.8	30	72	18	1:1.41	1.41:1	12.11
Y-27120	320 ct	12.8 ct	3.2	.6	.2	.1	5.6	36	1.8	.45	5:1	10:1	11.55
Y-27125	400 ct	40 ct	10	.6	.2	.1	5	40	4.8	1.2	3.16:1	6.32:1	15.23
Y-27130	400 ct	120 ct	30	.6	.2	.1	5	40	14.5	3.6	1.83:1	3.65:1	15.23
Y-27135	400 ct	200 ct	50	.6	.2	.1	5	40	24	6	1.4:1	2.83:1	12.83
Y-27140	400 ct	400 ct	100	.6	.2	.1	5	40	48	12	1:1	2:1	15.23
Y-27145	400 ct	1000 ct	250	.6	.2	.1	5	40	125	31	1:1.58	1.26:1	17.48
Y-27150	400 ct	2000 ct	500	.6	.2	.1	5	40	240	60	1:2.24	1:1.12	17.48
Y-27155	400 ct	4000 ct	1000	.6	.2	.1	5	40	480	120	1:3.16	1:1.58	15.78
Y-27160	500 ct	12.8 ct	3.2	.6	.2	.1	4.5	50	1.5	.38	6.25:1	12.5:1	13.56
Y-27165	500 ct	16 ct	4	.6	.2	.1	4.5	50	1.9	.48	5.6:1	11.2:1	13.56
Y-27170	500 ct	50 ct	12.5	.6	.2	.1	4.5	50	6	1.5	3.16:1	6.32:1	13.56
Y-27175	500 ct	150 ct	37.5	.6	.2	.1	4.5	50	18	4.5	1.83:1	3.65:1	13.56
Y-27180	500 ct	500 ct	125	.6	.2	.1	4.5	50	60	15	1:1	2:1	13.56
Y-27185	*500 ct	500 ct	-	.6	.2	.1	4.5	50	60	-	1:1	-	13.56
Y-27190	500 ct	600 ct	150	.6	.2	.1	4.5	50	72	18	1:1.1	1.83:1	12.11
Y-27195	600 ct	12.8 ct	3.2	.6	.2	.1	4.1	60	1.5	.38	6.85:1	13.7:1	10.90
Y-27200	600 ct	30 ct	7.5	.6	.2	.1	4.1	60	3.6	.9	4.47:1	8.94:1	12.11
Y-27205	600 ct	48 ct	12	.6	.2	.1	4.1	60	5.8	1.45	3.54:1	7.07:1	12.11
Y-27210	600 ct	200 ct	50	.6	.2	.1	4.1	60	24	6	1.73:1	3.46:1	12.11
Y-27215**	600 ct	600 ct	150	.6	.2	.1	4.1	60	72	18	1:1	2:1	12.11
Y-27220**	*600 ct	600 ct	-	.6	.2	.1	4.1	60	72	-	1:1	-	12.11
Y-27225**	600 ct	1200 ct	300	.6	.2	.1	4.1	60	144	36	1:1.41	1.41:1	12.11
Y-27230	640 ct	12.8 ct	3.2	.6	.2	.1	3.9	64	1.5	.38	7.07:1	14.14:1	12.11
Y-27235	700 ct	100 ct	25	.6	.2	.1	3.8	70	12	3	2.65:1	5.29:1	12.11
Y-27240	800 ct	12.8 ct	3.2	.6	.2	.1	3.5	80	1.5	.38	7.9:1	15.8:1	12.11
Y-27245	800 ct	48 ct	12	.6	.2	.1	3.5	80	5.8	1.45	4.08:1	8.16:1	13.56
Y-27250	800 ct	800 ct	200	.6	.2	.1	3.5	80	96	24	1:1	2:1	13.56
Y-27255	900 ct	600 ct	150	.6	.2	.1	3.3	90	72	18	1.22:1	2.45:1	12.11
Y-27260	1000 ct	12 ct	3	.6	.2	.1	3.2	100	1.4	.35	9.13:1	18.3:1	12.11
Y-27265	1000 ct	50 ct	12.5	.6	.2	.1	3.2	100	6	1.5	4.47:1	8.94:1	13.56
Y-27270	1000 ct	1000 ct	250	.6	.2	.1	3.2	100	120	30	1:1	2:1	13.56
Y-27275	1060 ct	12.8 ct	3.2	.6	.2	.1	3.1	106	1.5	.38	9.1:1	18.2:1	12.11
Y-27280	1200 ct	12.8 ct	3.2	.6	.2	.1	2.9	120	1.5	.38	9.68:1	19.4:1	10.90
Y-27285	1200 ct	500 ct	125	.6	.2	.1	2.9	120	60	15	1.55:1	3.1:1	10.90
Y-27290	1200 ct	1200 ct	300	.6	.2	.1	2.9	120	144	36	1:1	2:1	10.90
Y-27295	*1200 ct	1200 ct	-	.6	.2	.1	2.9	120	144	-	1:1	-	12.11
Y-27300	1500 ct	12 ct	3	.6	.2	.1	2.6	150	1.44	.36	11.2:1	22.4:1	12.11
Y-27305	1500 ct	500 ct	125	.6	.2	.1	2.6	150	60	15	1.73:1	3.46:1	13.56
Y-27310	*1500 ct	600 ct	-	.6	.2	.1	2.6	150	72	-	1.58:1	-	17.48
Y-27315	*1500 ct	1500 ct	-	.6	.2	.1	2.6	150	180	-	1:1	-	13.56
Y-27320	1600 ct	12.8 ct	3.2	.6	.2	.1	2.5	160	1.5	.38	11.2:1	22.4:1	12.11
Y-27325	2000 ct	8 ct	2	.6	.2	.1	2.2	200	.96	.24	15.8:1	31.6:1	13.56
Y-27330	2000 ct	2000 ct	500	.6	.2	.1	2.2	200	240	60	1:1	2:1	15.78
Y-27335	*2000 ct	2000 ct	-	.6	.2	.1	2.2	200	240	-	1:1	-	17.48
Y-27340	2000 ct	8000 ct	2000	.6	.2	.1	2.2	200	960	240	1:2	1:1	15.78
Y-27345	2500 ct	2500 ct	625	.6	.2	.1	2	250	300	75	1:1	2:1	15.78
Y-27350	3000 ct	3000 ct	725	.6	.2	.1	1.8	300	360	90	1:1	2:1	12.70
Y-27355	*3000 ct	3000 ct	-	.6	.2	.1	1.8	300	360	-	1:1	-	17.48
Y-27360	3600 ct	3600 ct	900	.6	.2	.1	1.7	360	432	108	1:1	2:1	15.78
Y-27365	4000 ct	16 ct	4	.6	.2	.1	1.6	400	1.92	.48	15.8:1	31.6:1	15.78
Y-27370**	4000 ct	600 ct	150	.6	.2	.1	1.6	400	72	18	2.58:1	5.16:1	15.78
Y-27375	4000 ct	1000 ct	250	.6	.2	.1	1.6	400	120	30	2:1	4:1	15.78
Y-27380	*4000 ct	8000 ct	-	.6	.2	.1	1.6	400	960	-	1:1.41	-	15.78
Y-27385	5000 ct	500 ct	125	.5	.2	.1	1.4	500	60	15	3.16:1	6.32:1	12.70
Y-27390	5000 ct	5000 ct	1250	.5	.2	.1	1.4	500	600	150	1:1	2:1	12.70
Y-27395	7500 ct	50 ct	12.5	.33	.2	.1	1.2	750	6	1.5	12.2:1	24.5:1	12.70
Y-27400	7500 ct	100 ct	25	.33	.2	.1	1.2	750	12	3	8.66:1	17.3:1	13.56
Y-27405	7500 ct	600 ct	150	.33	.2	.1	1.2	750	72	18	3.54:1	7.07:1	14.89

***Discount Prices: 1-9 Net:
10-24 less 10%: 25-49 less 16%:
50-99 less 23%: 100-499 less 30%

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York
P.O. Box 1206

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

For More Information. Circle No. 506

PICO PART NUMBER Y Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 ***
		SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	Y-Series
Y-27410	7500 ct	2500 ct	625	.33	.2	.1	1.2	750	300	75	1.73:1	3.46:1	14.89
Y-27415	*7500 ct	7500 ct	-	.33	.2	.1	1.2	750	900	-	1:1	-	17.48
Y-27420	8000 ct	12.8 ct	3.2	.3	.2	.1	1.1	800	1.5	.38	25:1	50:1	12.70
Y-27425	8000 ct	1000 ct	250	.3	.2	.1	1.1	800	120	30	2.83:1	5.66:1	14.89
Y-27430	*8000 ct	1200 ct	-	.3	.2	.1	1.1	800	144	-	2.58:1	-	15.78
Y-27435	*9000 ct	9000 ct	-	.27	.2	.1	1.1	900	1080	-	1:1	-	16.42
Y-27440	10,000 ct	12.8 ct	3.2	.25	.2	.1	1.0	1000	1.5	.38	28:1	56:1	12.11
Y-27445	10,000 ct	16 ct	4	.25	.2	.1	1.0	1000	1.92	.48	25:1	50:1	13.37
Y-27450	10,000 ct	100 ct	25	.25	.2	.1	1.0	1000	12	3	10:1	20:1	13.37
Y-27455	10,000 ct	200 ct	50	.25	.2	.1	1.0	1000	24	6	7.07:1	14.14:1	13.37
Y-27460	10,000 ct	500 ct	125	.25	.2	.1	1.0	1000	60	15	4.47:1	8.94:1	13.37
Y-27465	10,000 ct	600 ct	150	.25	.2	.1	1.0	1000	72	18	4.08:1	8.16:1	13.37
Y-27470	10,000 ct	1000 ct	250	.25	.2	.1	1.0	1000	120	30	3.16:1	6.32:1	13.37
Y-27475	10,000 ct	1200 ct	300	.25	.2	.1	1.0	1000	144	36	2.89:1	5.77:1	13.37
Y-27480	10,000 ct	1500 ct	375	.25	.2	.1	1.0	1000	180	45	2.58:1	5.16:1	14.58
Y-27485	10,000 ct	2000 ct	500	.25	.2	.1	1.0	1000	240	60	2.24:1	4.47:1	14.58
Y-27490	10,000 ct	5000 ct	1250	.25	.2	.1	1.0	1000	600	150	1.41:1	2.83:1	15.61
Y-27495	10,000 ct	7500 ct	1875	.25	.2	.1	1.0	1000	900	225	1.15:1	2.3:1	15.61
Y-27500	10,000 ct	10,000 ct	2500	.25	.2	.1	1.0	1000	1200	300	1:1	2:1	15.23
Y-27505	*10,000 ct	10,000 ct	-	.25	.2	.1	1.0	1000	1200	-	1:1	-	16.98
Y-27510	15,000 ct	400 ct	100	.16	.16	.1	.82	1500	48	12	6.12:1	12.24:1	15.23
Y-27515	15,000 ct	500 ct	125	.16	.16	.1	.82	1500	60	15	5.48:1	10.95:1	15.23
Y-27520	15,000 ct	600 ct	150	.16	.16	.1	.82	1500	72	18	5:1	10:1	15.23
Y-27525	15,000 ct	10,000 ct	2500	.16	.16	.1	.82	1500	1200	300	1.22:1	2.45:1	16.98
Y-27530	*15,000 ct	15,000 ct	-	.16	.16	.1	.82	1500	1800	-	1:1	-	16.98
Y-27535	15,000 ct	15,000 ct	3750	.16	.16	.1	.82	1500	1800	450	1:1	2:1	16.98
Y-27540	16,000 ct	1000 ct	250	.15	.15	.1	.8	1600	120	30	4:1	8:1	15.78
Y-27545	20,000 ct	500 ct	125	.125	.125	.1	.7	2000	60	15	6.33:1	12.65:1	15.23
Y-27550	20,000 ct	600 ct	150	.125	.125	.1	.7	2000	72	18	5.77:1	11.55:1	15.23
Y-27555	20,000 ct	800 ct	200	.125	.125	.1	.7	2000	96	24	5:1	10:1	12.11
Y-27560	20,000 ct	1000 ct	250	.125	.125	.1	.7	2000	120	30	4.47:1	8.94:1	15.23
Y-27565	20,000 ct	5000 ct	1250	.125	.125	.1	.7	2000	600	150	2:1	4:1	15.23
Y-27570	20,000 ct	10,000 ct	2500	.125	.125	.1	.7	2000	1200	300	1.41:1	2.83:1	15.23
Y-27575	*20,000 ct	20,000 ct	-	.125	.125	.1	.7	2000	2400	-	1:1	-	15.23
Y-27580	25,000 ct	500 ct	125	.1	.1	.1	.63	2500	60	15	7.07:1	14.14:1	15.23
Y-27585	25,000 ct	1000 ct	250	.1	.1	.1	.63	2500	120	30	5:1	10:1	15.23
Y-27590	30,000 ct	50 ct	12.5	.08	.08	.08	.58	3000	6	1.5	24.5:1	49:1	15.23
Y-27595	30,000 ct	1200 ct	300	.08	.08	.08	.58	3000	144	36	5:1	10:1	15.23
Y-27600	30,000 ct	500 ct	125	.08	.08	.08	.58	3000	60	15	7.75:1	15.5:1	15.23
Y-27605	30,000 ct	200 ct	50	.08	.08	.08	.58	3000	24	6	12.25:1	24.5:1	15.23
Y-27610	30,000 ct	5000 ct	1250	.08	.08	.08	.58	3000	600	150	2.45:1	4.9:1	16.98
Y-27615	30,000 ct	10,000 ct	2500	.08	.08	.08	.58	3000	1200	300	1.73:1	3.46:1	16.98
Y-27620	*30,000 ct	30,000 ct	-	.08	.08	.08	.58	3000	3600	-	1:1	-	16.98
Y-27625	40,000 ct	400 ct	100	.06	.06	.06	.5	4000	48	12	10:1	20:1	16.98
Y-27630	40,000 ct	2,000 ct	500	.06	.06	.06	.5	4000	240	60	4.47:1	8.94:1	16.98
Y-27635	40,000 ct	4,000 ct	1000	.06	.06	.06	.5	4000	480	120	3.16:1	6.32:1	17.62
Y-27640	40,000 ct	20,000 ct	5000	.06	.06	.06	.5	4000	2400	600	1.41:1	2.83:1	16.98
Y-27645	*40,000 ct	40,000 ct	-	.06	.06	.06	.5	4000	4800	-	1:1	-	16.98
Y-27650	50,000 ct	200 ct	50	.05	.05	.05	.45	5000	24	6	15.8:1	31.6:1	18.56
Y-27655	50,000 ct	500 ct	125	.05	.05	.05	.45	5000	60	15	10:1	20:1	18.56
Y-27660	50,000 ct	600 ct	150	.05	.05	.05	.45	5000	72	18	9.13:1	18.26:1	18.56
Y-27665	60,000 ct	15,000 ct	3750	.04	.04	.04	.41	6000	1800	450	2:1	4:1	18.56
Y-27670	62,500 ct	50 ct	12.5	.04	.04	.04	.4	6250	6	1.5	35.4:1	70.7:1	18.56
Y-27675	80,000 ct	15,000 ct	3750	.03	.03	.03	.35	8000	1800	450	2.3:1	4.6:1	18.56
Y-27680	90,000 ct	10,000 ct	2500	.028	.028	.028	.33	9000	1200	300	3:1	6:1	18.56
Y-27685	95,000 ct	15,000 ct	3750	.026	.026	.026	.32	9500	1800	450	2.52:1	5.03:1	18.56
Y-27690	100,000 ct	60 ct	15	.025	.025	.025	.31	10,000	7.2	1.8	40.8:1	81.6:1	19.49
Y-27695	100,000 ct	100 ct	25	.025	.025	.025	.31	10,000	12	3	31.6:1	63.2:1	19.49
Y-27700	100,000 ct	500 ct	125	.025	.025	.025	.31	10,000	60	15	14.1:1	28.3:1	19.49
Y-27705	100,000 ct	10,000 ct	2500	.025	.025	.025	.31	10,000	1200	300	3.16:1	6.32:1	19.49
Y-SHIELD	MU-METAL SHIELD .37" DIA. X .46" HT. (9.4MM DIA. X 11.7MM HT.) SINGLE SHIELD												1.79
YXX-SHIELD	MU-METAL SHIELD .395" DIA. X .47" HT. (10.1MM DIA. X 11.9"MM HT.) USE WITH Y-SHIELD FOR DOUBLE SHIELDING												1.79

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%: 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

* INCLUDES ELECTROSTATIC SHIELD

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS.

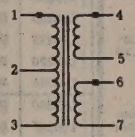
TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR.

Y-Series Plug-In		INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9***
Y-27750	SERIES	.075 .06	10 30	10.5	11.56
	PARALLEL	.018 .015	20 60	2.6	
Y-27760	SERIES	.3 .15	4 20	25	12.84
	PARALLEL	.075 .04	8 40	6.2	
Y-27770	SERIES	3.5 1.0	2 5	560	12.84
	PARALLEL	0.9 0.25	4 10	140	
Y-27780	SERIES	6.0 1.5	2 5	2100	12.84
	PARALLEL	1.5 0.38	4 10	525	
Y-27790	SERIES	20 8	1 3	5100	15.78
	PARALLEL	5 2	2 6	1275	

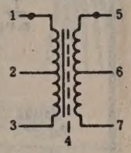
PICO's ultra-miniature transformers

Y SERIES Plug-In

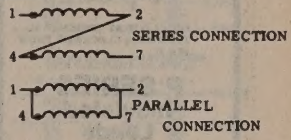
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

This Product is Patented

Delivery—
stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

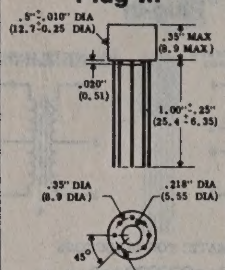
phone
914-699-5514

For Immediate Action please use return card, Vol. 4, or call 800-431-1064

For More Information. Circle No. 506

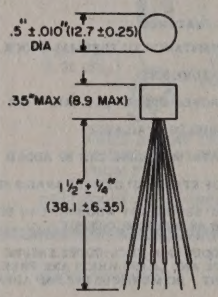
PICO's ultra-miniature transformers

L SERIES
Plug-In



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

P SERIES
Insulated Leads



Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27** . . . .
All Units Meet MIL-T-27 and are Hermetically Sealed in a Metal Case. Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . . .
±3db, 300 Hz - 75 KHz At 1.0 Milliwatt
- **MAXIMUM DISTORTION:** . . . . .
5% With Rated Power Level at 1 KHz, 400 Hz and 300 Hz
- **DIELECTRIC STRENGTH:** . . . .
All Units Tested at 200 V RMS
- **INSULATION RESISTANCE:** . . .
Greater than 10,000 Megohms at 300 V DC
- **WEIGHT:** . . . .
5 Grams
- **OPERATING TEMPERATURE:** . .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS:** . . . .
Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 ***	
L-Series Plug-in	P-Series Insulated Leads		SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	L-Series	P-Series
L-8203	P-9203	20 ct	8 ct	2	.6	.4	.3	30.0	2	1.2	.3	1.58:1	3.16:1	14.38	13.89
L-8205	P-9205	20 ct	20 ct	5	.6	.4	.3	30.0	2	2.8	.7	1:1	2:1	14.38	13.89
L-8210	P-9210	32 ct	32 ct	8	.6	.4	.3	23.0	3.3	4.5	1.13	1:1	2:1	14.38	13.89
L-8215	P-9215	40 ct	40 ct	10	.6	.4	.3	21.0	3.7	5	1.25	1:1	2:1	14.38	13.89
L-8218	P-9218	48 ct	16 ct	4	.6	.4	.3	19.0	3.75	3	.75	1.73:1	3.46:1	14.38	13.89
L-8220	P-9220	50 ct	50 ct	12.5	.6	.4	.3	19.0	5	7	1.75	1:1	2:1	14.38	13.89
L-8225	P-9225	80 ct	32 ct	8	.6	.4	.3	15.0	7.5	4.3	1.13	1.58:1	3.16:1	14.38	13.89
L-8228	P-9228	100 ct	40 ct	10	.6	.4	.3	13.0	10.8	5	1.25	1.58:1	3.16:1	14.38	13.89
L-8230	P-9230	100 ct	100 ct	25	.6	.4	.3	13.0	10.8	12	3	1:1	2:1	14.38	13.89
L-8235	P-9235	120 ct	12.8 ct	3.2	.6	.4	.3	12.0	9.3	2.2	.55	3.06:1	6.12:1	14.38	13.89
L-8240	P-9240	120 ct	60 ct	15	.6	.4	.3	12.0	9	7.2	1.8	1.41:1	2.83:1	14.38	13.89
L-8245	P-9245	120 ct	120 ct	30	.6	.4	.3	12.0	11.6	13	3.3	1:1	2:1	14.38	13.89
L-8250	P-9250	150 ct	12 ct	3	.6	.4	.3	11.0	11.2	2.2	.55	3.54:1	7.08:1	14.38	13.89
L-8255	P-9255	150 ct	50 ct	12.5	.6	.4	.3	11.0	13	6.8	1.7	1.73:1	3.46:1	14.38	13.89
L-8260	P-9260	150 ct	100 ct	25	.6	.4	.3	11.0	13	11.8	3	1.22:1	2.45:1	14.38	13.89
L-8265	P-9265	150 ct	150 ct	37.5	.6	.4	.3	11.0	13	18.3	4.6	1:1	2:1	14.38	13.89
L-8270	P-9270	150 ct	600 ct	150	.6	.4	.3	11.0	13	75	19	1:2	1:1	14.38	13.89
L-8275	P-9275	200 ct	200 ct	50	.6	.4	.3	10.0	19	21.3	5.4	1:1	2:1	14.38	13.89
L-8280	P-9280	300 ct	12 ct	3	.6	.4	.3	8.0	24	1.7	.43	5:1	10:1	14.38	13.89
L-8285	P-9285	300 ct	50 ct	12.5	.6	.4	.3	8.0	30	6.8	1.7	2.45:1	4.9:1	14.38	13.89
L-8290	P-9290	300 ct	150 ct	37.5	.6	.4	.3	8.0	30	18	4.6	1.41:1	2.83:1	14.38	13.89
L-8295	P-9295	300 ct	300 ct	75	.6	.4	.3	8.0	30	34	8.5	1:1	2:1	14.38	13.89
L-8300	P-9300	300 ct	600 ct	150	.6	.4	.3	8.0	30	60	15	1:1.41	1.41:1	14.38	13.89
L-8305	P-9305	320 ct	12.8 ct	3.2	.6	.4	.3	7.5	31	1.7	.43	5:1	10:1	14.38	13.89
L-8310	P-9310	400 ct	40 ct	10	.6	.4	.3	7.0	41	4.5	1.13	3.16:1	6.32:1	14.38	13.89
L-8315	P-9315	400 ct	120 ct	30	.6	.4	.3	7.0	41	12	3	1.83:1	3.65:1	14.38	13.89
L-8320	P-9320	400 ct	200 ct	50	.6	.4	.3	7.0	41	21.3	5.4	1.41:1	2.83:1	14.38	13.89
L-8325	P-9325	400 ct	400 ct	100	.6	.4	.3	7.0	41	37.5	9.4	1:1	2:1	14.38	13.89
L-8330	P-9330	400 ct	1000 ct	250	.6	.4	.3	7.0	41	96	24	1:1.58	1.26:1	14.38	13.89
L-8335	P-9335	400 ct	2000 ct	500	.6	.4	.3	7.0	41	212	53	1:2.24	1:1.12	14.38	13.89
L-8340	P-9340	400 ct	4000 ct	1000	.6	.4	.3	7.0	41	375	94	1:3.16	1:1.58	14.38	13.89
L-8342	P-9342	500 ct	12.8 ct	3.2	.6	.4	.3	6.0	48	1.7	.43	6.25:1	12.5:1	14.38	13.89
L-8344	P-9344	500 ct	16 ct	4	.6	.4	.3	6.0	48	1.9	.5	5.6:1	11.2:1	14.38	13.89
L-8345	P-9345	500 ct	50 ct	12.5	.6	.4	.3	6.0	39	6.8	1.7	3.16:1	6.32:1	14.38	13.89
L-8347	P-9347	500 ct	150 ct	37.5	.6	.4	.3	6.0	48	18	4.6	1.83:1	3.65:1	14.38	13.89
L-8350	P-9350	500 ct	500 ct	125	.6	.4	.3	6.0	48	54	13.5	1:1	2:1	14.38	13.89
L-8355	P-9355	*500 ct	500 ct	-	.6	.4	.3	6.0	48	68	-	1:1	-	14.98	14.38
L-8360	P-9360	500 ct	600 ct	150	.6	.4	.3	6.0	48	59	15	1:1.1	1.83:1	14.38	14.38
L-8365	P-9365	600 ct	12.8 ct	3.2	.6	.4	.3	5.5	53	1.7	.43	6.85:1	13.7:1	14.38	14.38
L-8367	P-9367	600 ct	30 ct	7.5	.6	.4	.3	5.5	53	4.2	1.1	4.47:1	8.94:1	14.38	14.38
L-8370	P-9370	600 ct	48 ct	12	.6	.4	.3	5.5	53	6.8	1.7	3.54:1	7.07:1	14.38	14.38
L-8375	P-9375	600 ct	200 ct	50	.6	.4	.3	5.5	53	21.3	5.3	1.73:1	3.46:1	14.38	13.89
L-8380**	P-9380	600 ct	600 ct	150	.6	.4	.3	5.5	57	79	20	1:1	2:1	14.38	13.89
L-8385**	P-9385	*600 ct	600 ct	-	.6	.4	.3	5.5	53	75	-	1:1	-	14.98	14.38
L-8387**	P-9387	600 ct	1200 ct	300	.6	.4	.3	5.5	53	105	26	1:1.41	1.41:1	14.38	13.89
L-8390	P-9390	640 ct	12.8 ct	3.2	.6	.4	.3	5.5	66	1.7	.43	7.07:1	14.14:1	14.38	13.89
L-8395	P-9395	700 ct	100 ct	25	.6	.4	.3	5.0	69	12	3	2.65:1	5.29:1	14.38	13.89
L-8400	P-9400	800 ct	12.8 ct	3.2	.6	.4	.3	5.0	75	1.7	.43	7.9:1	15.8:1	14.38	13.89
L-8405	P-9405	800 ct	48 ct	12	.6	.4	.3	5.0	75	6.8	1.7	4.08:1	8.16:1	14.38	13.89
L-8410	P-9410	800 ct	800 ct	200	.6	.4	.3	5.0	75	105	26	1:1	2:1	14.38	13.89
L-8415	P-9415	900 ct	600 ct	150	.6	.4	.3	4.5	79	75	19	1.22:1	2.45:1	14.38	13.89
L-8420	P-9420	1000 ct	12 ct	3	.6	.4	.3	4.5	103	1.6	.4	9.13:1	18.3:1	14.38	13.89
L-8425	P-9425	1000 ct	50 ct	12.5	.6	.4	.3	4.5	103	6.4	1.6	4.47:1	8.94:1	14.38	13.89
L-8430	P-9430	1000 ct	1000 ct	250	.6	.4	.3	4.5	103	115	29	1:1	2:1	14.38	13.89
L-8435	P-9435	1060 ct	12.8 ct	3.2	.6	.4	.3	4.0	108	1.7	.43	9.1:1	18.2:1	14.38	13.89
L-8440	P-9440	1200 ct	12.8 ct	3.2	.6	.4	.3	4.0	113	1.7	.43	9.68:1	19.4:1	14.38	13.89
L-8445	P-9445	1200 ct	500 ct	125	.6	.4	.3	4.0	113	54	13.5	1.55:1	3.1:1	14.38	13.89
L-8450	P-9450	1200 ct	1200 ct	300	.6	.4	.3	4.0	113	126	31.6	1:1	2:1	14.38	13.89
L-8455	P-9455	*1200 ct	1200 ct	-	.6	.4	.3	4.0	111	125	-	1:1	-	14.98	14.38
L-8460	P-9460	1500 ct	12 ct	3	.6	.4	.3	3.5	126	1.6	.4	11.2:1	22.4:1	14.38	13.89
L-8465	P-9465	1500 ct	500 ct	125	.6	.4	.3	3.5	126	68	17	1.73:1	3.46:1	14.38	13.89
L-8470	P-9470	*1500 ct	600 ct	-	.6	.4	.3	3.5	126	94	-	1.58:1	-	14.98	14.38
L-8475	P-9475	*1500 ct	1500 ct	-	.6	.4	.3	3.5	126	176	-	1:1	-	14.98	14.38
L-8480	P-9480	1600 ct	12.8 ct	3.2	.6	.4	.3	3.5	130	1.7	.43	11.2:1	22.4:1	14.38	13.89
L-8483	P-9483	2000 ct	8 ct	2	.6	.4	.3	3.0	210	1.2	.3	15.8:1	31.6:1	14.38	13.89
L-8485	P-9485	2000 ct	2000 ct	500	.6	.4	.3	3.0	198	218	55	1:1	2:1	14.38	13.89
L-8490	P-9490	*2000 ct	2000 ct	-	.6	.4	.3	3.0	198	218	-	1:1	-	14.38	13.89
L-8495	P-9495	2000 ct	8000 ct	2000	.6	.4	.3	3.0	198	850	213	1:2	1:1	14.38	13.89
L-8497	P-9497	2500 ct	2500 ct	625	.6	.4	.3	2.5	220	305	76	1:1	2:1	14.38	13.89
L-8500	P-9500	3000 ct	3000 ct	750	.6	.4	.3	2.5	243	335	84	1:1	2:1	14.38	13.89

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
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**MINIATURIZED TELEPHONE COUPLING APPLICATION

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stock to one week

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PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 ***	
L-Series Plug-in	P-Series Insulated Leads		SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	L-Series	P-Series
L-8505	P-9505	*3000 ct	3000 ct	-	.6	.4	.3	2.5	304	335	-	1:1	-	14.98	14.38
L-8510	P-9510	3600 ct	3600 ct	900	.6	.4	.3	2.5	330	366	92	1:1	2:1	14.38	13.89
L-8512	P-9512	4000 ct	16 ct	4	.6	.4	.3	2.0	350	3	.75	15.8:1	31.6:1	14.38	13.89
L-8514	P-9514	4000 ct	600 ct	150	.6	.4	.3	2.0	350	76	19	2.58:1	5.16:1	14.38	13.89
L-8515	P-9515	4000 ct	1000 ct	250	.6	.4	.3	2.0	350	115	29	2:1	4:1	14.38	13.89
L-8520	P-9520	*4000 ct	8000 ct	-	.6	.4	.3	2.0	350	1062	-	1:1.41	-	14.98	14.38
L-8525	P-9525	5000 ct	500 ct	125	.6	.4	.3	2.0	350	67	17	3.16:1	6.32:1	14.38	13.89
L-8530	P-9530	5000 ct	5000 ct	1250	.6	.4	.3	2.0	390	538	135	1:1	2:1	14.38	13.89
L-8535	P-9535	7500 ct	50 ct	12.5	.6	.4	.3	1.5	600	7	1.75	12.2:1	24.5:1	15.96	15.49
L-8540	P-9540	7500 ct	100 ct	25	.6	.4	.3	1.5	600	12	3	8.66:1	17.3:1	15.96	15.49
L-8545	P-9545	7500 ct	600 ct	150	.6	.4	.3	1.5	600	78	19.5	3.54:1	7.07:1	15.96	15.49
L-8550	P-9550	7500 ct	2500 ct	625	.6	.4	.3	1.5	600	305	77	1.73:1	3.46:1	15.96	15.49
L-8555	P-9555	*7500 ct	7500 ct	-	.6	.4	.3	1.5	750	828	-	1:1	-	17.09	15.95
L-8560	P-9560	8000 ct	12.8 ct	3.2	.6	.4	.3	1.5	750	1.7	.43	25:1	50:1	15.96	15.49
L-8565	P-9565	8000 ct	1000 ct	250	.6	.4	.3	1.5	750	115	29	2.83:1	5.66:1	15.96	15.49
L-8570	P-9570	*8000 ct	1200 ct	-	.6	.4	.3	1.5	750	158	-	2.58:1	-	17.09	15.95
L-8575	P-9575	*9000 ct	9000 ct	-	.6	.4	.3	1.4	796	1100	-	1:1	-	17.09	15.95
L-8580	P-9580	10,000 ct	12.8 ct	3.2	.6	.4	.3	1.4	1048	1.7	.43	28:1	56:1	15.96	15.49
L-8585	P-9585	10,000 ct	16 ct	4	.6	.4	.3	1.4	1048	3	.75	25:1	50:1	15.96	15.49
L-8590	P-9590	10,000 ct	100 ct	25	.6	.4	.3	1.4	839	12	3	10:1	20:1	15.96	15.49
L-8595	P-9595	10,000 ct	200 ct	50	.6	.4	.3	1.4	839	27	6.7	7.07:1	14.14:1	15.96	15.49
L-8600	P-9600	10,000 ct	500 ct	125	.6	.4	.3	1.4	850	67	17	4.47:1	8.94:1	15.96	15.49
L-8605	P-9605	10,000 ct	600 ct	150	.6	.4	.3	1.4	850	74	18.5	4.08:1	8.16:1	15.96	15.49
L-8610	P-9610	10,000 ct	1000 ct	250	.6	.4	.3	1.4	850	115	29	3.16:1	6.32:1	15.96	15.49
L-8615	P-9615	10,000 ct	1200 ct	300	.6	.4	.3	1.4	850	158	39.5	2.89:1	5.77:1	15.96	15.49
L-8620	P-9620	10,000 ct	1500 ct	375	.6	.4	.3	1.4	850	177	44	2.58:1	5.16:1	15.96	15.49
L-8625	P-9625	10,000 ct	2000 ct	500	.6	.4	.3	1.4	850	255	64	2.24:1	4.47:1	15.96	15.49
L-8630	P-9630	10,000 ct	5000 ct	1250	.6	.4	.3	1.4	850	630	158	1.41:1	2.83:1	15.96	15.49
L-8635	P-9635	10,000 ct	7500 ct	1875	.6	.4	.3	1.4	850	772	193	1.15:1	2.3:1	15.96	15.49
L-8640	P-9640	10,000 ct	10,000 ct	2500	.6	.4	.3	1.4	866	1215	304	1:1	2:1	15.96	15.49
L-8645	P-9645	*10,000 ct	10,000 ct	-	.6	.4	.3	1.4	1060	1215	-	1:1	-	17.09	15.95
L-8650	P-9650	15,000 ct	400 ct	100	.6	.4	.3	1.0	1305	47	12	6.12:1	12.24:1	15.96	15.49
L-8652	P-9652	15,000 ct	500 ct	125	.6	.4	.3	1.0	1305	53	13	5.48:1	10.95:1	15.96	15.49
L-8655	P-9655	15,000 ct	600 ct	150	.6	.4	.3	1.0	1305	72.5	18	5:1	10:1	15.96	15.49
L-8660	P-9660	15,000 ct	10,000 ct	2500	.6	.4	.3	1.0	1305	1215	304	1.22:1	2.45:1	15.96	15.49
L-8665	P-9665	*15,000 ct	15,000 ct	-	.6	.4	.3	1.0	1305	1800	-	1:1	-	17.09	15.95
L-8670	P-9670	15,000 ct	15,000 ct	3750	.6	.4	.3	1.0	1305	1800	450	1:1	2:1	15.96	15.49
L-8675	P-9675	16,000 ct	1000 ct	250	.6	.4	.3	1.0	1343	115	29	4:1	8:1	15.96	15.49
L-8680	P-9680	20,000 ct	500 ct	125	.5	.4	.3	1.0	1560	68	17	6.33:1	12.65:1	17.09	15.95
L-8685	P-9685	20,000 ct	600 ct	150	.5	.4	.3	1.0	1560	75	19	5.77:1	11.55:1	17.09	15.95
L-8690	P-9690	20,000 ct	800 ct	200	.5	.4	.3	1.0	1560	108	27	5:1	10:1	17.09	15.95
L-8695	P-9695	20,000 ct	1000 ct	250	.5	.4	.3	1.0	1560	121	30.5	4.47:1	8.94:1	17.09	15.95
L-8700	P-9700	20,000 ct	5000 ct	1250	.5	.4	.3	1.0	1560	672	168	2:1	4:1	17.09	15.95
L-8705	P-9705	20,000 ct	10,000 ct	2500	.5	.4	.3	1.0	1560	1520	380	1.41:1	2.83:1	17.09	15.95
L-8710	P-9710	*20,000 ct	20,000 ct	-	.5	.4	.3	1.0	1560	2727	682	1:1	-	17.76	17.09
L-8715	P-9715	25,000 ct	500 ct	125	.4	.4	.3	0.8	2170	68	17	7.07:1	14.14:1	17.09	15.95
L-8720	P-9720	25,000 ct	1000 ct	250	.4	.4	.3	0.8	2170	120	30	5:1	10:1	17.09	15.95
L-8725	P-9725	30,000 ct	50 ct	12.5	.33	.33	.3	0.8	2400	7	1.75	24.5:1	49:1	17.76	17.09
L-8730	P-9730	30,000 ct	1200 ct	300	.33	.33	.3	0.8	2400	156	39	5:1	10:1	17.76	17.09
L-8732	P-9732	30,000 ct	500 ct	125	.33	.33	.3	0.8	2400	68	17	7.75:1	15.5:1	17.76	17.09
L-8734	P-9734	30,000 ct	200 ct	50	.33	.33	.3	0.8	2400	29	7.2	12.25:1	24.5:1	17.76	17.09
L-8735	P-9735	30,000 ct	5000 ct	1250	.33	.33	.3	0.8	2400	673	169	2.45:1	4.9:1	17.76	17.09
L-8740	P-9740	30,000 ct	10,000 ct	2500	.33	.33	.3	0.8	2400	1520	380	1.73:1	3.46:1	17.76	17.09
L-8745	P-9745	*30,000 ct	30,000 ct	-	.33	.33	.3	0.8	3000	3310	-	1:1	-	19.08	17.94
L-8750	P-9750	40,000 ct	400 ct	100	.25	.25	.25	0.7	3400	57	14.3	10:1	20:1	19.08	17.94
L-8755	P-9755	40,000 ct	2000 ct	500	.25	.25	.25	0.7	3400	268	67	4.47:1	8.94:1	19.08	17.94
L-8760	P-9760	40,000 ct	4000 ct	1000	.25	.25	.25	0.7	3400	476	119	3.16:1	6.32:1	19.08	17.94
L-8765	P-9765	40,000 ct	20,000 ct	5000	.25	.25	.25	0.7	3400	2700	675	1.41:1	2.83:1	19.08	17.94
L-8770	P-9770	*40,000 ct	40,000 ct	-	.25	.25	.25	0.7	3400	4750	-	1:1	-	21.27	20.34
L-8775	P-9775	50,000 ct	200 ct	50	.2	.2	.2	0.6	4850	27	6.7	15.8:1	31.6:1	21.27	20.34
L-8777	P-9777	50,000 ct	500 ct	125	.2	.2	.2	0.6	4850	68	17	10:1	20:1	21.27	20.34
L-8779	P-9779	50,000 ct	600 ct	150	.2	.2	.2	0.6	4850	75	18.5	9.13:1	18.26:1	21.27	20.34
L-8780	P-9780	60,000 ct	15,000 ct	3750	.16	.16	.16	0.5	5275	2250	563	2:1	4:1	22.94	22.37
L-8785	P-9785	62,500 ct	50 ct	12.5	.16	.16	.16	0.5	5445	8.7	2.2	35.4:1	70.7:1	22.94	22.37
L-8787	P-9787	80,000 ct	15,000 ct	3750	.12	.12	.12	0.4	6130	2250	563	2.3:1	4.6:1	22.94	22.37
L-8790	P-9790	90,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8140	1520	380	3:1	6:1	24.09	23.22
L-8795	P-9795	95,000 ct	15,000 ct	3750	.1	.1	.1	0.4	8400	2250	563	2.52:1	5.03:1	24.09	23.22
L-8800	P-9800	100,000 ct	60 ct	15	.1	.1	.1	0.4	8750	9.2	2.3	40.8:1	81.6:1	24.09	23.22
L-8805	P-9805	100,000 ct	100 ct	25	.1	.1	.1	0.4	8750	15	3.8	31.6:1	63.2:1	24.09	23.22
L-8810	P-9810	100,000 ct	500 ct	125	.1	.1	.1	0.4	8750	68	17	14.1:1	28.3:1	24.09	23.22
L-8815	P-9815	100,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8750	1535	385	3.16:1	6.32:1	24.09	23.22
L-SHIELD	MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)													1.80	
P-SHIELD	MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)														1.79

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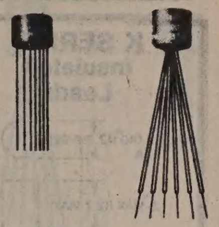
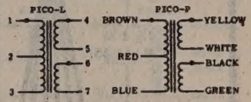
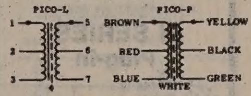
L SERIES Plug-In
P SERIES Insulated Leads



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

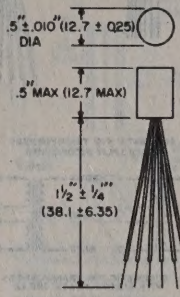
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

phone
914-699-5514

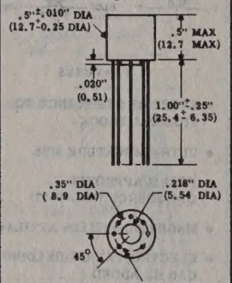
For Immediate Action please use return card, Vol. 4, or call 800-431-1064

PICO's ultra-miniature transformers

K SERIES
Insulated Leads



N SERIES
Plug-In



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27** . . . .
All Units Meet MIL-T-27, and Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . .
±3 db, 150 Hz - 75 KHz at 1.0 Milliwatt (When Primary Impedance ≥ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- **MAXIMUM DISTORTION:** . . . .
5% With Rated Power Level at 1 KHz, 400 Hz and 150 Hz
- **DIELECTRIC STRENGTH:** . . . .
All Units Tested at 200 V RMS
- **INSULATION RESISTANCE:** . . .
Greater Than 10,000 Megohms at 300 V DC
- **WEIGHT:** . . . .
7.5 Grams
- **OPERATING TEMPERATURE:** . .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS:** . . . .
Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

Delivery:
Stock to one week

This Product is Patented

PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 * * *	
K-Series Insulated Leads	N-Series Plug-in		SER	PAR	1KHz and higher	400 Hz and higher	150 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7203	N-6203	20 ct	8 ct	2	1.0	.75	.11	22.0	1.75	1.0	.25	1.58:1	3.16:1	13.89	14.39
K-7205	N-6205	20 ct	20 ct	5	1.0	.75	.11	22.0	1.75	2.5	.63	1:1	2:1	13.89	14.39
K-7210	N-6210	32 ct	32 ct	8	1.0	.75	.11	18.0	2.7	3.7	.93	1:1	2:1	13.89	14.39
K-7215	N-6215	40 ct	40 ct	10	1.0	.75	.11	16.0	3	5.2	1.3	1:1	2:1	13.89	14.39
K-7218	N-6218	48 ct	16 ct	4	1.0	.75	.11	13.0	4.5	2.4	.6	1.73:1	3.46:1	13.89	14.39
K-7220	N-6220	50 ct	50 ct	12.5	1.0	.75	.11	13.0	4.5	6.2	1.6	1:1	2:1	13.89	14.39
K-7225	N-6225	80 ct	32 ct	8	1.0	.75	.11	11.0	6.6	3.7	.93	1.58:1	3.16:1	13.89	14.39
K-7228	N-6228	100 ct	40 ct	10	1.0	.75	.11	10.0	9.7	5.6	1.4	1.58:1	3.16:1	13.89	14.39
K-7230	N-6230	100 ct	100 ct	25	1.0	.75	.11	10.0	9.7	11	2.8	1:1	2:1	13.89	14.39
K-7235	N-6235	120 ct	12.8 ct	3.2	1.0	.75	.11	9.0	10.8	1.6	.4	3.06:1	6.12:1	13.89	14.39
K-7240	N-6240	120 ct	60 ct	15	1.0	.75	.11	9.0	10.8	8.5	2.2	1.41:1	2.83:1	13.89	14.39
K-7245	N-6245	120 ct	120 ct	30	1.0	.75	.11	9.0	10.8	15	3.8	1:1	2:1	13.89	14.39
K-7250	N-6250	150 ct	12 ct	3	1.0	.75	.11	8.0	13.5	1.75	.44	3.54:1	7.08:1	13.89	14.39
K-7255	N-6255	150 ct	50 ct	12.5	1.0	.75	.11	8.0	12	5.8	1.5	1.73:1	3.46:1	13.89	14.39
K-7260	N-6260	150 ct	100 ct	25	1.0	.75	.11	8.0	12	13	3.3	1.22:1	2.44:1	13.89	14.39
K-7265	N-6265	150 ct	150 ct	37.5	1.0	.75	.11	8.0	12	20	5	1:1	2:1	13.89	14.39
K-7270	N-6270	150 ct	600 ct	150	1.0	.75	.11	8.0	12	82	20.5	1:2	1:1	13.89	14.39
K-7275	N-6275	200 ct	200 ct	50	1.0	.75	.11	7.0	17	24	6.0	1:1	2:1	13.89	14.39
K-7280	N-6280	300 ct	12 ct	3	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	13.89	14.39
K-7285	N-6285	300 ct	50 ct	12.5	1.0	.75	.11	5.0	27	6.2	1.6	2.45:1	4.9:1	13.89	14.39
K-7290	N-6290	300 ct	150 ct	37.5	1.0	.75	.11	5.0	26	21	5.3	1.41:1	2.83:1	13.89	14.39
K-7295	N-6295	300 ct	300 ct	75	1.0	.75	.11	5.0	27	38	9.5	1:1	2:1	13.89	14.39
K-7300	N-6300	300 ct	600 ct	150	1.0	.75	.11	5.0	27	66	17	1:1.41	1.41:1	13.89	14.39
K-7305	N-6305	320 ct	12.8 ct	3.2	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	13.89	14.39
K-7310	N-6310	400 ct	40 ct	10	1.0	.75	.11	5.0	39	4.3	1.1	3.16:1	6.32:1	13.89	14.39
K-7315	N-6315	400 ct	120 ct	30	1.0	.75	.11	5.0	30	14	3.5	1:83:1	3.65:1	13.89	14.39
K-7320	N-6320	400 ct	200 ct	50	1.0	.75	.11	5.0	39	24	6	1.41:1	2.83:1	13.89	14.39
K-7325	N-6325	400 ct	400 ct	100	1.0	.75	.11	5.0	39	42	10.5	1:1	2:1	13.89	14.39
K-7330	N-6330	400 ct	1000 ct	250	1.0	.75	.11	5.0	39	109	28	1:1.58	1.26:1	13.89	14.39
K-7335	N-6335	400 ct	2000 ct	500	1.0	.75	.11	5.0	39	198	49	1:2.24	1:1.12	13.89	14.39
K-7340	N-6340	400 ct	4000 ct	1000	1.0	.75	.11	5.0	39	436	109	1:3.16	1:1.58	13.89	14.39
K-7342	N-6342	500 ct	12.8 ct	3.2	1.0	.75	.11	4.5	43	1.6	.4	6.25:1	12.5:1	13.89	14.39
K-7344	N-6344	500 ct	16 ct	4	1.0	.75	.11	4.5	43	2.3	.56	5.6:1	11.2:1	13.89	14.39
K-7345	N-6345	500 ct	50 ct	12.5	1.0	.75	.11	4.5	43	5.8	1.5	3.16:1	6.32:1	13.89	14.39
K-7347	N-6347	500 ct	150 ct	37.5	1.0	.75	.11	4.5	43	19.8	5	1.83:1	3.65:1	13.89	14.39
K-7350	N-6350	500 ct	500 ct	125	1.0	.75	.11	4.5	43	60	15	1:1	2:1	13.89	14.39
K-7355	N-6355	*500 ct	500 ct	-	1.0	.75	.11	4.5	43	60	-	1:1	-	14.38	14.98
K-7360	N-6360	500 ct	600 ct	150	1.0	.75	.11	4.5	43	66	17	1:1.1	1.83:1	13.89	14.39
K-7365	N-6365	600 ct	12.8 ct	3.2	1.0	.75	.11	4.0	68	1.75	.44	6.85:1	13.7:1	13.89	14.39
K-7367	N-6367	600 ct	30 ct	7.5	1.0	.75	.11	4.0	60	3.7	.93	4.47:1	8.94:1	13.89	14.39
K-7370	N-6370	600 ct	48 ct	12	1.0	.75	.11	4.0	60	5.9	1.5	3.54:1	7.07:1	13.89	14.39
K-7375	N-6375	600 ct	200 ct	50	1.0	.75	.11	4.0	60	25	6.3	1.73:1	3.46:1	13.89	14.39
K-7380**	N-6380**	600 ct	600 ct	150	1.0	.75	.11	4.0	60	66	17	1:1	2:1	13.89	14.39
K-7385**	N-6385**	*600 ct	600 ct	-	1.0	.75	.11	4.0	60	68	-	1:1	-	14.38	14.98
K-7386**	N-6386**	*600 ct	900 ct	-	1.0	.75	.11	4.0	60	104	-	1:1.22	-	14.38	14.98
K-7387**	N-6387**	600 ct	1200 ct	300	1.0	.75	.11	4.0	60	116	29	1:1.41	1.41:1	13.89	14.39
K-7390	N-6390	640 ct	12.8 ct	3.2	1.0	.75	.11	4.0	69	1.75	.44	7.07:1	14.14:1	13.89	14.39
K-7395	N-6395	700 ct	100 ct	25	1.0	.75	.11	4.0	62	10.6	2.7	2.65:1	5.29:1	13.89	14.39
K-7400	N-6400	800 ct	12.8 ct	3.2	1.0	.75	.11	3.5	78	1.75	.44	7.91:1	15.8:1	13.89	14.39
K-7405	N-6405	800 ct	48 ct	12	1.0	.75	.11	3.5	74	6	1.5	4.08:1	8.16:1	13.89	14.39
K-7410	N-6410	800 ct	800 ct	200	1.0	.75	.11	3.5	74	102	26	1:1	2:1	13.89	14.39
K-7415	N-6415	900 ct	600 ct	150	1.0	.75	.11	3.0	90	66	17	1.23:1	2.45:1	13.89	14.39
K-7417**	N-6417**	*900 ct	900 ct	-	1.0	.75	.11	3.0	90	102	-	1:1	-	14.38	14.98
K-7420	N-6420	1000 ct	12 ct	3	1.0	.75	.11	3.0	115	1.75	.44	9.13:1	18.26:1	13.89	14.39
K-7425	N-6425	1000 ct	50 ct	12.5	1.0	.75	.11	3.0	100	5.8	1.5	4.47:1	8.94:1	13.89	14.39
K-7430	N-6430	1000 ct	1000 ct	250	1.0	.75	.11	3.0	75	103	26	1:1	2:1	13.89	14.39
K-7435	N-6435	1060 ct	12.8 ct	3.2	1.0	.75	.11	3.0	115	1.75	.44	9.1:1	18.2:1	13.89	14.39
K-7440	N-6440	1200 ct	12.8 ct	3.2	1.0	.75	.11	3.0	122	1.75	.44	9.68:1	19.4:1	13.89	14.39
K-7445	N-6445	1200 ct	500 ct	125	1.0	.75	.11	3.0	113	63	16	1.55:1	3.1:1	13.89	14.39
K-7450	N-6450	1200 ct	1200 ct	300	1.0	.75	.11	3.0	113	155	39	1:1	2:1	13.89	14.39
K-7455	N-6455	*1200 ct	1200 ct	-	1.0	.75	.11	3.0	109	150	-	1:1	-	14.38	14.98
K-7460	N-6460	1500 ct	12 ct	3	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	13.89	14.39
K-7465	N-6465	1500 ct	500 ct	125	1.0	.75	.11	2.5	150	60	15	1.73:1	3.46:1	13.89	14.39
K-7470	N-6470	*1500 ct	600 ct	-	1.0	.75	.11	2.5	150	66	-	1.58:1	-	14.38	14.98
K-7475	N-6475	*1500 ct	1500 ct	-	1.0	.75	.11	2.5	150	168	-	1:1	-	14.38	14.98
K-7480	N-6480	1600 ct	12.8 ct	3.2	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	13.89	14.39
K-7483	N-6483	2000 ct	8 ct	2	1.0	.75	.11	2.0	250	1.0	.25	15.8:1	31.6:1	13.89	14.39
K-7485	N-6485	2000 ct	2000 ct	500	1.0	.75	.11	2.0	185	255	64	1:1	2:1	13.89	14.39
K-7490	N-6490	*2000 ct	2000 ct	-	1.0	.75	.11	2.0	175	240	-	1:1	-	14.38	14.98
K-7495	N-6495	2000 ct	8000 ct	2000	1.0	.75	.11	2.0	185	1015	254	1:2	1:1	13.89	14.39
K-7497	N-6497	2500 ct	2500 ct	625	1.0	.75	.11	2.0	245	268	68	1:1	2:1	13.89	14.39
K-7500	N-6500	3000 ct	3000 ct	750	1.0	.75	.11	1.8	267	295	74	1:1	2:1	13.89	14.39
K-7505	N-6505	*3000 ct	3000 ct	-	1.0	.75	.11	1.8	267	368	-	1:1	-	14.38	14.98
K-7510	N-6510	3600 ct	3600 ct	900	1.0	.75	.11	1.5	300	413	103	1:1	2:1	13.89	14.39
K-7512	N-6512	4000 ct	16 ct	4	1.0	.75	.11	1.5	395	2.5	.65	15.8:1	31.6:1	13.89	14.39
K-7514**	N-6514**	4000 ct	600 ct	150	1.0	.75	.11	1.5	395	66	17	2.58:1	5.16:1	13.89	14.39

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

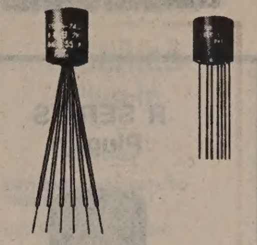
"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

For More Information. Circle No. 506

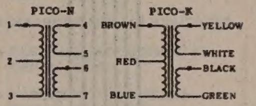
PICO PART NUMBER		PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9 * * *	
K-Series Insulated Leads	N-Series Plug-in		SER	PAR	1KHz and higher	400 Hz and higher	150 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7515	N-6515	4000 ct	1000 ct	250	1.0	.75	.11	1.5	395	108	27	2:1	4:1	13.89	14.39
K-7520	N-6520	*4000 ct	8000 ct	-	1.0	.75	.11	1.5	390	955	-	1:1.41	-	14.38	14.98
K-7525	N-6525	5000 ct	500 ct	125	1.0	.75	.11	1.3	450	62	16	3.16:1	6.32:1	13.89	14.39
K-7530	N-6530	5000 ct	5000 ct	1250	1.0	.75	.11	1.3	450	620	155	1:1	2:1	13.89	14.39
K-7535	N-6535	7500 ct	50 ct	12.5	1.0	.75	.11	1.0	670	6	1.5	12.25:1	24.5:1	15.49	15.96
K-7540	N-6540	7500 ct	100 ct	25	1.0	.75	.11	1.0	670	11	2.8	8.66:1	17.32:1	15.49	15.96
K-7545	N-6545	7500 ct	600 ct	150	1.0	.75	.11	1.0	670	66	16.5	3.54:1	7.07:1	15.49	15.96
K-7550	N-6550	7500 ct	2500 ct	625	1.0	.75	.11	1.0	670	268	67	1.73:1	3.46:1	15.49	15.96
K-7555	N-6555	*7500 ct	7500 ct	-	1.0	.75	.11	1.0	670	925	-	1:1	-	15.95	17.09
K-7560	N-6560	8000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	765	1.75	.44	25:1	50:1	15.49	15.96
K-7565	N-6565	8000 ct	1000 ct	250	1.0	.75	.11	1.0	695	106	26.5	2.83:1	5.66:1	15.49	15.96
K-7570	N-6570	*8000 ct	1200 ct	-	1.0	.75	.11	1.0	715	153	-	2.58:1	-	15.95	17.09
K-7575	N-6575	*9000 ct	9000 ct	-	1.0	.75	.11	1.0	925	1020	-	1:1	-	15.95	17.09
K-7580	N-6580	10,000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	768	1.6	.4	28:1	56:1	15.49	15.96
K-7585	N-6585	10,000 ct	16 ct	4	1.0	.75	.11	1.0	756	1.7	.43	25:1	50:1	15.49	15.96
K-7590	N-6590	10,000 ct	100 ct	25	1.0	.75	.11	1.0	780	10	2.5	10:1	20:1	15.49	15.96
K-7595	N-6595	10,000 ct	200 ct	50	1.0	.75	.11	1.0	780	24	6	7.07:1	14.14:1	15.49	15.96
K-7600	N-6600	10,000 ct	500 ct	125	1.0	.75	.11	1.0	780	60	15	4.47:1	8.94:1	15.49	15.96
K-7605	N-6605	10,000 ct	600 ct	150	1.0	.75	.11	1.0	780	83	21	4.08:1	8.16:1	15.49	15.96
K-7610	N-6610	10,000 ct	1000 ct	250	1.0	.75	.11	1.0	780	106	27	3.16:1	6.32:1	15.49	15.96
K-7615	N-6615	10,000 ct	1200 ct	300	1.0	.75	.11	1.0	780	145	36	2.89:1	5.77:1	15.49	15.96
K-7620	N-6620	10,000 ct	1500 ct	375	1.0	.75	.11	1.0	780	160	40	2.58:1	5.16:1	15.49	15.96
K-7625	N-6625	10,000 ct	2000 ct	500	1.0	.75	.11	1.0	780	300	75	2.24:1	4.47:1	15.49	15.96
K-7630	N-6630	10,000 ct	5000 ct	1250	1.0	.75	.11	1.0	780	610	153	1.41:1	2.83:1	15.49	15.96
K-7635	N-6635	10,000 ct	7500 ct	1875	1.0	.75	.11	1.0	780	932	233	1.16:1	2.31:1	15.49	15.96
K-7640	N-6640	10,000 ct	10,000 ct	2500	1.0	.75	.11	1.0	780	1075	269	1:1	2:1	15.49	15.96
K-7645	N-6645	*10,000 ct	10,000 ct	-	1.0	.75	.11	1.0	715	985	-	1:1	-	15.95	17.09
K-7650	N-6650	15,000 ct	400 ct	100	.66	.66	.11	0.8	1165	52	13	6.12:1	12.25:1	15.49	15.96
K-7652	N-6652	15,000 ct	500 ct	125	.66	.66	.11	0.8	1165	60	15	5.48:1	10.95:1	15.49	15.96
K-7655	N-6655	15,000 ct	600 ct	150	.66	.66	.11	0.8	1165	80	20	5:1	10:1	15.49	15.96
K-7660	N-6660	15,000 ct	10,000 ct	2500	.66	.66	.11	0.8	1165	1050	263	1.22:1	2.45:1	15.49	15.96
K-7665	N-6665	*15,000 ct	15,000 ct	-	.66	.66	.11	0.8	1165	1600	-	1:1	-	15.95	17.09
K-7670	N-6670	15,000 ct	15,000 ct	3750	.66	.66	.11	0.8	1165	1600	400	1:1	2:1	15.49	15.96
K-7675	N-6675	16,000 ct	1000 ct	250	.62	.62	.11	0.8	1560	108	27	4:1	8:1	15.49	15.96
K-7680	N-6680	20,000 ct	500 ct	125	.5	.5	.11	0.7	1750	60	15	6.32:1	12.65:1	15.95	17.09
K-7685	N-6685	20,000 ct	600 ct	150	.5	.5	.11	0.7	1750	82	20.5	5.77:1	11.55:1	15.95	17.09
K-7690	N-6690	20,000 ct	800 ct	200	.5	.5	.11	0.7	1750	98	24.5	5:1	10:1	15.95	17.09
K-7695	N-6695	20,000 ct	1000 ct	250	.5	.5	.11	0.7	1750	135	34	4.47:1	8.94:1	15.95	17.09
K-7700	N-6700	20,000 ct	5000 ct	1250	.5	.5	.11	0.7	1750	610	153	2:1	4:1	15.95	17.09
K-7705	N-6705	20,000 ct	10,000 ct	2500	.5	.5	.11	0.7	1750	1075	269	1.41:1	2.83:1	15.95	17.09
K-7710	N-6710	*20,000 ct	20,000 ct	-	.5	.5	.11	0.7	1715	2370	-	1:1	-	17.09	17.76
K-7715	N-6715	25,000 ct	500 ct	125	.4	.4	.11	0.6	2470	60	15	7.07:1	14.14:1	15.95	17.09
K-7720	N-6720	25,000 ct	1000 ct	250	.4	.4	.11	0.6	2470	106	27	5:1	10:1	15.95	17.09
K-7725	N-6725	30,000 ct	50 ct	12.5	.33	.33	.11	0.5	2730	6.2	1.6	24.5:1	49:1	17.09	17.76
K-7730	N-6730	30,000 ct	1200 ct	300	.33	.33	.11	0.5	2815	156	39	5:1	10:1	17.09	17.76
K-7732	N-6732	30,000 ct	500 ct	125	.33	.33	.11	0.5	2730	61	15.3	7.7:1	15.5:1	17.09	17.76
K-7734	N-6734	30,000 ct	200 ct	50	.33	.33	.11	0.5	2730	24	6	12.2:1	24.5:1	17.09	17.76
K-7735	N-6735	30,000 ct	5000 ct	1250	.33	.33	.11	0.5	2730	620	155	2.45:1	4.9:1	17.09	17.76
K-7740	N-6740	30,000 ct	10,000 ct	2500	.33	.33	.11	0.5	2730	1090	272	1.73:1	3.46:1	17.09	17.76
K-7745	N-6745	*30,000 ct	30,000 ct	-	.33	.33	.11	0.5	2730	3740	-	1:1	-	17.94	19.08
K-7750	N-6750	40,000 ct	400 ct	100	.25	.25	.11	0.5	3150	53	13	10:1	20:1	17.94	19.08
K-7755	N-6755	40,000 ct	2000 ct	500	.25	.25	.11	0.5	3150	300	75	4.47:1	8.94:1	17.94	19.08
K-7760	N-6760	40,000 ct	4000 ct	1000	.25	.25	.11	0.5	3150	548	137	3.16:1	6.32:1	17.94	19.08
K-7765	N-6765	40,000 ct	20,000 ct	5000	.25	.25	.11	0.5	3150	3075	769	1.41:1	2.83:1	17.94	19.08
K-7770	N-6770	*40,000 ct	40,000 ct	-	.25	.25	.11	0.5	3940	4350	-	1:1	-	20.34	21.27
K-7775	N-6775	50,000 ct	200 ct	50	.2	.2	.11	0.4	4275	24	6	15.8:1	31.6:1	20.34	21.27
K-7777	N-6777	50,000 ct	500 ct	125	.2	.2	.11	0.4	4275	60	15	10:1	20:1	20.34	21.27
K-7778	N-6778	50,000 ct	600 ct	150	.2	.2	.11	0.4	4275	82	21	9.13:1	18.26:1	20.34	21.27
K-7779	N-6779	50,000 ct	50,000 ct	12,500	.2	.2	.11	0.4	4500	6270	1568	1:1	2:1	20.34	21.27
K-7780	N-6780	60,000 ct	15,000 ct	3750	.16	.16	.11	0.4	5960	1650	412	2:1	4:1	22.37	23.02
K-7785	N-6785	62,500 ct	50 ct	12.5	.16	.16	.11	0.4	5960	6	1.5	35.4:1	70.7:1	22.37	23.02
K-7787	N-6787	80,000 ct	15,000 ct	3750	.12	.12	.11	0.3	7200	1690	423	2.3:1	4.6:1	22.37	23.02
K-7789	N-6789	80,000 ct	80,000 ct	20,000	.12	.12	.11	0.3	7200	9920	2480	1:1	2:1	22.37	23.02
K-7790	N-6790	90,000 ct	10,000 ct	2500	.11	.11	.11	0.3	7500	1350	338	3:1	6:1	23.22	24.09
K-7795	N-6795	95,000 ct	15,000 ct	3750	.1	.1	.10	0.3	9550	1635	410	2.5:1	5:1	23.22	24.09
K-7800	N-6800	100,000 ct	60 ct	15	.1	.1	.10	0.3	10,000	8.5	2.2	40.8:1	81.6:1	23.22	24.09
K-7805	N-6805	100,000 ct	100 ct	25	.1	.1	.10	0.3	10,000	14	3.5	31.6:1	63.2:1	23.22	24.09
K-7810	N-6810	100,000 ct	500 ct	125	.1	.1	.10	0.3	10,000	62	15.5	14.1:1	28.3:1	23.22	24.09
K-7813	N-6813	100,000 ct	1000 ct	250	.1	.1	.10	0.3	10,000	140	35	10:1	20:1	23.22	24.09
K-7814	N-6814	100,000 ct	2000 ct	500	.1	.1	.10	0.3	10,000	248	62	7.07:1	14.14:1	23.22	24.09
K-7815	N-6815	100,000 ct	10,000 ct	2500	.1	.1	.10	0.3	10,000	1075	270	3.16:1	6.32:1	23.22	24.09
K-7820	N-6820	135,000 ct	82 ct	20.5	.074	.074	.074	0.25	13,700	9.5	2.4	40.6:1	81.2:1	24.45	25.17
K-7823	N-6823	200,000 ct	500 ct	125	.05	.05	.05	0.2	17,340	75	19	20:1	40:1	24.45	25.17
K-7825	N-6825	200,000 ct	1000 ct	250	.05	.05	.05	0.2	17,340	133	33	14.1:1	28.3:1	24.45	25.17
K-7830	N-6830	200,000 ct	10,000 ct	2500	.05	.05	.05	0.2	17,340	1350	336	4.47:1	8.94:1	24.45	25.17
K-7835	N-6835	200,000 ct	20,000 ct	5000	.05	.05	.05	0.2	17,340	3000	750	3.16:1	6.32:1	24.45	25.17
K-7837	N-6837	250,000 ct	200 ct	50	.04	.04	.04	0.2	17,340	28	7	35.4:1	70.7:1	25.17	25.82
K-7840	N-6840	250,000 ct	1000 ct	250	.04	.04	.04	0.2	17,340	118	30	15.8:1	31.6:1	25.17	25.82
K-SHIELD	MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)													1.79	
N-SHIELD	MU-METAL SHIELD .53" d X .56" h (13.46 mm d X 14.22 mm h)														1.80

K SERIES N SERIES

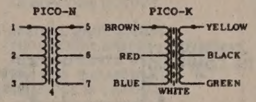
Insulated Leads **Plug-In**



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

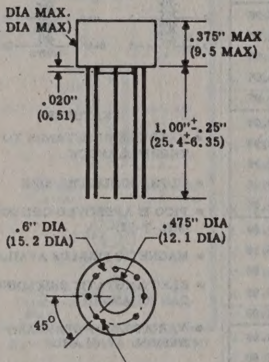
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

phone
914-699-5514

For Immediate
Action
please use
return card,
Vol. 4,
or call
800-431-1064

PICO's ultra-miniature transformers

R SERIES Plug-In



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-27: . . . .
All Units Meet MIL-T-27
And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- FREQUENCY RESPONSE: . . .
± 3 db, 75 Hz - 30 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: . . .
5% With Rated Power Level at 1 KHz, 300 Hz and 75 Hz
- DIELECTRIC STRENGTH: . . .
All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: . .
Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: . . . .
12 Grams
- OPERATING TEMPERATURE: .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- TERMINALS: . . . .
Solid .016 Diameter Conductor. Conductor is Copper Clad Steel, Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK: . . . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

Delivery— stock to one week

PICO PART NUMBER R-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	75 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	R-Series
R-20003	20 ct	8 ct	2	1.5	.9	.03	22	1.6	.76	.19	1.58:1	3.16:1	15.76
R-20005	20 ct	20 ct	5	1.5	.9	.03	22	1.6	1.9	.48	1:1	2:1	15.76
R-20010	32 ct	32 ct	8	1.5	.9	.03	17.5	2.56	3	.75	1:1	2:1	15.76
R-20015	40 ct	40 ct	10	1.5	.9	.03	16	3.2	3.8	.95	1:1	2:1	15.76
R-20018	48 ct	16 ct	4	1.5	.9	.03	14.5	3.84	1.52	.38	1.73:1	3.46:1	15.76
R-20020	50 ct	50 ct	12.5	1.5	.9	.03	14	4	4.75	1.19	1:1	2:1	15.76
R-20025	80 ct	32 ct	8	1.5	.9	.03	11	6.4	3	.75	1.58:1	3.16:1	15.76
R-20028	100 ct	40 ct	10	1.5	.9	.03	10	8	3.8	.95	1.58:1	3.16:1	15.76
R-20030	100 ct	100 ct	25	1.5	.9	.03	10	8	9.5	2.38	1:1	2:1	15.76
R-20035	120 ct	12.8 ct	3.2	1.5	.9	.03	9	9.6	1.22	.3	3.06:1	6.12:1	15.76
R-20040	120 ct	60 ct	15	1.5	.9	.03	9	9.6	5.7	1.4	1.41:1	2.83:1	15.76
R-20045	120 ct	120 ct	30	1.5	.9	.03	9	9.6	11.4	2.85	1:1	2:1	15.76
R-20050	150 ct	12 ct	3	1.5	.9	.03	8	12	1.14	.29	3.54:1	7.08:1	15.76
R-20055	150 ct	50 ct	12.5	1.5	.9	.03	8	12	4.75	1.19	1.73:1	3.46:1	15.76
R-20060	150 ct	100 ct	25	1.5	.9	.03	8	12	9.5	2.38	1.22:1	2.44:1	15.76
R-20065	150 ct	150 ct	37.5	1.5	.9	.03	8	12	14.3	3.56	1:1	2:1	15.76
R-20070	150 ct	600 ct	150	1.5	.9	.03	8	12	57	14.3	1:2	1:1	15.76
R-20075	200 ct	200 ct	50	1.5	.9	.03	7	16	19	4.75	1:1	2:1	15.76
R-20080	300 ct	12 ct	3	1.5	.9	.03	5.5	24	1.14	.29	5:1	10:1	15.76
R-20085	300 ct	50 ct	12.5	1.5	.9	.03	5.5	24	4.75	1.19	2.45:1	4.9:1	15.76
R-20090	300 ct	150 ct	37.5	1.5	.9	.03	5.5	24	14.25	3.56	1.41:1	2.83:1	15.76
R-20095	300 ct	300 ct	75	1.5	.9	.03	5.5	24	28.5	7.13	1:1	2:1	15.76
R-20100	300 ct	600 ct	150	1.5	.9	.03	5.5	24	57	14.25	1:1.41	1.41:1	15.76
R-20105	320 ct	12.8 ct	3.2	1.5	.9	.03	5.5	25.6	1.22	.3	5:1	10:1	15.76
R-20110	400 ct	40 ct	10	1.5	.9	.03	5	32	3.8	.95	3.16:1	6.32:1	15.76
R-20115	400 ct	120 ct	30	1.5	.9	.03	5	32	11.4	2.85	1.83:1	3.65:1	15.76
R-20120	400 ct	200 ct	50	1.5	.9	.03	5	32	19	4.75	1.41:1	2.83:1	15.76
R-20125	400 ct	400 ct	100	1.5	.9	.03	5	32	38	9.5	1:1	2:1	15.76
R-20130	400 ct	1000 ct	250	1.5	.9	.03	5	32	95	23.8	1:1.58	1.26:1	15.76
R-20135	400 ct	2000 ct	500	1.5	.9	.03	5	32	190	47.5	1:2.24	1:1.12	15.76
R-20140	400 ct	4000 ct	1000	1.5	.9	.03	5	32	380	95	1:3.16	1:1.58	15.76
R-20142	500 ct	12.8 ct	3.2	1.5	.9	.03	4.5	40	1.22	.3	6.25:1	12.5:1	15.76
R-20144	500 ct	16 ct	4	1.5	.9	.03	4.5	40	1.52	.38	5.6:1	11.2:1	15.76
R-20145	500 ct	50 ct	12.5	1.5	.9	.03	4.5	40	4.75	1.19	3.16:1	6.32:1	15.76
R-20147	500 ct	150 ct	37.5	1.5	.9	.03	4.5	40	14.25	3.56	1.83:1	3.65:1	15.76
R-20150	500 ct	500 ct	125	1.5	.9	.03	4.5	40	47.5	11.88	1:1	2:1	15.76
R-20155	*500 ct	500 ct	-	1.5	.9	.03	4.5	40	47.5	-	1:1	-	16.42
R-20160	500 ct	600 ct	150	1.5	.9	.03	4.5	40	57	14.25	1:1.1	1.83:1	15.76
R-20165	600 ct	12.8 ct	3.2	1.5	.9	.03	4	48	1.22	.3	6.85:1	13.7	15.76
R-20167	600 ct	30 ct	7.5	1.5	.9	.03	4	48	2.85	.71	4.47:1	8.94:1	15.76
R-20170	600 ct	48 ct	12	1.5	.9	.03	4	48	4.56	1.14	3.54:1	7.07:1	15.76
R-20175	600 ct	200 ct	50	1.5	.9	.03	4	48	19	4.75	1.73:1	3.46:1	15.76
R-20180**	600 ct	600 ct	150	1.5	.9	.03	4	48	57	14.25	1:1	2:1	15.76
R-20185**	*600 ct	600 ct	-	1.5	.9	.03	4	48	57	-	1:1	-	16.42
R-20186**	*600 ct	900 ct	-	1.5	.9	.03	4	48	85.5	-	1:1.22	-	16.42
R-20187**	600 ct	1200 ct	300	1.5	.9	.03	4	48	114	28.5	1:1.41	1.41:1	15.76
R-20190	640 ct	12.8 ct	3.2	1.5	.9	.03	4	51.2	1.22	.3	7.07:1	14.14:1	15.76
R-20195	700 ct	100 ct	25	1.5	.9	.03	3.5	56	9.5	2.38	2.65:1	5.29:1	15.76
R-20200	800 ct	12.8 ct	3.2	1.5	.9	.03	3.5	64	1.22	.3	7.91:1	15.8:1	15.76
R-20205	800 ct	48 ct	12	1.5	.9	.03	3.5	64	4.56	1.14	4.08:1	8.16:1	15.76
R-20210	800 ct	800 ct	200	1.5	.9	.03	3.5	64	76	19	1:1	2:1	15.76
R-20215	900 ct	600 ct	150	1.5	.9	.03	3	72	57	14.3	1.23:1	2.45:1	15.76
R-20217**	*900 ct	900 ct	-	1.5	.9	.03	3	72	85.5	-	1:1	-	16.42
R-20220	1000 ct	12 ct	3	1.5	.9	.03	3	80	1.14	.29	9.13:1	18.26:1	15.76
R-20225	1000 ct	50 ct	12.5	1.5	.9	.03	3	80	4.75	1.19	4.47:1	8.94:1	15.76
R-20230	1000 ct	1000 ct	250	1.5	.9	.03	3	80	95	23.8	1:1	2:1	15.76
R-20235	1060 ct	12.8 ct	3.2	1.5	.9	.03	3	85	1.22	.3	9.1:1	18.2:1	15.76
R-20240	1200 ct	12.8 ct	3.2	1.5	.9	.03	3	96	1.22	.3	9.68:1	19.4:1	15.76
R-20245	1200 ct	500 ct	125	1.5	.9	.03	3	96	47.5	11.88	1.55:1	3.1:1	15.76
R-20250	1200 ct	1200 ct	300	1.5	.9	.03	3	96	114	28.5	1:1	2:1	15.76
R-20255	*1200 ct	1200 ct	-	1.5	.9	.03	3	96	114	-	1:1	-	16.42
R-20260	1500 ct	12 ct	3	1.5	.9	.03	2.5	120	1.14	.29	11.18:1	22.36:1	15.76
R-20265	1500 ct	500 ct	125	1.5	.9	.03	2.5	120	47.5	11.88	1.73:1	3.46:1	15.76
R-20270	*1500 ct	600 ct	-	1.5	.9	.03	2.5	120	57	-	1.58:1	-	16.42
R-20275	*1500 ct	1500 ct	-	1.5	.9	.03	2.5	120	142	-	1:1	-	16.42
R-20280	1600 ct	12.8 ct	3.2	1.5	.9	.03	2.5	128	1.22	3	11.18:1	22.36:1	15.76
R-20283	2000 ct	8 ct	2	1.5	.9	.03	2.2	160	.76	.19	15.8:1	31.6:1	15.76
R-20285	2000 ct	2000 ct	500	1.5	.9	.03	2.2	160	190	47.5	1:1	2:1	15.76
R-20290	*2000 ct	2000 ct	-	1.5	.9	.03	2.2	160	190	-	1:1	-	16.42
R-20295	2000 ct	8000 ct	2000	1.5	.9	.03	2.2	160	760	190	1:2	1:1	15.76
R-20297	2500 ct	2500 ct	625	1.5	.9	.03	2	200	238	59.5	1:1	2:1	15.76
R-20300	3000 ct	3000 ct	750	1.5	.9	.03	1.8	240	285	71.3	1:1	2:1	15.76
R-20305	*3000 ct	3000 ct	-	1.5	.9	.03	1.8	240	285	-	1:1	-	16.42

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

*** **Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

"For Immediate Action please use return card, Vol. 4, or call 800–431–1064."

PICO PART NUMBER R-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	75 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	R-Series
R-20310	3600 ct	3600 ct	900	1.5	.9	.03	1.7	288	342	86	1:1	2:1	15.76
R-20312	4000 ct	16 ct	4	1.5	.9	.03	1.6	320	1.52	.38	15.8:1	31.6:1	15.76
R-20314**	4000 ct	600 ct	150	1.5	.9	.03	1.6	320	57	14.3	2.58:1	5.16:1	15.76
R-20315	4000 ct	1000 ct	250	1.5	.9	.03	1.6	320	95	23.8	2:1	4:1	15.76
R-20320	*4000 ct	8000 ct	-	1.5	.9	.03	1.6	320	760	-	1:1.41	-	16.42
R-20325	5000 ct	500 ct	125	1.5	.9	.03	1.4	400	47.5	11.88	3.16:1	6.32:1	15.76
R-20330	5000 ct	5000 ct	1250	1.5	.9	.03	1.4	400	475	119	1:1	2:1	15.76
R-20335	7500 ct	50 ct	12.5	1.3	.9	.03	1.2	600	4.75	1.19	12.25:1	24.5:1	17.49
R-20340	7500 ct	100 ct	25	1.3	.9	.03	1.2	600	9.5	2.38	8.66:1	17.32:1	17.49
R-20345	7500 ct	600 ct	150	1.3	.9	.03	1.2	600	57	14.3	3.54:1	7.07:1	17.49
R-20350	7500 ct	2500 ct	625	1.3	.9	.03	1.2	600	238	59.5	1.73:1	3.46:1	17.49
R-20355	*7500 ct	7500 ct	-	1.3	.9	.03	1.2	600	713	-	1:1	-	18.72
R-20360	8000 ct	12.8 ct	3.2	1.2	.9	.03	1.1	640	1.22	.3	25:1	50:1	17.49
R-20365	8000 ct	1000 ct	250	1.2	.9	.03	1.1	640	95	23.8	2.83:1	5.66:1	17.49
R-20370	*8000 ct	1200 ct	-	1.2	.9	.03	1.1	640	114	-	2.58:1	-	18.72
R-20375	*9000 ct	9000 ct	-	1.1	.9	.03	1.1	720	855	-	1:1	-	18.72
R-20380	10,000 ct	12.8 ct	3.2	1.0	.9	.03	1	800	1.22	.3	28:1	56:1	17.49
R-20385	10,000 ct	16 ct	4	1.0	.9	.03	1	800	1.52	.38	25:1	50:1	17.49
R-20390	10,000 ct	100 ct	25	1.0	.9	.03	1	800	9.5	2.38	10:1	20:1	17.49
R-20395	10,000 ct	200 ct	50	1.0	.9	.03	1	800	19	4.75	7.07:1	14.14:1	17.49
R-20400	10,000 ct	500 ct	125	1.0	.9	.03	1	800	47.5	11.88	4.47:1	8.94:1	17.49
R-20405	10,000 ct	600 ct	150	1.0	.9	.03	1	800	57	14.25	4.08:1	8.16:1	17.49
R-20410	10,000 ct	1000 ct	250	1.0	.9	.03	1	800	95	23.8	3.16:1	6.32:1	17.49
R-20415	10,000 ct	1200 ct	300	1.0	.9	.03	1	800	114	28.5	2.89:1	5.77:1	17.49
R-20420	10,000 ct	1500 ct	375	1.0	.9	.03	1	800	143	35.8	2.58:1	5.16:1	17.49
R-20425	10,000 ct	2000 ct	500	1.0	.9	.03	1	800	190	47.5	2.24:1	4.47:1	17.49
R-20430	10,000 ct	5000 ct	1250	1.0	.9	.03	1	800	475	119	1.41:1	2.83:1	17.49
R-20435	10,000 ct	7500 ct	1875	1.0	.9	.03	1	800	713	178	1.16:1	2.31:1	17.49
R-20440	10,000 ct	10,000 ct	2500	1.0	.9	.03	1	800	950	238	1:1	2:1	17.49
R-20445	*10,000 ct	10,000 ct	-	1.0	.9	.03	1	800	950	-	1:1	-	18.72
R-20450	15,000 ct	400 ct	100	.66	.66	.03	.8	1200	38	9.5	6.12:1	12.25:1	17.49
R-20452	15,000 ct	500 ct	125	.66	.66	.03	.8	1200	48	12	5.48:1	10.95:1	17.49
R-20455	15,000 ct	600 ct	150	.66	.66	.03	.8	1200	57	14.3	5:1	10:1	17.49
R-20460	15,000 ct	10,000 ct	2500	.66	.66	.03	.8	1200	950	238	1.22:1	2.45:1	17.49
R-20465	*15,000 ct	15,000 ct	-	.66	.66	.03	.8	1200	1430	-	1:1	-	18.72
R-20470	15,000 ct	15,000 ct	3750	.66	.66	.03	.8	1200	1430	357	1:1	2:1	17.49
R-20475	16,000 ct	1000 ct	250	.62	.62	.03	.8	1280	95	23.8	4:1	8:1	17.49
R-20480	20,000 ct	500 ct	125	.5	.5	.03	.7	1600	47.5	11.88	6.32:1	12.65:1	18.72
R-20485	20,000 ct	600 ct	150	.5	.5	.03	.7	1600	57	14.25	5.77:1	11.55:1	18.72
R-20490	20,000 ct	800 ct	200	.5	.5	.03	.7	1600	76	19	5:1	10:1	18.72
R-20495	20,000 ct	1000 ct	250	.5	.5	.03	.7	1600	95	23.8	4.47:1	8.94:1	18.72
R-20500	20,000 ct	5000 ct	1250	.5	.5	.03	.7	1600	475	119	2:1	4:1	18.72
R-20505	20,000 ct	10,000 ct	2500	.5	.5	.03	.7	1600	950	238	1.41:1	2.83:1	18.72
R-20510	*20,000 ct	20,000 ct	-	.5	.5	.03	.7	1600	1900	-	1:1	-	19.46
R-20515	25,000 ct	500 ct	125	.4	.4	.03	.6	2000	47.5	11.88	7.07:1	14.14:1	18.72
R-20520	25,000 ct	1000 ct	250	.4	.4	.03	.6	2000	95	23.8	5:1	10:1	18.72
R-20525	30,000 ct	50 ct	12.5	.33	.33	.03	.6	2400	4.75	1.19	24.5:1	49:1	19.46
R-20530	30,000 ct	1200 ct	300	.33	.33	.03	.6	2400	114	28.5	5:1	10:1	19.46
R-20532	30,000 ct	500 ct	125	.33	.33	.03	.6	2400	47.5	11.88	7.7:1	15.5:1	19.46
R-20534	30,000 ct	200 ct	50	.33	.33	.03	.6	2400	19	4.75	12.2:1	24.5:1	19.46
R-20535	30,000 ct	5000 ct	1250	.33	.33	.03	.6	2400	475	119	2.45:1	4.9:1	19.46
R-20540	30,000 ct	10,000 ct	2500	.33	.33	.03	.6	2400	950	238	1.73:1	3.46:1	19.46
R-20545	*30,000 ct	30,000 ct	-	.33	.33	.03	.6	2400	2850	-	1:1	-	20.91
R-20550	40,000 ct	400 ct	100	.25	.25	.03	.5	3200	38	9.5	10:1	20:1	20.91
R-20555	40,000 ct	2000 ct	500	.25	.25	.03	.5	3200	190	47.5	4.47:1	8.94:1	20.91
R-20560	40,000 ct	4000 ct	1000	.25	.25	.03	.5	3200	380	95	3.16:1	6.32:1	20.91
R-20565	40,000 ct	20,000 ct	5000	.25	.25	.03	.5	3200	1900	475	1.41:1	2.83:1	20.91
R-20570	*40,000 ct	40,000 ct	-	.25	.25	.03	.5	3200	3800	-	1:1	-	23.28
R-20575	50,000 ct	200 ct	50	.2	.2	.03	.4	4000	19	4.75	15.8:1	31.6:1	23.28
R-20577	50,000 ct	500 ct	125	.2	.2	.03	.4	4000	47.5	11.88	10:1	20:1	23.28
R-20578	50,000 ct	600 ct	150	.2	.2	.03	.4	4000	57	14.3	9.13:1	18.26:1	23.28
R-20579	50,000 ct	50,000 ct	12,500	.2	.2	.03	.4	4000	4750	1190	1:1	2:1	23.28
R-20580	60,000 ct	15,000 ct	3750	.16	.16	.03	.4	4800	1430	358	2:1	4:1	25.14
R-20585	62,500 ct	50 ct	12.5	.16	.16	.03	.4	5000	4.75	1.19	35.4:1	70.7:1	25.14
R-20587	80,000 ct	15,000 ct	3750	.12	.12	.03	.3	6400	1430	358	2.3:1	4.6:1	25.14
R-20590	90,000 ct	10,000 ct	2500	.11	.11	.03	.3	7200	950	238	3:1	6:1	26.39
R-20595	95,000 ct	15,000 ct	3750	.1	.1	.03	.3	7600	1430	358	2.5:1	5:1	26.39
R-20600	100,000 ct	60 ct	15	.1	.1	.03	.3	8000	5.7	1.43	40.8:1	81.6:1	26.39
R-20605	100,000 ct	100 ct	25	.1	.1	.03	.3	8000	9.5	2.38	31.6:1	63.2:1	26.39
R-20610	100,000 ct	500 ct	125	.1	.1	.03	.3	8000	47.5	11.88	14.1:1	28.3:1	26.39
R-20613	100,000 ct	1000 ct	250	.1	.1	.03	.3	8000	95	23.8	10:1	20:1	26.39
R-20614	100,000 ct	2000 ct	500	.1	.1	.03	.3	8000	190	47.5	7.07:1	14.14:1	26.39
R-20615	100,000 ct	10,000 ct	2500	.1	.1	.03	.3	8000	950	238	3.16:1	6.32:1	26.39
R-20620	135,000 ct	82 ct	20.5	.07	.07	.03	.2	10,800	7.8	1.9	40.6:1	81.2:1	27.57

*INCLUDES ELECTROSTATIC SHIELD

**MINIATURIZED TELEPHONE COUPLING APPLICATION

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Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

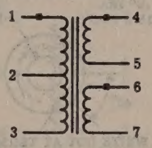
PICO's ultra-miniature transformers

R SERIES Plug-In

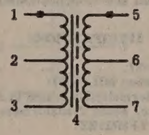
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.

453 N. MacQuesten Pkwy
Mt. Vernon, N.Y. 10552

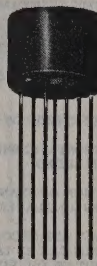
phone
914-699-5514

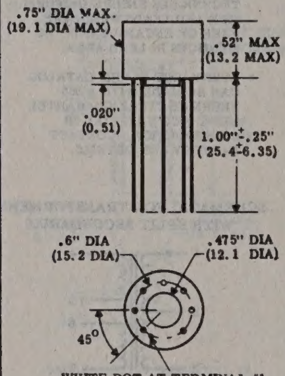
For Immediate Action please use return card, Vol. 4, or call 800-431-1064

Delivery— stock to one week

PICO's
ultra-miniature transformers

S SERIES
Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27:** . . . . All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** . . . ± 3 db, 50 Hz - 30 KHz at 1.0 Milliwatt. (±0.5 db, 300 Hz-5 KHz)
- **MAXIMUM DISTORTION:** . . . 5% With Rated Power Level at 1 KHz, 300 Hz and 50 Hz.
- **DIELECTRIC STRENGTH:** . . . All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** . . Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** . . . . 17 Grams
- **OPERATING TEMPERATURE:** . -55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).
- **TERMINALS:** . . . . Solid .020 Conductor, Copper Clad Steel Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452
- **THERMAL SHOCK:** . . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

PICO PART NUMBER S-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	50 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	S-Series
S-21003	20 ct	8 ct	2	2.0	1.5	.05	22	1.6	.88	.22	1.58:1	3.16:1	15.76
S-21005	20 ct	20 ct	5	2.0	1.5	.05	22	1.6	2.2	.55	1:1	2:1	15.76
S-21010	32 ct	32 ct	8	2.0	1.5	.05	17.5	2.56	3.52	.88	1:1	2:1	15.76
S-21015	40 ct	40 ct	10	2.0	1.5	.05	16	3.2	4.4	1.1	1:1	2:1	15.76
S-21018	48 ct	16 ct	4	2.0	1.5	.05	14.5	3.84	1.76	.44	1.73:1	3.46:1	15.76
S-21020	50 ct	50 ct	12.5	2.0	1.5	.05	14	4	5.5	1.38	1:1	2:1	15.76
S-21025	80 ct	32 ct	8	2.0	1.5	.05	11	6.4	3.52	.88	1.58:1	3.16:1	15.76
S-21028	100 ct	40 ct	10	2.0	1.5	.05	10	8	4.4	1.1	1.58:1	3.16:1	15.76
S-21030	100 ct	100 ct	25	2.0	1.5	.05	10	8	11	2.75	1:1	2:1	15.76
S-21035	120 ct	12.8 ct	3.2	2.0	1.5	.05	9	9.6	1.41	.35	3.06:1	6.12:1	15.76
S-21040	120 ct	60 ct	15	2.0	1.5	.05	9	9,6	6.6	1.65	1.41:1	2.83:1	15.76
S-21045	120 ct	120 ct	30	2.0	1.5	.05	9	9.6	13.2	3.3	1:1	2:1	15.76
S-21050	150 ct	12 ct	3	2.0	1.5	.05	8	12	1.32	.33	3.54:1	7.08:1	15.76
S-21055	150 ct	50 ct	12.5	2.0	1.5	.05	8	12	5.5	1.38	1.73:1	3.46:1	15.76
S-21060	150 ct	100 ct	25	2.0	1.5	.05	8	12	11	2.75	1.22:1	2.44:1	15.76
S-21065	150 ct	150 ct	37.5	2.0	1.5	.05	8	12	16.5	4.13	1:1	2:1	15.76
S-21070	150 ct	600 ct	150	2.0	1.5	.05	8	12	66	16.5	1:2	1:1	15.76
S-21075	200 ct	200 ct	50	2.0	1.5	.05	7	16	22	5.5	1:1	2:1	15.76
S-21080	300 ct	12 ct	3	2.0	1.5	.05	5.5	24	1.32	.33	5:1	10:1	15.76
S-21085	300 ct	50 ct	12.5	2.0	1.5	.05	5.5	24	5.5	1.38	2.45:1	4.9:1	15.76
S-21090	300 ct	150 ct	37.5	2.0	1.5	.05	5.5	24	16.5	4.13	1.41:1	2.83:1	15.76
S-21095	300 ct	300 ct	75	2.0	1.5	.05	5.5	24	33	8.25	1:1	2:1	15.76
S-21100	300 ct	600 ct	150	2.0	1.5	.05	5.5	24	66	16.5	1:1.41	1.41:1	15.76
S-21105	320 ct	12.8 ct	3.2	2.0	1.5	.05	5.5	25.6	1.41	.35	5:1	10:1	15.76
S-21110	400 ct	40 ct	10	2.0	1.5	.05	5	32	4.4	1.1	3.16:1	6.32:1	15.76
S-21115	400 ct	120 ct	30	2.0	1.5	.05	5	32	13.2	3.3	1.83:1	3.65:1	15.76
S-21120	400 ct	200 ct	50	2.0	1.5	.05	5	32	22	5.5	1.41:1	2.83:1	15.76
S-21125	400 ct	400 ct	100	2.0	1.5	.05	5	32	44	11	1:1	2:1	15.76
S-21130	400 ct	1000 ct	250	2.0	1.5	.05	5	32	110	27.5	1:1.58	1.26:1	15.76
S-21135	400 ct	2000 ct	500	2.0	1.5	.05	5	32	220	55	1:2.24	1:1.12	15.76
S-21140	400 ct	4000 ct	1000	2.0	1.5	.05	5	32	440	110	1:3.16	1:1.58	15.76
S-21142	500 ct	12.8 ct	3.2	2.0	1.5	.05	4.5	40	1.41	.35	6.25:1	12.5:1	15.76
S-21144	500 ct	16 ct	4	2.0	1.5	.05	4.5	40	1.76	.44	5.6:1	11.2:1	15.76
S-21145	500 ct	50 ct	12.5	2.0	1.5	.05	4.5	40	5.5	1.38	3.16:1	6.32:1	15.76
S-21147	500 ct	150 ct	37.5	2.0	1.5	.05	4.5	40	16.5	4.13	1.83:1	3.65:1	15.76
S-21150	500 ct	500 ct	125	2.0	1.5	.05	4.5	40	55	13.75	1:1	2:1	15.76
S-21155	*500 ct	500 ct	-	2.0	1.5	.05	4.5	40	55	-	1:1	-	16.42
S-21160	500 ct	600 ct	150	2.0	1.5	.05	4.5	40	66	16.5	1:1.1	1.83:1	15.76
S-21165	600 ct	12.8 ct	3.2	2.0	1.5	.05	4	48	1.41	.35	6.85:1	13.7	15.76
S-21167	600 ct	30 ct	7.5	2.0	1.5	.05	4	48	3.3	.83	4.47:1	8.94:1	15.76
S-21170	600 ct	48 ct	12	2.0	1.5	.05	4	48	5.28	1.37	3.54:1	7.07:1	15.76
S-21175	600 ct	200 ct	50	2.0	1.5	.05	4	48	22	5.5	1.73:1	3.46:1	15.76
S-21180**	600 ct	600 ct	150	2.0	1.5	.05	4	48	66	16.5	1:1	2:1	15.76
S-21185**	*600 ct	600 ct	-	2.0	1.5	.05	4	48	66	-	1:1	-	16.42
S-21186**	*600 ct	900 ct	-	2.0	1.5	.05	4	48	99	-	1:1.22	-	16.42
S-21187**	600 ct	1200 ct	300	2.0	1.5	.05	4	48	132	33	1:1.41	1.41:1	15.76
S-21190	640 ct	12.8 ct	3.2	2.0	1.5	.05	4	51	1.41	.35	7.07:1	14.14:1	15.76
S-21195	700 ct	100 ct	25	2.0	1.5	.05	3.5	56	11	2.75	2.65:1	5.29:1	15.76
S-21200	800 ct	12.8 ct	3.2	2.0	1.5	.05	3.5	64	1.41	.35	7.91:1	15.8:1	15.76
S-21205	800 ct	48 ct	12	2.0	1.5	.05	3.5	64	5.28	1.32	4.08:1	8.16:1	15.76
S-21210	800 ct	800 ct	200	2.0	1.5	.05	3.5	64	88	22	1:1	2:1	15.76
S-21215	900 ct	600 ct	150	2.0	1.5	.05	3	72	66	16.5	1.23:1	2.45:1	15.76
S-21217**	*900 ct	900 ct	-	2.0	1.5	.05	3	72	99	-	1:1	-	16.42
S-21220	1000 ct	12 ct	3	2.0	1.5	.05	3	80	1,32	.33	9.13:1	18.26:1	15.76
S-21225	1000 ct	50 ct	12.5	2.0	1.5	.05	3	80	5.5	1.38	4.47:1	8.94:1	15.76
S-21230	1000 ct	1000 ct	250	2.0	1.5	.05	3	80	110	27.5	1:1	2:1	15.76
S-21235	1060 ct	12.8 ct	3.2	2.0	1.5	.05	3	85	1.41	.35	9.1:1	18.2:1	15.76
S-21240	1200 ct	12.8 ct	3.2	2.0	1.5	.05	3	96	1.41	.35	9.68:1	19.4:1	15.76
S-21245	1200 ct	500 ct	125	2.0	1.5	.05	3	96	55	13.75	1.55:1	3.1:1	15.76
S-21250	1200 ct	1200 ct	300	2.0	1.5	.05	3	96	132	33	1:1	2:1	15.76
S-21255	*1200 ct	1200 ct	-	2.0	1.5	.05	3	96	132	-	1:1	-	16.42
S-21260	1500 ct	12 ct	3	2.0	1.5	.05	2.5	120	1,32	.33	11.18:1	22.36:1	15.76
S-21265	1500 ct	500 ct	125	2.0	1.5	.05	2.5	120	55	13.75	1.73:1	3.46:1	15.76
S-21270	*1500 ct	600 ct	-	2.0	1.5	.05	2.5	120	66	-	1.58:1	-	16.42
S-21275	*1500 ct	1500 ct	-	2.0	1.5	.05	2.5	120	165	-	1:1	-	16.42
S-21280	1600 ct	12.8 ct	3.2	2.0	1.5	.05	2.5	128	1.41	.35	11.18:1	22.36:1	15.76
S-21283	2000 ct	8 ct	2	2.0	1.5	.05	2.2	160	.88	.22	15.8:1	31.6:1	15.76
S-21285	2000 ct	2000 ct	500	2.0	1.5	.05	2.2	160	220	55	1:1	2:1	15.76
S-21290	*2000 ct	2000 ct	-	2.0	1.5	.05	2.2	160	220	-	1:1	-	16.42
S-21295	2000 ct	8000 ct	2000	2.0	1.5	.05	2.2	160	880	220	1:2	1:1	16.42
S-21297	2500 ct	2500 ct	625	2.0	1.5	.05	2	200	275	69	1:1	2:1	16.42
S-21300	3000 ct	3000 ct	750	2.0	1.5	.05	1.8	240	330	83	1:1	2:1	16.42
S-21305	*3000 ct	3000 ct	-	2.0	1.5	.05	1.8	240	330	-	1:1	-	16.42

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED-TELEPHONE COUPLING APPLICATION

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

PICO Electronic$, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO PART NUMBER S-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9*** S-Series
		SER	PAR	1KHz and higher	300 Hz and higher	50 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	
S-21310	3600 ct	3600 ct	900	2.0	1.5	.05	1.7	288	396	99	1:1	2:1	16.42
S-21312	4000 ct	16 ct	4	2.0	1.5	.05	1.6	320	1.76	.44	15.8:1	31.6:1	16.42
S-21314**	4000 ct	600 ct	150	2.0	1.5	.05	1.6	320	66	16.5	2.58:1	5.16:1	16.42
S-21315	4000 ct	1000 ct	250	2.0	1.5	.05	1.6	320	110	27.5	2:1	4:1	16.42
S-21320	*4000 ct	8000 ct	-	2.0	1.5	.05	1.6	320	880	-	1:1.41	-	16.42
S-21325	5000 ct	500 ct	125	2.0	1.5	.05	1.4	400	55	13.8	3.16:1	6.32:1	15.76
S-21330	5000 ct	5000 ct	1250	2.0	1.5	.05	1.4	400	550	138	1:1	2:1	15.76
S-21335	7500 ct	50 ct	12.5	1.3	1.3	.05	1.2	600	5.5	1.38	12.25:1	24.5:1	17.48
S-21340	7500 ct	100 ct	25	1.3	1.3	.05	1.2	600	11	2.75	8.66:1	17.32:1	17.48
S-21345	7500 ct	600 ct	150	1.3	1.3	.05	1.2	600	66	16.5	3.54:1	7.07:1	17.48
S-21350	7500 ct	2500 ct	625	1.3	1.3	.05	1.2	600	275	69	1.73:1	3.46:1	17.48
S-21355	*7500 ct	7500 ct	-	1.3	1.3	.05	1.2	600	825	-	1:1	-	18.72
S-21360	8000 ct	12.8 ct	3.2	1.2	1.2	.05	1.1	640	1.4	.35	25:1	50:1	17.48
S-21365	8000 ct	1000 ct	250	1.2	1.2	.05	1.1	640	110	27.5	2.83:1	5.66:1	17.48
S-21370	*8000 ct	1200 ct	-	1.2	1.2	.05	1.1	640	132	-	2.58:1	-	18.72
S-21375	*9000 ct	9000 ct	-	1.1	1.1	.05	1.1	720	990	-	1:1	-	18.72
S-21380	10,000 ct	12.8 ct	3.2	1.0	1.0	.05	1	800	1.4	.35	28:1	56:1	17.48
S-21385	10,000 ct	16 ct	4	1.0	1.0	.05	1	800	1.76	.44	25:1	50:1	17.48
S-21390	10,000 ct	100 ct	25	1.0	1.0	.05	1	800	11	2.75	10:1	20:1	17.48
S-21395	10,000 ct	200 ct	50	1.0	1.0	.05	1	800	22	5.5	7.07:1	14.14:1	17.48
S-21400	10,000 ct	500 ct	125	1.0	1.0	.05	1	800	55	13.75	4.47:1	8.94:1	17.48
S-21405	10,000 ct	600 ct	150	1.0	1.0	.05	1	800	66	16.5	4.08:1	8.16:1	17.48
S-21410	10,000 ct	1000 ct	250	1.0	1.0	.05	1	800	110	27.5	3.16:1	6.32:1	17.48
S-21415	10,000 ct	1200 ct	300	1.0	1.0	.05	1	800	132	33	2.89:1	5.77:1	17.48
S-21420	10,000 ct	1500 ct	375	1.0	1.0	.05	1	800	165	41.3	2.58:1	5.16:1	17.48
S-21425	10,000 ct	2000 ct	500	1.0	1.0	.05	1	800	220	55	2.24:1	4.47:1	17.48
S-21430	10,000 ct	5000 ct	1250	1.0	1.0	.05	1	800	550	138	1.41:1	2.83:1	17.48
S-21435	10,000 ct	7500 ct	1875	1.0	1.0	.05	1	800	825	206	1.16:1	2.31:1	17.48
S-21440	10,000 ct	10,000 ct	2500	1.0	1.0	.05	1	800	1100	275	1:1	2:1	17.48
S-21445	*10,000 ct	10,000 ct	-	1.0	1.0	.05	1	800	1100	-	1:1	-	18.72
S-21450	15,000 ct	400 ct	100	.65	.65	.05	.8	1200	44	11	6.12:1	12.25:1	17.48
S-21452	15,000 ct	500 ct	125	.65	.65	.05	.8	1200	55	13.8	5.48:1	10.95:1	17.48
S-21455	15,000 ct	600 ct	150	.65	.65	.05	.8	1200	66	16.5	5:1	10:1	17.48
S-21460	15,000 ct	10,000 ct	2500	.65	.65	.05	.8	1200	1100	275	1.22:1	2.45:1	17.48
S-21465	*15,000 ct	15,000 ct	-	.65	.65	.05	.8	1200	1650	-	1:1	-	18.72
S-21470	15,000 ct	15,000 ct	3750	.65	.65	.05	.8	1200	1650	413	1:1	2:1	17.48
S-21475	16,000 ct	1000 ct	250	.62	.62	.05	.8	1280	110	27.5	4:1	8:1	17.48
S-21480	20,000 ct	500 ct	125	.5	.5	.05	.7	1600	55	13.8	6.32:1	12.65:1	18.72
S-21485	20,000 ct	600 ct	150	.5	.5	.05	.7	1600	66	16.5	5.77:1	11.55:1	18.72
S-21490	20,000 ct	800 ct	200	.5	.5	.05	.7	1600	88	22	5:1	10:1	18.72
S-21495	20,000 ct	1000 ct	250	.5	.5	.05	.7	1600	110	27.5	4.47:1	8.94:1	18.72
S-21500	20,000 ct	5000 ct	1250	.5	.5	.05	.7	1600	550	138	2:1	4:1	18.72
S-21505	20,000 ct	10,000 ct	2500	.5	.5	.05	.7	1600	1100	275	1.41:1	2.83:1	18.72
S-21510	*20,000 ct	20,000 ct	-	.5	.5	.05	.7	1600	2200	-	1:1	-	19.46
S-21515	25,000 ct	500 ct	125	.4	.4	.05	.6	2000	55	13.8	7.07:1	14.14:1	18.72
S-21520	25,000 ct	1000 ct	250	.4	.4	.05	.6	2000	110	27.5	5:1	10:1	18.72
S-21525	30,000 ct	50 ct	12.5	.33	.33	.05	.6	2400	5.5	1.38	24.5:1	49:1	19.46
S-21530	30,000 ct	1200 ct	300	.33	.33	.05	.6	2400	132	33	5:1	10:1	19.46
S-21532	30,000 ct	500 ct	125	.33	.33	.05	.6	2400	55	13.8	7.7:1	15.5:1	19.46
S-21534	30,000 ct	200 ct	50	.33	.33	.05	.6	2400	22	5.5	12.2:1	24.5:1	19.46
S-21535	30,000 ct	5000 ct	1250	.33	.33	.05	.6	2400	550	137.5	2.45:1	4.9:1	19.46
S-21540	30,000 ct	10,000 ct	2500	.33	.33	.05	.6	2400	1100	275	1.73:1	3.46:1	19.46
S-21545	*30,000 ct	30,000 ct	-	.33	.33	.05	.6	2400	3300	-	1:1	-	20.91
S-21550	40,000 ct	400 ct	100	.25	.25	.05	.5	3200	44	11	10:1	20:1	20.91
S-21555	40,000 ct	2000 ct	500	.25	.25	.05	.5	3200	220	55	4.47:1	8.94:1	20.91
S-21560	40,000 ct	4000 ct	1000	.25	.25	.05	.5	3200	440	110	3.16:1	6.32:1	20.91
S-21565	40,000 ct	20,000 ct	5000	.25	.25	.05	.5	3200	2200	550	1.41:1	2.83:1	20.91
S-21570	*40,000 ct	40,000 ct	-	.25	.25	.05	.5	3200	4400	-	1:1	-	23.28
S-21575	50,000 ct	200 ct	50	.2	.2	.05	.4	4000	22	5.5	15.8:1	31.6:1	23.28
S-21577	50,000 ct	500 ct	125	.2	.2	.05	.4	4000	55	13.8	10:1	20:1	23.28
S-21578	50,000 ct	600 ct	150	.2	.2	.05	.4	4000	66	16.5	9.13:1	18.26:1	23.28
S-21579	50,000 ct	50,000 ct	12,500	.2	.2	.05	.4	4000	5500	1380	1:1	2:1	23.28
S-21580	60,000 ct	15,000 ct	3750	.16	.16	.05	.4	4800	1650	413	2:1	4:1	25.14
S-21585	62,500 ct	50 ct	12.5	.16	.16	.05	.4	5000	5.5	1.38	35.4:1	70.7:1	25.14
S-21587	80,000 ct	15,000 ct	3750	.12	.12	.05	.3	6400	1650	413	2.3:1	4.6:1	25.14
S-21590	90,000 ct	10,000 ct	2500	.11	.11	.05	.3	7200	1100	275	3:1	6:1	26.39
S-21595	95,000 ct	15,000 ct	3750	.1	.1	.05	.3	7600	1650	413	2.5:1	5:1	26.39
S-21600	100,000 ct	60 ct	15	.1	.1	.05	.3	8000	6.6	1.65	40.8:1	81.6:1	26.39
S-21605	100,000 ct	100 ct	25	.1	.1	.05	.3	8000	11	2.75	31.6:1	63.2:1	26.39
S-21610	100,000 ct	500 ct	125	.1	.1	.05	.3	8000	55	13.8	14.1:1	28.3:1	26.39
S-21613	100,000 ct	1000 ct	250	.1	.1	.05	.3	8000	110	27.5	10:1	20:1	26.39
S-21614	100,000 ct	2000 ct	500	.1	.1	.05	.3	8000	220	55	7.07:1	14.14:1	26.39
S-21615	100,000 ct	10,000 ct	2500	.1	.1	.05	.3	8000	1100	275	3.16:1	6.32:1	26.39
S-21620	135,000 ct	82 ct	20.5	.07	.07	.05	.2	10,800	9	2.25	40.6:1	81.2:1	27.57

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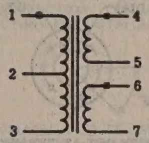
PICO's ultra-miniature transformers

S SERIES Plug-In

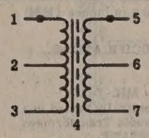
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

phone
914-699-5514

For Immediate Action please use return card, Vol. 4, or call 800-431-1064

• Delivery— stock to one week

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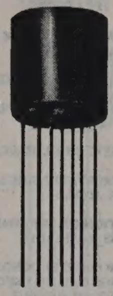
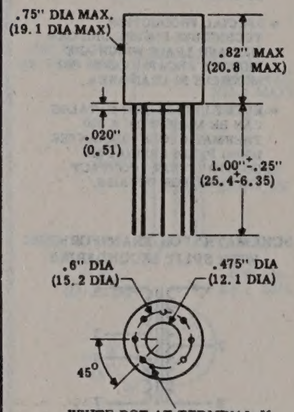
T SERIES Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27:** . . . .
All Units Meet MIL-T-27 And Are Hermetically Sealed in a Metal Case, Audio Transformers Are Type TF5R21ZZ.

- **FREQUENCY RESPONSE:** . . .
± 3 db, 20 Hz - 25 KHz at 1.0 Milliwatt.

- **MAXIMUM DISTORTION:** . . .
5% With Rated Power Level at 1 KHz and 300 Hz. 10% Distortion at 20 Hz.

- **DIELECTRIC STRENGTH:** . . .
All Units Tested at 200 V RMS.

- **INSULATION RESISTANCE:** . .
Greater Than 10,000 Megohms at 300 V DC.

- **WEIGHT:** . . . .
28 Grams

- **OPERATING TEMPERATURE:** .
-55°c to 105°c (All Units Can Be Supplied to Class S Requirements 130°c Maximum).

- **TERMINALS:** . . . .
Solid .020 Conductor, Copper Clad Steel Tinned 100%, Electroplated Per MIL-T-10727A and ASTM CCS B452

- **THERMAL SHOCK:** . . . . . .
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1

This Product is Patented

Delivery— stock to one week

PICO PART NUMBER T-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	20 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	T-Series
T-22003	20 ct	8 ct	2	3.0	2.0	.006	22	1.6	.8	.2	1.58:1	3.16:1	17.32
T-22005	20 ct	20 ct	5	3.0	2.0	.006	22	1.6	2	.5	1:1	2:1	17.32
T-22010	32 ct	32 ct	8	3.0	2.0	.006	17.5	2.56	3.2	.8	1:1	2:1	17.32
T-22015	40 ct	40 ct	10	3.0	2.0	.006	16	3.2	4	1	1:1	2:1	17.32
T-22018	48 ct	16 ct	4	3.0	2.0	.006	14.5	3.84	1.6	.4	1.73:1	3.46:1	17.32
T-22020	50 ct	50 ct	12.5	3.0	2.0	.006	14	4	5	1.25	1:1	2:1	17.32
T-22025	80 ct	32 ct	8	3.0	2.0	.006	11	6.4	3.2	.8	1.58:1	3.16:1	17.32
T-22028	100 ct	40 ct	10	3.0	2.0	.006	10	8	4	1	1.58:1	3.16:1	17.32
T-22030	100 ct	100 ct	25	3.0	2.0	.006	10	8	10	2.5	1:1	2:1	17.32
T-22035	120 ct	12.8 ct	3.2	3.0	2.0	.006	9	9.6	1.3	.32	3.06:1	6.12:1	17.32
T-22040	120 ct	60 ct	15	3.0	2.0	.006	9	9.6	6	1.5	1.41:1	2.83:1	17.32
T-22045	120 ct	120 ct	30	3.0	2.0	.006	9	9.6	12	3	1:1	2:1	17.32
T-22050	150 ct	12 ct	3	3.0	2.0	.006	8	12	1.2	.3	3.54:1	7.08:1	17.32
T-22055	150 ct	50 ct	12.5	3.0	2.0	.006	8	12	5	1.25	1.73:1	3.46:1	17.32
T-22060	150 ct	100 ct	25	3.0	2.0	.006	8	12	10	2.5	1.22:1	2.44:1	17.32
T-22065	150 ct	150 ct	37.5	3.0	2.0	.006	8	12	15	3.75	1:1	2:1	17.32
T-22070	150 ct	600 ct	150	3.0	2.0	.006	8	12	60	15	1:2	1:1	17.32
T-22075	200 ct	200 ct	50	3.0	2.0	.006	7	16	20	5	1:1	2:1	17.32
T-22080	300 ct	12 ct	3	3.0	2.0	.006	5.5	24	1.2	.3	5:1	10:1	17.32
T-22085	300 ct	50 ct	12.5	3.0	2.0	.006	5.5	24	5	1.25	2.45:1	4.9:1	17.32
T-22090	300 ct	150 ct	37.5	3.0	2.0	.006	5.5	24	15	3.75	1.41:1	2.83:1	17.32
T-22095	300 ct	300 ct	75	3.0	2.0	.006	5.5	24	30	7.5	1:1	2:1	17.32
T-22100	300 ct	600 ct	150	3.0	2.0	.006	5.5	24	60	15	1:1.41	1.41:1	17.32
T-22105	320 ct	12.8 ct	3.2	3.0	2.0	.006	5.5	25.6	1.3	.32	5:1	10:1	17.32
T-22110	400 ct	40 ct	10	3.0	2.0	.006	5	32	4	1	3.16:1	6.32:1	17.32
T-22115	400 ct	120 ct	30	3.0	2.0	.006	5	32	12	3	1.83:1	3.65:1	17.32
T-22120	400 ct	200 ct	50	3.0	2.0	.006	5	32	20	5	1.41:1	2.83:1	17.32
T-22125	400 ct	400 ct	100	3.0	2.0	.006	5	32	40	10	1:1	2:1	17.32
T-22130	400 ct	1000 ct	250	3.0	2.0	.006	5	32	100	25	1:1.58	1.26:1	17.32
T-22135	400 ct	2000 ct	500	3.0	2.0	.006	5	32	200	50	1:2.24	1:1.12	17.32
T-22140	400 ct	4000 ct	1000	3.0	2.0	.006	5	32	400	100	1:3.16	1:1.58	17.32
T-22142	500 ct	12.8 ct	3.2	3.0	2.0	.006	4.5	40	1.3	.32	6.25:1	12.5:1	17.32
T-22144	500 ct	16 ct	4	3.0	2.0	.006	4.5	40	1.6	.4	5.6:1	11.2:1	17.32
T-22145	500 ct	50 ct	12.5	3.0	2.0	.006	4.5	40	5	1.25	3.16:1	6.32:1	17.32
T-22147	500 ct	150 ct	37.5	3.0	2.0	.006	4.5	40	15	3.75	1.83:1	3.65:1	17.32
T-22150	500 ct	500 ct	125	3.0	2.0	.006	4.5	40	50	12.5	1:1	2:1	17.32
T-22155	*500 ct	500 ct	-	3.0	2.0	.006	4.5	40	50	-	1:1	-	18.05
T-22160	500 ct	600 ct	150	3.0	2.0	.006	4.5	40	60	15	1:1.1	1.83:1	17.32
T-22165	600 ct	12.8 ct	3.2	3.0	2.0	.006	4	48	1.3	.32	6.85:1	13.7:1	17.32
T-22167	600 ct	30 ct	7.5	3.0	2.0	.006	4	48	3	.75	4.47:1	8.94:1	17.32
T-22170	600 ct	48 ct	12	3.0	2.0	.006	4	48	4.8	1.2	3.54:1	7.07:1	17.32
T-22175	600 ct	200 ct	50	3.0	2.0	.006	4	48	20	5	1.73:1	3.46:1	17.32
T-22180**	600 ct	600 ct	150	3.0	2.0	.006	4	48	60	15	1:1	2:1	17.32
T-22185**	*600 ct	600 ct	-	3.0	2.0	.006	4	48	60	-	1:1	-	18.05
T-22186**	*600 ct	900 ct	-	3.0	2.0	.006	4	48	90	-	1:1.22	-	18.05
T-22187**	600 ct	1200 ct	300	3.0	2.0	.006	4	48	120	30	1:1.41	1.41:1	17.32
T-22190	640 ct	12.8 ct	3.2	3.0	2.0	.006	4	51	1.3	.32	7.07:1	14.14:1	17.32
T-22195	700 ct	100 ct	25	3.0	2.0	.006	3.5	56	10	2.5	2.65:1	5.29:1	17.32
T-22200	800 ct	12.8 ct	3.2	3.0	2.0	.006	3.5	64	1.3	.32	7.91:1	15.8:1	17.32
T-22205	800 ct	48 ct	12	3.0	2.0	.006	3.5	64	4.8	1.2	4.08:1	8.16:1	17.32
T-22210	800 ct	800 ct	200	3.0	2.0	.006	3.5	64	80	20	1:1	2:1	17.32
T-22215	900 ct	600 ct	150	3.0	2.0	.006	3	72	60	15	1.22:1	2.45:1	17.32
T-22217**	*900 ct	900 ct	-	3.0	2.0	.006	3	72	90	-	1:1	-	18.05
T-22220	1000 ct	12 ct	3	3.0	2.0	.006	3	80	1.2	.3	9.13:1	18.26:1	17.32
T-22225	1000 ct	50 ct	12.5	3.0	2.0	.006	3	80	5	1.25	4.47:1	8.94:1	17.32
T-22230	1000 ct	1000 ct	250	3.0	2.0	.006	3	80	100	25	1:1	2:1	17.32
T-22235	1060 ct	12.8 ct	3.2	3.0	2.0	.006	3	85	1.3	.32	9.1:1	18.2:1	17.32
T-22240	1200 ct	12.8 ct	3.2	3.0	2.0	.006	3	96	1.3	.32	9.68:1	19.4:1	17.32
T-22245	1200 ct	500 ct	125	3.0	2.0	.006	3	96	50	12.5	1.55:1	3.1:1	17.32
T-22250	1200 ct	1200 ct	300	3.0	2.0	.006	3	96	120	30	1:1	2:1	17.32
T-22255	*1200 ct	1200 ct	-	3.0	2.0	.006	3	96	120	-	1:1	-	18.05
T-22260	1500 ct	12 ct	3	3.0	2.0	.006	2.5	120	1.2	.3	11.18:1	22.36:1	17.32
T-22265	1500 ct	500 ct	125	3.0	2.0	.006	2.5	120	50	12.5	1.73:1	3.46:1	17.32
T-22270	*1500 ct	600 ct	-	3.0	2.0	.006	2.5	120	60	-	1.58:1	-	18.05
T-22275	*1500 ct	1500 ct	-	3.0	2.0	.006	2.5	120	150	-	1:1	-	18.05
T-22280	1600 ct	12.8 ct	3.2	3.0	2.0	.006	2.5	128	1.3	.32	11.18:1	22.36:1	17.32
T-22283	2000 ct	8 ct	2	3.0	2.0	.006	2.2	160	.8	.2	15.8:1	31.6:1	17.32
T-22285	2000 ct	2000 ct	500	3.0	2.0	.006	2.2	160	200	50	1:1	2:1	17.32
T-22290	*2000 ct	2000 ct	-	3.0	2.0	.006	2.2	160	200	-	1:1	-	18.05
T-22295	2000 ct	8000 ct	2000	3.0	2.0	.006	2.2	160	800	200	1:2	1:1	17.32
T-22297	2500 ct	2500 ct	625	3.0	2.0	.006	2	200	250	63	1:1	2:1	17.32
T-22300	3000 ct	3000 ct	750	3.0	2.0	.006	1.8	240	300	75	1:1	2:1	17.32
T-22305	*3000 ct	3000 ct	-	3.0	2.0	.006	1.8	240	300	-	1:1	-	17.32

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

PICO PART NUMBER T-Series Plug-in	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS			PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***
		SER	PAR	1KHz and higher	300 Hz and higher	20 Hz and higher			SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	T-Series
T-22310	3600 ct	3600 ct	900	2.7	2.0	.006	1.7	288	360	90	1:1	2:1	17.32
T-22312	4000 ct	16 ct	4	2.5	2.0	.006	1.6	320	1.6	.4	15.8:1	31.6:1	17.32
T-22314**	4000 ct	600 ct	150	2.5	2.0	.006	1.6	320	60	15	2.58:1	5.16:1	17.32
T-22315	4000 ct	1000 ct	250	2.5	2.0	.006	1.6	320	100	25	2:1	4:1	17.32
T-22320	*4000 ct	8000 ct	-	2.5	2.0	.006	1.6	320	800	-	1:1.41	-	18.05
T-22325	5000 ct	500 ct	125	2.0	2.0	.006	1.4	400	50	12.5	3.16:1	6.32:1	17.32
T-22330	5000 ct	5000 ct	1250	2.0	2.0	.006	1.4	400	500	125	1:1	2:1	17.32
T-22335	7500 ct	50 ct	12.5	1.3	1.3	.006	1.2	600	5	1.25	12.25:1	24.5:1	19.22
T-22340	7500 ct	100 ct	25	1.3	1.3	.006	1.2	600	10	2.5	8.66:1	17.32:1	19.22
T-22345	7500 ct	600 ct	150	1.3	1.3	.006	1.2	600	60	15	3.54:1	7.07:1	19.22
T-22350	7500 ct	2500 ct	625	1.3	1.3	.006	1.2	600	250	63	1.73:1	3.46:1	19.22
T-22355	*7500 ct	7500 ct	-	1.3	1.3	.006	1.2	600	750	-	1:1	-	20.59
T-22360	8000 ct	12.8 ct	3.2	1.2	1.2	.006	1.1	640	1.3	.32	25:1	50:1	19.22
T-22365	8000 ct	1000 ct	250	1.2	1.2	.006	1.1	640	100	25	2.83:1	5.66:1	19.22
T-22370	*8000 ct	1200 ct	-	1.2	1.2	.006	1.1	640	120	-	2.58:1	-	20.59
T-22375	*9000 ct	9000 ct	-	1.1	1.1	.006	1.1	720	900	-	1:1	-	20.59
T-22380	10,000 ct	12.8 ct	3.2	1.0	1.0	.006	1	800	1.3	.32	28:1	56:1	19.22
T-22385	10,000 ct	16 ct	4	1.0	1.0	.006	1	800	1.6	.4	25:1	50:1	19.22
T-22390	10,000 ct	100 ct	25	1.0	1.0	.006	1	800	10	2.5	10:1	20:1	19.22
T-22395	10,000 ct	200 ct	50	1.0	1.0	.006	1	800	20	5	7.07:1	14.14:1	19.22
T-22400	10,000 ct	500 ct	125	1.0	1.0	.006	1	800	50	12.5	4.47:1	8.94:1	19.22
T-22405	10,000 ct	600 ct	150	1.0	1.0	.006	1	800	60	15	4.08:1	8.16:1	19.22
T-22410	10,000 ct	1000 ct	250	1.0	1.0	.006	1	800	100	25	3.16:1	6.32:1	19.22
T-22415	10,000 ct	1200 ct	300	1.0	1.0	.006	1	800	120	30	2.89:1	5.77:1	19.22
T-22420	10,000 ct	1500 ct	375	1.0	1.0	.006	1	800	150	38	2.58:1	5.16:1	19.22
T-22425	10,000 ct	2000 ct	500	1.0	1.0	.006	1	800	200	50	2.24:1	4.47:1	19.22
T-22430	10,000 ct	5000 ct	1250	1.0	1.0	.006	1	800	500	125	1.41:1	2.83:1	19.22
T-22435	10,000 ct	7500 ct	1875	1.0	1.0	.006	1	800	750	188	1.16:1	2.31:1	19.22
T-22440	10,000 ct	10,000 ct	2500	1.0	1.0	.006	1	800	1000	250	1:1	2:1	19.22
T-22445	*10,000 ct	10,000 ct	-	1.0	1.0	.006	1	800	1000	-	1:1	-	20.59
T-22450	15,000 ct	400 ct	100	.66	.66	.006	.8	1200	40	10	6.12:1	12.25:1	19.22
T-22452	15,000 ct	500 ct	125	.66	.66	.006	.8	1200	50	12.5	5.48:1	10.95:1	19.22
T-22455	15,000 ct	600 ct	150	.66	.66	.006	.8	1200	60	15	5:1	10:1	19.22
T-22460	15,000 ct	10,000 ct	2500	.66	.66	.006	.8	1200	1000	250	1.22:1	2.45:1	19.22
T-22465	*15,000 ct	15,000 ct	-	.66	.66	.006	.8	1200	1500	-	1:1	-	20.59
T-22470	15,000 ct	15,000 ct	3750	.66	.66	.006	.8	1200	1500	375	1:1	2:1	19.22
T-22475	16,000 ct	1000 ct	250	.62	.62	.006	.8	1280	100	25	4:1	8:1	19.22
T-22480	20,000 ct	500 ct	125	.5	.5	.006	.7	1600	50	12.5	6.32:1	12.65:1	20.59
T-22485	20,000 ct	600 ct	150	.5	.5	.006	.7	1600	60	15	5.77:1	11.55:1	20.59
T-22490	20,000 ct	800 ct	200	.5	.5	.006	.7	1600	80	20	5:1	10:1	20.59
T-22495	20,000 ct	1000 ct	250	.5	.5	.006	.7	1600	100	25	4.47:1	8.94:1	20.59
T-22500	20,000 ct	5000 ct	1250	.5	.5	.006	.7	1600	500	125	2:1	4:1	20.59
T-22505	20,000 ct	10,000 ct	2500	.5	.5	.006	.7	1600	1000	250	1.41:1	2.83:1	20.59
T-22510	*20,000 ct	20,000 ct	-	.5	.5	.006	.7	1600	2000	-	1:1	-	21.40
T-22515	25,000 ct	500 ct	125	.4	.4	.006	.6	2000	50	12.5	7.07:1	14.14:1	20.59
T-22520	25,000 ct	1000 ct	250	.4	.4	.006	.6	2000	100	25	5:1	10:1	20.59
T-22525	30,000 ct	50 ct	12.5	.33	.33	.006	.6	2400	5	1.25	24.5:1	49:1	21.40
T-22530	30,000 ct	1200 ct	300	.33	.33	.006	.6	2400	120	30	5:1	10:1	21.40
T-22532	30,000 ct	500 ct	125	.33	.33	.006	.6	2400	50	12.5	7.7:1	15.5:1	21.40
T-22534	30,000 ct	200 ct	50	.33	.33	.006	.6	2400	20	5	12.2:1	24.5:1	21.40
T-22535	30,000 ct	5000 ct	1250	.33	.33	.006	.6	2400	500	125	2.45:1	4.9:1	21.40
T-22540	30,000 ct	10,000 ct	2500	.33	.33	.006	.6	2400	1000	250	1.73:1	3.46:1	21.40
T-22545	*30,000 ct	30,000 ct	-	.33	.33	.006	.6	2400	3000	-	1:1	-	22.96
T-22550	40,000 ct	400 ct	100	.25	.25	.006	.5	3200	40	10	10:1	20:1	22.96
T-22555	40,000 ct	2000 ct	500	.25	.25	.006	.5	3200	200	50	4.47:1	8.94:1	22.96
T-22560	40,000 ct	4000 ct	1000	.25	.25	.006	.5	3200	400	100	3.16:1	6.32:1	22.96
T-22565	40,000 ct	20,000 ct	5000	.25	.25	.006	.5	3200	2000	500	1.41:1	2.83:1	22.96
T-22570	*40,000 ct	40,000 ct	-	.25	.25	.006	.5	3200	4000	-	1:1	-	25.60
T-22575	50,000 ct	200 ct	50	.2	.2	.006	.4	4000	20	5	15.8:1	31.6:1	25.60
T-22577	50,000 ct	500 ct	125	.2	.2	.006	.4	4000	50	12.5	10:1	20:1	25.60
T-22578	50,000 ct	600 ct	150	.2	.2	.006	.4	4000	60	15	9.13:1	18.26:1	25.60
T-22579	50,000 ct	50,000 ct	12,500	.2	.2	.006	.4	4000	5000	1250	1:1	2:1	25.60
T-22580	60,000 ct	15,000 ct	3750	.16	.16	.006	.4	4800	1500	375	2:1	4:1	27.64
T-22585	62,500 ct	50 ct	12.5	.16	.16	.006	.4	5000	5	1.25	35.4:1	70.7:1	27.64
T-22587	80,000 ct	15,000 ct	3750	.12	.12	.006	.3	6400	1500	375	2.3:1	4.6:1	27.64

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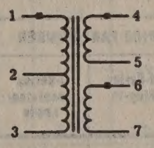
PICO's ultra-miniature transformers

T SERIES Plug-In

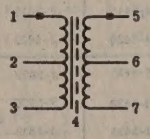
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



For Immediate Action please use return card, Vol. 4, or call 800-431-1064

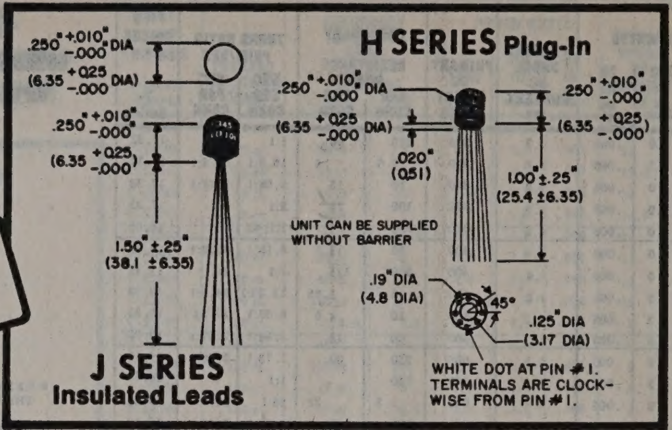
Delivery—
stock to one week

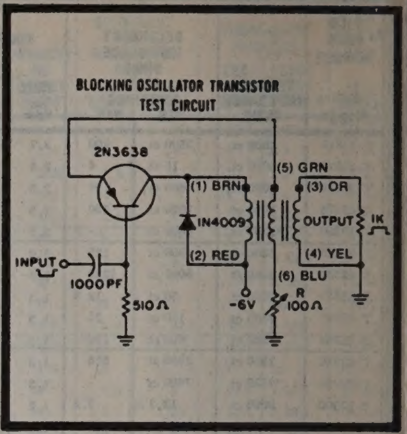
PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO's ultra-miniature PULSE transformers

1/4"x1/4"


.250" +.010" -.000" DIA
(6.35 +.025 -.000 DIA)
.250" +.010" -.000"
(6.35 +.025 -.000)
1.50" ±.25"
(38.1 ±6.35)
J SERIES
Insulated Leads
H SERIES Plug-In
.250" +.010" -.000" DIA
(6.35 +.025 -.000 DIA)
.250" +.010" -.000"
(6.35 +.025 -.000)
.020"
(.051)
1.00" ±.25"
(25.4 ±6.35)
UNIT CAN BE SUPPLIED WITHOUT BARRIER
.19" DIA
(4.8 DIA)
45°
.125" DIA
(3.17 DIA)
WHITE DOT AT PIN #1.
TERMINALS ARE CLOCKWISE FROM PIN #1.


BLOCKING OSCILLATOR TRANSISTOR TEST CIRCUIT
2N3638
(5) GRN
(1) BRN
(3) OR
1N4009
OUTPUT
1K
(2) RED
(4) YEL
INPUT
1000PF
(6) BLU
510Ω
-6V
R
100Ω

Dimensions are in inches (MM)

SPECIFICATIONS

- MIL-T-21038:
  Units Meet MIL-T-21038
  and are Hermetically Sealed in a Metal Case
- DIELECTRIC STRENGTH:
  All Units tested at 200 V RMS
- INSULATION RESISTANCE:
  Greater than 10,000 Megohms at 300 V DC
- WEIGHT:
  1.1 Grams
- OPERATING TEMPERATURE:
  -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- TERMINALS: . . . .
  Solid .012 Diameter Conductor.
  Conductor is copper clad steel,
  Tinned 100%. Electroplated Per
  MIL-T-10727A and ASTM CCS B452.
- THERMAL SHOCK:
  25 Cycles, Method 107C, MIL-STD-202D.
  Test Conduction A-1

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS							BLOCKING OSCILLATOR CIRCUIT					PICO PRICES 1-9 *	
H-Series Plug-In	J-Series Insulated Leads	P Width µSec	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp* in/out,	P Width µSec	Rise Time	% Over Shoot	Droop %	% Back Swing	H-Series	J-Series
H-5400	J-5600	0.05	0.2	0.01	0	0	20	50	0.05	0.01	0	0	35	13.60	12.48
H-5405	J-5605	0.1	0.5	0.015	0	0	20	50	0.1	0.012	0	0	25	13.60	12.48
H-5410	J-5610	0.2	1.2	0.02	0	0	20	100	0.2	0.02	0	0	15	13.60	12.48
H-5415	J-5615	0.5	1.5	0.023	0	5	25	100	0.5	0.023	0	5	15	13.60	12.48
H-5420	J-5620	1	1.5	0.025	0	20	28	100	1	0.03	0	10	15	13.60	12.48
H-5425	J-5625	2	1.5	0.028	0	15	23	100	2	0.035	0	10	15	13.60	12.48
H-5430	J-5630	3	1.5	0.030	0	15	28	100	3	0.04	0	10	15	13.60	12.48
H-5435	J-5635	5	2	0.035	0	20	20	200	5	0.040	0	15	15	13.60	12.48
H-5440	J-5640	10	2	0.05	0	25	25	200	10	0.060	0	15	10	13.60	12.48
H-5445	J-5645	15	2	0.06	0	25	18	200	15	0.07	0	15	15	13.60	12.48
H-5450	J-5650	25	3	0.1	0	30	30	500	25	0.08	0	15	15	13.60	12.48
H-5455	J-5655	50	3	0.3	0	20	20	500	50	0.2	0	10	5	13.60	12.48
H-5460	J-5660	100	6	0.4	0	15	18	500	100	0.35	0	10	15	13.60	12.48

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1V

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%**

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

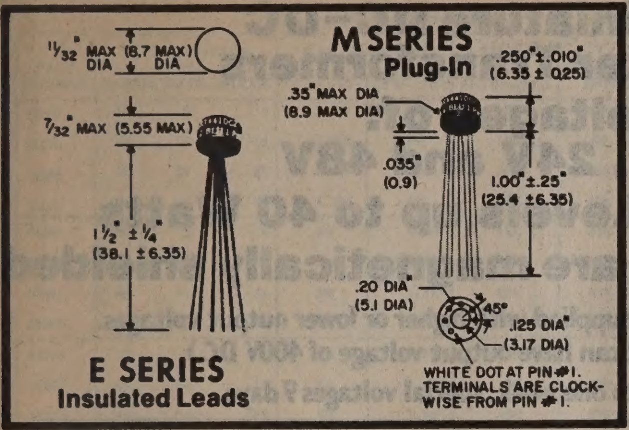
Delivery—stock to one week

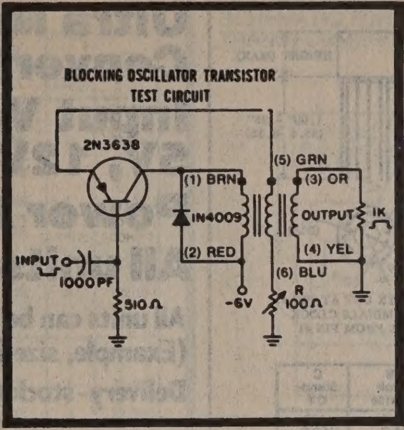
*"For Immediate Action please use return card, Vol. 4, or call **800-431-1064.**"*

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO's ultra-miniature PULSE transformers





Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-21038:** All Units Meet MIL-T-21038 and are Hermetically Sealed in a Metal Case
- **DIELECTRIC STRENGTH:** All Units tested at 200 V RMS
- **INSULATION RESISTANCE:** Greater than 10,000 Megohms at 300 V DC
- **WEIGHT:** 1/20 Ounce
- **OPERATING TEMPERATURE:** -55°c to 105°c (All Units Can be Supplied to Class S Requirements 130°c maximum)
- **TERMINALS:** Solid .012 Diameter Conductor. Conductor is copper clad steel, Tinned 100%. Electroplated Per MIL-T-10727A and ASTM CCS B452.
- **THERMAL SHOCK:** 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

This Product is Patented

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

MILITARY DESIGNATION TP6RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS								BLOCKING OSCILLATOR CIRCUIT					D.C. RESISTANCE			PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μSEC.	VOLT OUT	RISE TIME μSEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 2DB	P. WIDTH μSEC.	RISE TIME μSEC.	% OVER SHOOT	DROOP %	% BACK SWING	4 TNS BRN RED	4 TNS OR YEL	1 TURN GRN BLU	E-Series	M-Series
E5020	M5300	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.05	0.02	0	0	35	0.21	0.23	0.13	9.45	10.48
E5040	M5305	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.1	0.025	0	0	25	0.47	0.56	0.17	9.45	10.48
E5060	M5310	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	0.2	0.030	0	0	15	1.0	1.25	0.37	9.45	10.48
E5080	M5315	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	0.5	0.05	0	0	15	1.5	1.80	0.54	9.45	10.48
E5100	M5320	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	1	0.08	0	0	15	2.5	3.1	0.9	9.45	10.48
E5120	M5325	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	2	0.10	0	0	15	3.0	3.7	1.1	9.45	10.48
E5140	M5330	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	3	0.20	0	0	15	4.9	6.0	1.8	9.45	10.48
E5160	M5335	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	5	0.30	0	0	3	8.0	9.7	2.9	9.45	10.48
E5180	M5340	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	10	0.35	0	5	10	13.0	15.8	4.7	9.45	10.48

MILITARY DESIGNATION TP6RX5310CZ TURNS RATIO 5:3:1

															5 TURNS	3 TURNS	1 TURN		
E5200	M5345	0.1	8	0.01	0	0	5	140/50	170 KHz-32 MHz	0.1	0.01	0	0	20	0.55	0.40	0.15	9.45	10.48
E5220	M5350	1	8	0.05	0	6	10	280/100	12.5 KHz-3.3 MHz	1	0.02	5	5	5	3.0	2.2	0.9	9.45	10.48
E5240	M5355	5	8	0.09	0	12	25	560/200	15 KHz-4 MHz	5	0.05	0	10	10	9.5	7.0	2.6	9.45	10.48

MILITARY DESIGNATION TP6RX4440CZ TURNS RATIO 4:4:4

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS											PICO PRICES 1-9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH μ SEC.	VOLT OUT	RISE TIME μ SEC	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 2DB	4 TNS BRN RED	4 TNS OR YEL	4 TURNS GRN BLU	E-Series	M-Series
E5181	M-5356	0.05	10	0.018	0	0	10	50	150 KHz-30 MHz	0.21	0.23	0.25	10.48	10.48
E5182	M-5357	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0.47	0.56	0.67	10.48	10.48
E5183	M-5358	0.2	8	0.035	0	0	5	100	16 KHz-10 MHz	1.0	1.25	1.56	10.48	10.48
E5184	M-5359	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	1.5	1.80	2.2	10.48	10.48
E5185	M-5360	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	2.5	3.1	3.9	10.48	10.48
E5186	M-5361	2	8	0.17	0	0	10	100	2.2 KHz-1.3 MHz	3.0	3.7	4.6	10.48	10.48
E5187	M-5362	3	8	0.20	0	0	10	100	1.7 KHz-1.5 MHz	4.9	6.0	7.4	10.48	10.48
E5188	M-5363	5	8	0.20	0	15	25	200	1.8 KHz-1.5 MHz	8.0	9.7	11.8	10.48	10.48
E5189	M-5364	10	8	0.4	0	15	20	200	1.5 KHz-1.2 MHz	13.0	15.8	19.2	10.48	10.48

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1V

* **Discount Prices:** 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

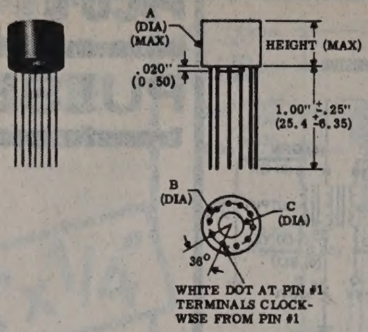
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

Delivery—
stock to one week

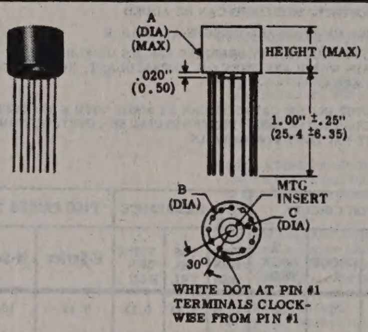
PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

All dimensions are in inches, ( )=MM



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—
5	.635 (16.12)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	6-32 UNC 8 Threads Deep

All dimensions are in inches, ( )=MM

Ultra Miniature DC-DC Converter Transformers

Input Voltages of: 5V, 12V, 24V and 48V

Power Levels up to 40 Watts

All units are magnetically shielded

All units can be supplied with higher or lower output voltages. (Example, size 2 can have output voltage of 400V D.C.)

Delivery- stock to one week, special voltages 9 days.

INPUT 5 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	-55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31020	10	5	± 5	1.5W	3W	15K	30K to 60K	1	22.38
31040	12	6	± 6	1.5W	3W	15K	30K to 60K	1	22.38
31060	28	14	±14	1.5W	3W	15K	30K to 60K	1	22.38
31080	48	24	±24	1.5W	3W	20K	40K to 60K	1	22.38
31100	100	50	±50	1.5W	3W	20K	40K to 60K	1	22.38
32105	10	5	± 5	3W	4.5W	15K	30K to 60K	2	22.38
32125	12	6	± 6	3W	4.5W	15K	30K to 60K	2	22.38
32145	28	14	±14	3W	4.5W	15K	30K to 60K	2	22.38
32165	48	24	±24	3W	4.5W	20K	40K to 60K	2	22.38
32185	100	50	±50	3W	4.5W	20K	40K to 60K	2	22.38
33103	10	5	± 5	5W	7.5W	10K	20K to 50K	3	22.38
33123	12	6	± 6	5W	7.5W	10K	20K to 50K	3	22.38
33143	28	14	±14	5W	7.5W	10K	20K to 50K	3	22.38
33163	48	24	±24	5W	7.5W	10K	20K to 50K	3	22.38
33183	100	50	±50	5W	7.5W	10K	20K to 50K	3	22.38
34500	10	5	± 5	10W	14W	10K	20K to 40K	4	22.38
34520	28	14	±14	10W	14W	10K	20K to 40K	4	22.38
34540	48	24	±24	10W	14W	10K	20K to 40K	4	22.38

** Lower switching frequency may be used at lower output power.

INPUT 12 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	-55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31120	12	6	± 6	1.5W	3W	15K	30K to 60K	1	22.38
31140	24	12	±12	1.5W	3W	15K	30K to 60K	1	22.38
31160	28	14	±14	1.5W	3W	15K	30K to 60K	1	22.38
31180	48	24	±24	1.5W	3W	20K	40K to 60K	1	22.38
31200	100	50	±50	1.5W	3W	20K	40K to 60K	1	22.38
32205	12	6	± 6	3W	4.5W	15K	30K to 60K	2	22.38
32225	24	12	±12	3W	4.5W	15K	30K to 60K	2	22.38
32245	28	14	±14	3W	4.5W	15K	30K to 60K	2	22.38
32265	48	24	±24	3W	4.5W	20K	40K to 60K	2	22.38
32285	100	50	±50	3W	4.5W	20K	40K to 60K	2	22.38
33203	12	6	± 6	5W	7.5W	15K	30K to 60K	3	22.38
33223	28	14	±14	5W	7.5W	15K	30K to 60K	3	22.38
33243	48	24	±24	5W	7.5W	20K	40K to 60K	3	22.38
33263	100	50	±50	5W	7.5W	20K	40K to 60K	3	22.38
34560	24	12	±12	10W	14W	15K	30K to 50K	4	22.38
34580	28	14	±14	10W	14W	15K	30K to 50K	4	22.38
34600	48	24	±24	10W	14W	15K	30K to 50K	4	22.38
35107	24	12	±12	17W	25W	15K	30K to 50K	5	33.57
35127	28	14	±14	17W	25W	15K	30K to 50K	5	33.57
35147	48	24	±24	17W	25W	15K	30K to 50K	5	33.57

**Lower switching frequency may be used at lower output power.

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

FEATURES

1) Units can be used as self-saturating or for linear switching applications. Operation over ambient temperature range from −55°c to +105°c. All units meet the requirements of MIL-T-27 (TF5S40ZZ)
2) All units can be supplied with higher or lower secondary voltages at the same power levels.
3) Secondary can be connected for full-wave bridge or dual bridge.
4) All units are magnetically shielded.

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

PICO
Electronics, Inc.

453 North Mac Questen Pkwy.
Mt. Vernon, New York 10552
phone
914-699-5514

INPUT 24 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c - +105°c	-55°c - +70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31220	10	5	±5	1.5W	3W	15K	30K to 60K	1	22.38
31240	28	14	±14	1.5W	3W	15K	30K to 60K	1	22.38
31260	48	24	±24	1.5W	3W	20K	40K to 60K	1	22.38
31280	100	50	±50	1.5W	3W	20K	40K to 60K	1	22.38
32305	10	5	±5	3W	4.5W	15K	30K to 60K	2	22.38
32325	28	14	±14	3W	4.5W	15K	30K to 60K	2	22.38
32345	48	24	±24	3W	4.5W	20K	40K to 60K	2	22.38
32365	100	50	±50	3W	4.5W	20K	40K to 60K	2	22.38
33283	10	5	±5	5W	7.5W	15K	30K to 60K	3	22.38
33303	28	14	±14	5W	7.5W	15K	30K to 60K	3	22.38
33323	48	24	±24	5W	7.5W	20K	40K to 60K	3	22.38
33343	100	50	±50	5W	7.5W	20K	40K to 60K	3	22.38
34620	28	14	±14	10W	14W	15K	30K to 50K	4	22.38
34640	48	24	±24	10W	14W	15K	30K to 50K	4	22.38
35167	24	12	±12	17W	25W	15K	30K to 50K	5	33.57
35187	28	14	±14	17W	25W	15K	30K to 50K	5	33.57
35207	48	24	±24	17W	25W	15K	30K to 50K	5	33.57
36705	48	24	±24	25W	40W	15K	30K to 40K	6	38.72
36725	56	28	±28	25W	40W	15K	30K to 40K	6	38.72

** Lower switching frequency may be used at lower output power.

INPUT 48 VOLTS

PART NUMBER	D.C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c - +105°c	-55°c - +70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31300	24	12	±12	1.5W	3W	15K	30K to 60K	1	22.38
31320	48	24	±24	1.5W	3W	20K	40K to 60K	1	22.38
31340	100	50	±50	1.5W	3W	20K	40K to 60K	1	22.38
31360	150	75	±75	1.5W	3W	20K	40K to 60K	1	22.38
32385	24	12	±12	3W	4.5W	15K	30K to 60K	2	22.38
32405	48	24	±24	3W	4.5W	20K	40K to 60K	2	22.38
32425	100	50	±50	3W	4.5W	20K	40K to 60K	2	22.38
32445	150	75	±75	3W	4.5W	20K	40K to 60K	2	22.38
33363	24	12	±12	5W	7.5W	15K	30K to 60K	3	22.38
33383	48	24	±24	5W	7.5W	20K	40K to 60K	3	22.38
33403	100	50	±50	5W	7.5W	20K	40K to 60K	3	22.38
33423	150	75	±75	5W	7.5W	20K	40K to 60K	3	22.38
34660	24	12	±12	10W	14W	15K	30K to 50K	4	22.38
34680	48	24	±24	10W	14W	15K	30K to 50K	4	22.38
34700	56	28	±28	10W	14W	15K	30K to 50K	4	22.38
35227	24	12	±12	17W	25W	15K	30K to 50K	5	33.57
35247	48	24	±24	17W	25W	15K	30K to 50K	5	33.57
35267	56	28	±28	17W	25W	15K	30K to 50K	5	33.57
36745	48	24	±24	25W	40W	15K	30K to 40K	6	38.72
36765	56	28	±28	25W	40W	15K	30K to 40K	6	38.72
36785	100	50	±50	25W	40W	15K	30K to 40K	6	38.72

** Lower switching frequency may be used at lower output power.

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

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PICO Electronics, Inc.

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SCHEMATIC FOR SIZES 1, 2 & 3 USING TRANSFORMERS AS SELF-SATURATING

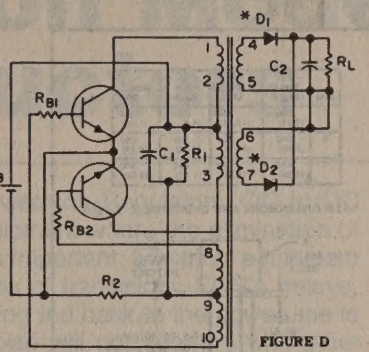


FIGURE D

SCHEMATIC FOR SIZES 1, 2, AND 3 USING TRANSFORMERS AS LINEAR SWITCHING

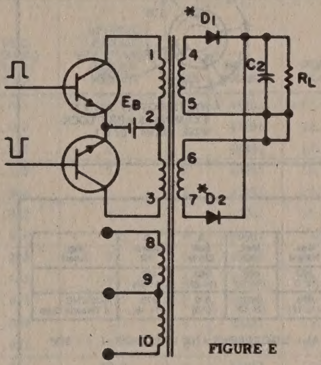


FIGURE E

* D1 AND D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZES 4, 5 & 6 USING TRANSFORMER AS SELF-SATURATING

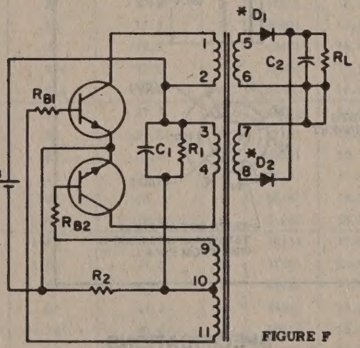


FIGURE F

SCHEMATIC FOR SIZES 4, 5 & 6 USING TRANSFORMERS AS LINEAR SWITCHING.

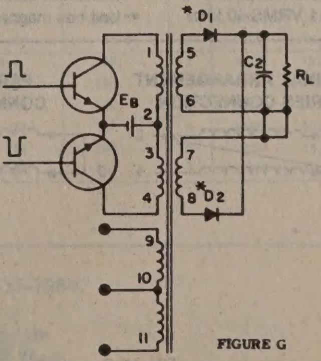


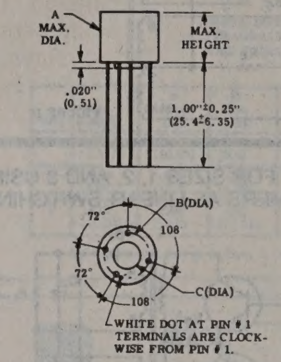
FIGURE G

*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

PICO's Miniaturized Power Inductors

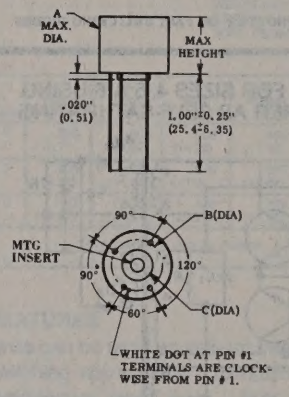
Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)

ALL DIMENSIONS ARE IN INCHES, ( ) = MM



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	
5	.635 (16.12)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep

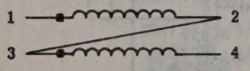
ALL DIMENSIONS ARE IN INCHES, ( ) = MM



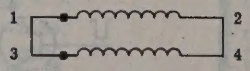
SPECIFICATIONS:

- All units meet MIL-T-27D and are type TF5S04ZZ
- Inductance measured at 0.1 VRMS-10 kHz
- Temperature rise at rated D.C. current is less than 30°C
- Maximum ambient is 100°C
- Unit has magnetic shield

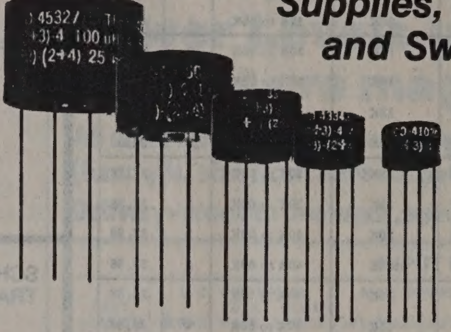
TERMINAL ARRANGEMENT SERIES CONNECTION



PARALLEL CONNECTION



These Inductors are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators



- **Minimum possible size**
- **Meets MIL-T-27D (TF5S04ZZ)**
- **Special high frequency core material to insure low losses**
- **All units have split windings**
- **Large selection of sizes available**
- **All units are magnetically shielded**

All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-41020 will have 5 millihenry at .12 Amps DC with DC resistance of 13.5 Ohms

INDUCTANCE	I_{DC} (AMPS)	R_{DC} (OHMS)	SIZE	MODEL NUMBER	*** PRICE 1-9
20 MILLI-HENRY	.06	54	1	41020	11.24
	.10	29	2	42105	11.24
	.14	20	3	43103	11.24
	.22	12.4	4	44500	13.45
	.29	10.2	5	45107	13.45
15 MILLI-HENRY	.07	40.5	1	41040	11.24
	.12	22	2	42125	11.24
	.16	15	3	43123	11.24
	.25	9.3	4	44520	13.45
	.33	7.7	5	45127	13.45
10 MILLI-HENRY	.08	27	1	41060	11.24
	.14	14.6	2	42145	11.24
	.20	10	3	43143	11.24
	.31	6.2	4	44560	13.45
	.40	5.1	5	45147	13.45
7.5 MILLI-HENRY	.10	20.3	1	41080	11.24
	.17	11	2	42165	11.24
	.24	7.5	3	43163	11.24
	.38	4.7	4	44580	13.45
	.49	3.8	5	45167	13.45
5 MILLI-HENRY	.12	13.5	1	41100	11.24
	.21	7.3	2	42185	11.24
	.30	5	3	43183	11.24
	.47	3.1	4	44600	13.45
	.6	2.6	5	45187	13.45
3 MILLI-HENRY	.16	8.1	1	41120	11.24
	.27	4.4	2	42205	11.24
	.38	3	3	43203	11.24
	.6	1.9	4	44620	13.45
	.78	1.5	5	45207	13.45
2 MILLI-HENRY	.19	5.4	1	41140	11.24
	.33	2.9	2	42225	11.24
	.47	2	3	43223	11.24
	.74	1.3	4	44640	13.45
	.95	1	5	45227	13.45
1 MILLI-HENRY	.27	2.7	1	41160	11.24
	.47	1.5	2	42245	11.24
	.66	1	3	43243	11.24
	1	.62	4	44660	13.45
	1.3	.5	5	45247	13.45
750 MICRO-HENRY	.31	2	1	41180	11.24
	.54	1	2	42265	11.24
	.76	.75	3	43263	11.24
	1.2	.47	4	44680	13.45
	1.6	.38	5	45267	13.45
500 MICRO-HENRY	.38	1.3	1	41200	11.24
	.66	.66	2	42285	11.24
	.93	.5	3	43283	11.24
	1.47	.31	4	44700	13.45
	1.9	.25	5	45287	13.45
250 MICRO-HENRY	.53	.66	1	41220	11.24
	.93	.33	2	42305	11.24
	1.3	.25	3	43303	11.24
	2.08	.16	4	44720	13.45
	2.7	.13	5	45307	13.45
100 MICRO-HENRY	.84	.26	1	41240	11.24
	1.47	.13	2	42325	11.24
	2.07	.1	3	43323	11.24
	3.28	.062	4	44740	13.45
	4.25	.05	5	45327	13.45
40 MICRO-HENRY	1.33	.11	1	41260	11.24
	2.33	.053	2	42345	11.24
	3.28	.04	3	43343	11.24

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

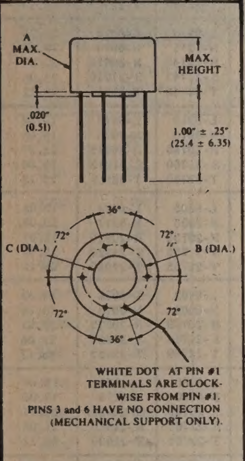
Delivery— stock to one week

PICO's EMI Common Mode Suppression Inductors

- **Minimum possible size**
- **130°C operation (Ambient + Temp. Rise)**
- **Windings Balance ± 1%**
- **Dielectric Strength . . . . 1500 Volts RMS**
- **All units are magnetically shielded**

These Inductors are well suited for use in Switching Regulators, DC to DC Power Supplies and all types of Electrical Equipment where the elimination of line transmitted Electromagnetic Interference is important. Electrical equipment will generate noise due to switching operations of transistors, SCR's, relays, triacs, etc. By using these Inductors, noise being fed back to the power line is minimized to an acceptable level and this noise will not interfere with other equipment operating on the same power line.

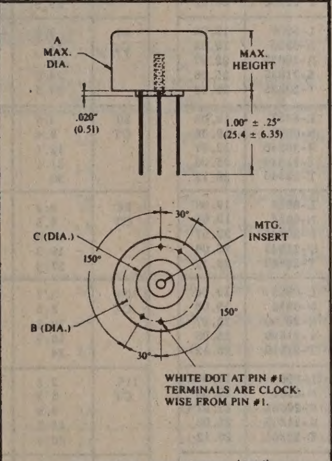
Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)



WHITE DOT AT PIN #1 TERMINALS ARE CLOCKWISE FROM PIN #1.
PINS 3 and 6 HAVE NO CONNECTION (MECHANICAL SUPPORT ONLY).

Dimensions are in inches (MM)

Size	Max. Height	A Max. Dia	B Bolt Circle	C Stand-Off	Mtg Insert
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	2-56 UNC 6 Threads Deep
5	.635 (16.12)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	6-32 UNC 8 Threads Deep



WHITE DOT AT PIN #1 TERMINALS ARE CLOCKWISE FROM PIN #1.

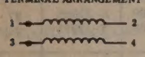
Dimensions are in inches (MM)

INDUCTANCE	IRMS (AMPS) TEMP. RISE 60°C	IRMS (AMPS) TEMP. RISE 40°C	IRMS (AMPS) TEMP. RISE 25°C	RDC. (OHMS) EACH WDG.	APPROX. LEAKAGE INDUCTANCE (MICRO-HENRY)	SIZE	MODEL NUMBER	PRICE 1-9
100 MICRO-HENRY	1.95	1.57	1.29	.051	3.5	1	46283	12.57
	2.57	2.20	1.90	.033	3.5	2	47291	12.57
	4.43	3.79	3.23	.015	4	3	48381	12.57
250 MICRO-HENRY	1.25	1.00	.959	.125	5	1	46263	12.57
	1.61	1.39	1.19	.083	5	2	47271	12.57
	2.80	2.39	2.04	.038	4.5	3	48361	12.57
	4.58	3.83	3.06	.019	4.5	4	49461	15.09
500 MICRO-HENRY	.862	.691	.572	.263	9	1	46243	12.57
	1.14	.986	.851	.163	8	2	47251	12.57
	1.98	1.70	1.44	.075	8	3	48341	12.57
	3.23	2.70	2.16	.037	7.5	4	49441	15.09
	4.70	4.18	3.04	.021	6.5	5	50241	15.09
750 MICRO-HENRY	.711	.568	.472	.31	10.3	1	46223	12.57
	.924	.792	.686	.20	8.9	2	47231	12.57
	1.62	1.38	1.18	.09	8.4	3	48321	12.57
	2.64	2.20	1.77	.045	7.7	4	49421	15.09
	3.80	3.39	2.46	.026	7.5	5	50221	15.09
1 MILLI-HENRY	.619	.495	.410	.41	13.8	1	46203	12.57
	.814	.694	.601	.26	11.9	2	47211	12.57
	1.40	1.20	1.02	.12	11.3	3	48301	12.57
	2.29	1.91	1.53	.06	10.3	4	49401	15.09
	3.33	2.96	2.15	.034	10.0	5	50201	15.09
	5.10	4.23	3.77	.022	9.4	6	51303	16.56
2 MILLI-HENRY	.437	.349	.290	.82	27.5	1	46183	12.57
	.575	.491	.425	.52	23.8	2	47191	12.57
	.986	.847	.722	.24	22.5	3	48281	12.57
	1.61	1.36	1.08	.12	20.6	4	49381	15.09
	2.31	2.06	1.50	.07	20	5	50181	15.09
	3.78	3.14	2.80	.04	18.8	6	51283	16.56
4 MILLI-HENRY	.308	.246	.204	1.65	55	1	46163	12.57
	.405	.345	.299	1.05	47.5	2	47171	12.57
	.708	.605	.516	.47	45.0	3	48261	12.57
	1.14	.959	.766	.24	41.3	4	49361	15.09
	1.64	1.45	1.06	.14	40.0	5	50161	15.09
	2.53	2.09	1.86	.09	37.5	6	51263	16.56
9 MILLI-HENRY	.205	.165	.136	3.71	123.8	1	46143	12.57
	.270	.231	.200	2.36	106.9	2	47151	12.57
	.468	.401	.342	1.07	101.3	3	48241	12.57
	.769	.643	.516	.53	92.8	4	49341	15.09
	1.10	.977	.711	.31	90.0	5	50141	15.09
	1.69	1.41	1.25	.20	84.4	6	51243	16.56
16 MILLI-HENRY	.154	.123	.101	6.6	220	1	46123	12.57
	.202	.172	.150	4.2	190	2	47131	12.57
	.352	.299	.255	1.9	180	3	48221	12.57
	.572	.480	.378	.95	165	4	49321	15.09
	.827	.730	.528	.55	160	5	50121	15.09
	1.28	1.06	.942	.35	150	6	51223	16.56

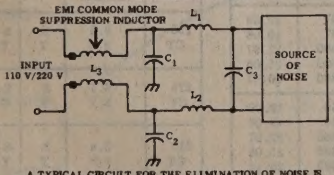
SPECIFICATIONS

- **All units meet MIL-T-27D and are type TF5S04ZZ**
- **Inductance measured at 0.1VRMS-10kHz**
- **Unit has magnetic shield**
- **Dielectric Strength . . . . 1500 Volts RMS**
- **Windings Balanced ± 1%**
- **Maximum ambient plus temp. rise limited to 130°C (ie maximum ambient of part no. 46282 would be 105°C if IRMS is 1.47 AMPS)**

TERMINAL ARRANGEMENT



TYPICAL APPLICATION CIRCUIT



A TYPICAL CIRCUIT FOR THE ELIMINATION OF NOISE IS SHOWN ABOVE. THE FILTER CONTAINS TWO STAGES, ONE FOR COMMON MODE NOISE (L_3, C_1, C_2) AND ONE FOR CONDUCTED NOISE (L_1, L_2, AND C_3).

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

Delivery—
stock to one week

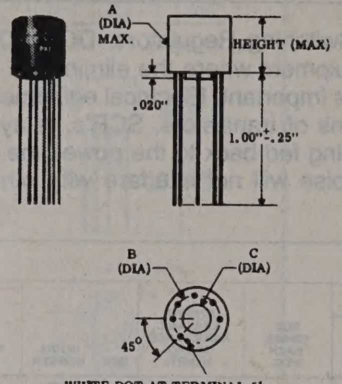
PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

For More Information. Circle No. 506

PICO's miniature 400 Hz transformers

115V/26V Primary
Printed Circuit Construction



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM
PIN #1

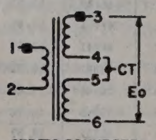
CASE SIZE	HEIGHT (MAX)	A (DIA) MAX	B (DIA)	C (DIA)
L	.35	.51	.35	.218
N	.5	.51	.35	.218
R	.375	.75	.6	.475
S	.52	.75	.6	.475
T	.82	.75	.6	.475

FEATURES

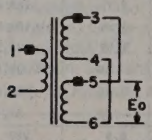
- 400 Hz Aerospace Application
- Smallest Possible Size
- Printed Circuit Plug-In Construction
- Secondary Has Split Winding (Secondary can Be Used at Half Voltage Twice the Current.)

SPECIFICATIONS

- MIL-T-27D (TF5S03ZZ)
- 90 °c Ambient
- Input Primary 115v-400 Hz ±20 Hz or 26V-400HZ-±20 Hz (Your Choice-Just Choose The Proper Part No.)
- Regulation is 24% (T Units Have Regulation of 17%)
- Secondary Voltage Adjusted to Nominal Value at Half Load.



SERIES CONNECTED
SECONDARY



PARALLEL CONNECTED
SECONDARY

This Product is Patented

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
5.0 CT	75	L	L-8948	L-8951	19.08
	150	N	N-6948	N-6951	19.08
	204	R	R-20650	R-20815	22.97
	338	S	S-21650	S-21815	25.06
	480	T	T-22650	T-22815	26.12
6.3 CT	59.5	L	L-8947	L-8952	19.08
	119	N	N-6947	N-6952	19.08
	162	R	R-20655	R-20820	22.97
	268	S	S-21655	S-21820	25.06
	381	T	T-22655	T-22820	26.12
8.0 CT	47	L	L-8946	L-8953	19.08
	94	N	N-6946	N-6953	19.08
	128	R	R-20660	R-20825	22.97
	211	S	S-21660	S-21825	25.06
	300	T	T-22660	T-22825	26.12
10 CT	37.5	L	L-8945	L-8954	19.08
	75	N	N-6945	N-6954	19.08
	102	R	R-20665	R-20830	22.97
	169	S	S-21665	S-21830	25.06
	240	T	T-22665	T-22830	26.12
12.8 CT	29	L	L-8940	L-8956	19.08
	58.6	N	N-6940	N-6956	19.08
	79.7	R	R-20670	R-20835	22.97
	132	S	S-21670	S-21835	25.06
	188	T	T-22670	T-22835	26.12
14 CT	26.8	L	L-8937	L-8957	19.08
	53.6	N	N-6937	N-6957	19.08
	72.9	R	R-20675	R-20840	22.97
	121	S	S-21675	S-21840	25.06
	171	T	T-22675	T-22840	26.12
16 CT	23	L	L-8935	L-8958	19.08
	47	N	N-6935	N-6958	19.08
	63.8	R	R-20680	R-20845	22.97
	106	S	S-21680	S-21845	25.06
	150	T	T-22680	T-22845	26.12
18 CT	20.8	L	L-8934	L-8959	19.08
	41.7	N	N-6934	N-6959	19.08
	56.7	R	R-20685	R-20850	22.97
	93.9	S	S-21685	S-21850	25.06
	133	T	T-22685	T-22850	26.12
20 CT	18.8	L	L-8933	L-8961	19.08
	37.5	N	N-6933	N-6961	19.08
	51	R	R-20690	R-20855	22.97
	84.5	S	S-21690	S-21855	25.06
	120	T	T-22690	T-22855	26.12
22 CT	17	L	L-8932	L-8962	19.08
	34	N	N-6932	N-6962	19.08
	46.4	R	R-20695	R-20860	22.97
	76.8	S	S-21695	S-21860	25.06
	109	T	T-22695	T-22860	26.12
24 CT	15.5	L	L-8930	L-8963	19.08
	31	N	N-6930	N-6963	19.08
	42.5	R	R-20700	R-20865	22.97
	70.4	S	S-21700	S-21865	25.06
	100	T	T-22700	T-22865	26.12
28 CT	13.4	L	L-8929	L-8964	19.08
	26.8	N	N-6929	N-6964	19.08
	36.4	R	R-20705	R-20870	22.97
	60.4	S	S-21705	S-21870	25.06
	85.7	T	T-22705	T-22870	26.12
31 CT	12	L	L-8927	L-8966	19.08
	24	N	N-6927	N-6966	19.08
	32.9	R	R-20710	R-20875	22.97
	54.5	S	S-21710	S-21875	25.06
	77.4	T	T-22710	T-22875	26.12
36 CT	10.4	L	L-8925	L-8967	19.08
	20.8	N	N-6925	N-6967	19.08
	28.3	R	R-20715	R-20880	22.97
	46.9	S	S-21715	S-21880	25.06
	66.7	T	T-22715	T-22880	26.12
39 CT	9.6	L	L-8924	L-8968	19.08
	19.2	N	N-6924	N-6968	19.08
	26.2	R	R-20720	R-20885	22.97
	43.3	S	S-21720	S-21885	25.06
	61.5	T	T-22720	T-22885	26.12
43 CT	8.7	L	L-8923	L-8969	19.08
	17.4	N	N-6923	N-6969	19.08
	23.7	R	R-20725	R-20890	22.97
	39.3	S	S-21725	S-21890	25.06
	55.8	T	T-22725	T-22890	26.12
48 CT	7.8	L	L-8922	L-8971	19.08
	15.6	N	N-6922	N-6971	19.08
	21.1	R	R-20730	R-20895	22.97
	35.2	S	S-21730	S-21895	25.06
	50	T	T-22730	T-22895	26.12
56 CT	6.6	L	L-8920	L-8972	19.08
	13.2	N	N-6920	N-6972	19.08
	18.2	R	R-20735	R-20900	22.97
	30.2	S	S-21735	S-21900	25.06
	42.9	T	T-22735	T-22900	26.12
63 CT	6	L	L-8917	L-8973	19.08
	11.9	N	N-6917	N-6973	19.08
	16.2	R	R-20740	R-20905	22.97
	26.9	S	S-21740	S-21905	25.06
	38.2	T	T-22740	T-22905	26.12
68 CT	5.5	L	L-8915	L-8974	19.08
	11	N	N-6915	N-6974	19.08
	15	R	R-20745	R-20910	22.97
	24.9	S	S-21745	S-21910	25.06
	35.3	T	T-22745	T-22910	26.12
80 CT	4.6	L	L-8910	L-8976	19.08
	9.4	N	N-6910	N-6976	19.08
	12.1	R	R-20750	R-20915	22.97
	21.1	S	S-21750	S-21915	25.06
	30	T	T-22750	T-22915	26.12
88 CT	4.2	L	L-8905	L-8977	19.08
	8.5	N	N-6905	N-6977	19.08
	11.6	R	R-20755	R-20920	22.97
	19.2	S	S-21755	S-21920	25.06
	27.3	T	T-22755	T-22920	26.12
100 CT	3.7	L	L-8902	L-8978	19.08
	8.5	N	N-6902	N-6978	19.08
	10.2	R	R-20760	R-20925	22.97
	16.9	S	S-21760	S-21925	25.06
	24	T	T-22760	T-22925	26.12
115 CT	3.2	L	L-8900	L-8979	19.08
	6.5	N	N-6900	N-6979	19.08
	8.9	R	R-20765	R-20930	22.97
	14.7	S	S-21765	S-21930	25.06
	20.9	T	T-22765	T-22930	26.12
123 CT	8.3	R	R-20770	R-20935	22.97
	13.7	S	S-21770	S-21935	25.06
	19.5	T	T-22770	T-22935	26.12
138 CT	7.4	R	R-20775	R-20940	22.97
	12.2	S	S-21775	S-21940	25.06
	17.4	T	T-22775	T-22940	26.12
157 CT	6.5	R	R-20780	R-20945	22.97
	10.8	S	S-21780	S-21945	25.06
	15.3	T	T-22780	T-22945	26.12
175 CT	5.8	R	R-20785	R-20950	22.97
	9.6	S	S-21785	S-21950	25.06
	13.7	T	T-22785	T-22950	26.12
200 CT	5.1	R	R-20790	R-20955	22.97
	8.4	S	S-21790	S-21955	25.06
	12	T	T-22790	T-22955	26.12
220 CT	7.7	S	S-21795	S-21960	26.32
	10.9	T	T-22795	T-22960	27.43
250 CT	6.8	S	S-21800	S-21965	27.57
	9.6	T	T-22800	T-22965	28.73
275 CT	6.1	S	S-21805	S-21970	28.84
	8.7	T	T-22805	T-22970	30.02
310 CT	5.4	S	S-21810	S-21975	30.08
	7.7	T	T-22810	T-22975	31.37

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

*** Discount Prices: 1-9 Net; 10-24 less 10%: 25-49 less 16%, 50-99 less 23%; 100-499 less 30%**

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

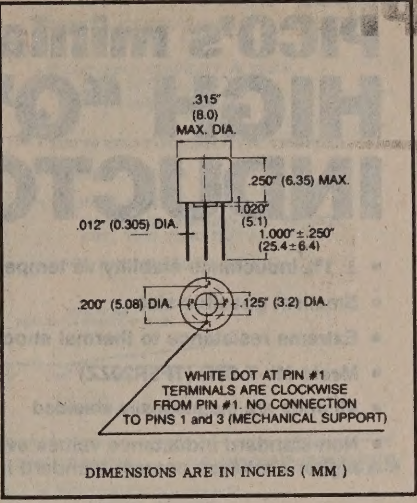
Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

PICO's ultra-miniature HIGH "Q" INDUCTORS

- ± 2% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Meets Mil-T-27D (TF5R20ZZ)
- All units a[illegible]
- Non-standard inductance values available at 10% higher [illegible] standard inductor.

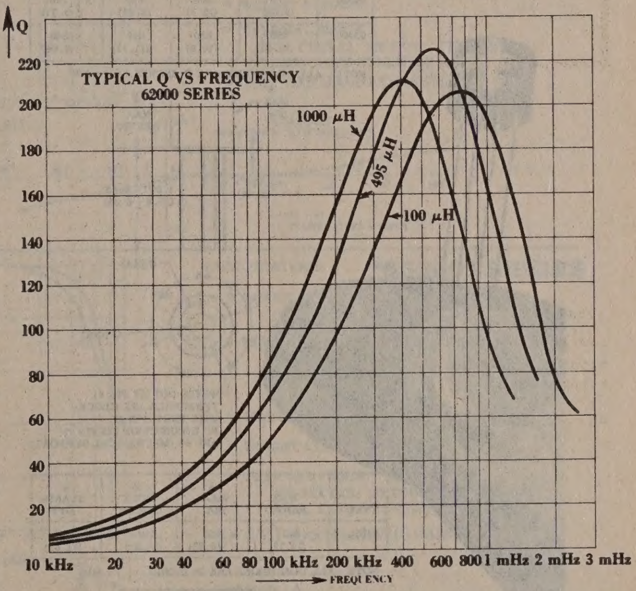


DIMENSIONS ARE IN INCHES (MM)

Delivery— stock to one week

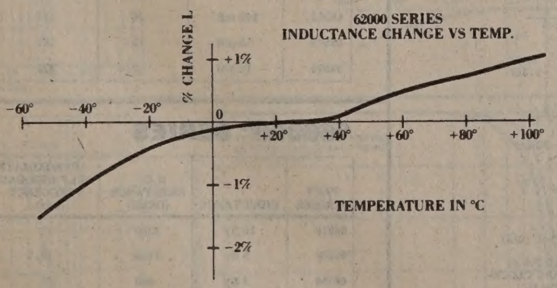
"62000" SERIES

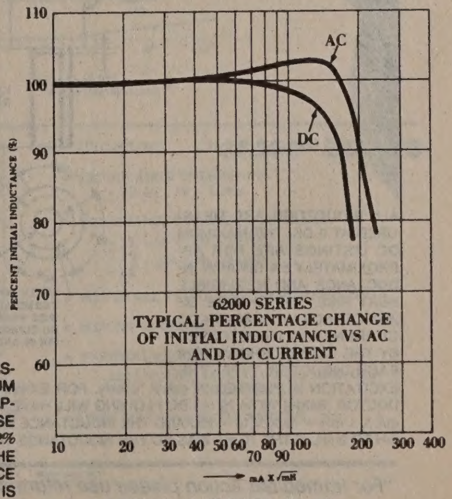
PART NUMBER	INDUCTANCE (MICRO-HENRYS)	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (MHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	PRICE (1-9)
62112	2500	18	1.15	80	180 at (400 kHz)	14.25
62132	1500	10	1.5	100	180 at (400 kHz)	14.25
62152	992	7	1.8	125	200 at (400 kHz)	14.25
62172	900	6.5	1.9	130	200 at (400 kHz)	14.25
62192	800	6.0	2.1	140	200 at (400 kHz)	14.25
62212	742	5.7	2.3	150	200 at (500 kHz)	14.25
62232	702	5.5	2.5	155	200 at (500 kHz)	14.25
62252	600	5.0	2.7	160	200 at (500 kHz)	14.25
62272	495	4.5	3	170	200 at (500 kHz)	14.25
62292	400	3.7	3.3	185	180 at (500 kHz)	14.25
62312	298	2.8	3.8	215	170 at (500 kHz)	14.25
62332	248	2.3	4.2	235	170 at (500 kHz)	14.25
62352	196	1.8	4.75	265	160 at (500 kHz)	14.25
62372	150	1.4	5.5	300	160 at (500 kHz)	14.25
62392	100	1.2	6.8	330	150 at (500 kHz)	14.25



SPECIFICATIONS:

- INDUCTANCE TOLERANCE ±3% AT 0.1V-100KHZ
- INDUCTANCE STABILITY VS TEMPERATURE ±2% -55°C TO 105°C
- MEETS MIL-T-27D TF5R20ZZ
- WEIGHT 1 GRAM
- THERMAL SHOCK 100 CYCLES, METHOD 107D MIL-STD 202E TEST CONDITION A3
- UNIT HAS MAGNETIC SHIELD





"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

PICO Electronics, Inc.

453 North MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
Telephone 914-699-5514

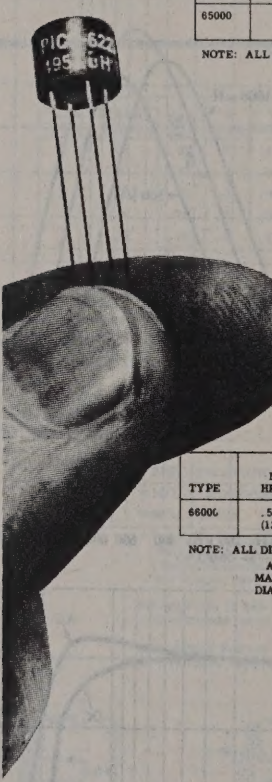
ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 30°C HEAT RISE AND APPROXIMATELY 2% DROP IN INDUCTANCE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES. THE EXCITATION IS PLOTTED IN mA $\times\sqrt{mHy}$. FOR EXAMPLE THE 0.495 mH INDUCTOR (62272) WITH 170 mA DC FLOWING WILL HAVE AN EXCITATION OF mA $\times\sqrt{mHy}$ = 120, AND THE INDUCTANCE WILL DROP FROM 495 uH to 485 uH. IF THE 170 mA WAS AC, THE INDUCTANCE WOULD BE [illegible]10 uH.

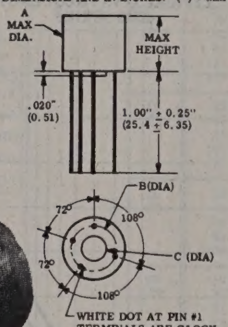
PICO's miniature HIGH "Q" INDUCTORS

- ± 1% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Meets Mil-T-27D (TF5R20ZZ)
- All units are magnetically shielded
- Non-standard inductance values available at 10% higher cost than nearest standard inductor.

TYPE	MAX HEIGHT	A MAX DIA.	B BOLT CIRCLE	C STAND-OFF
63000	.290 (7.37)	.410 (10.41)	.260 (6.6)	.160 (4.06;
64000	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)
65000	.450 (11.43)	.630 (16.0)	.440 (11.17)	.340 (8.64)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM

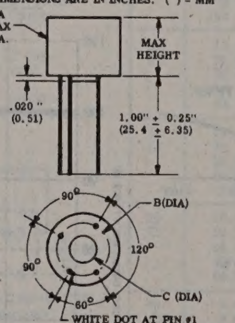




WHITE DOT AT PIN #1
TERMINALS ARE CLOCKWISE FROM PIN #1.
NO CONNECTION TO PIN #1 AND #3 (MECHANICAL SUPPORT)

TYPE	MAX HEIGHT	A MAX DIA	B BOLT CIRCLE	C STAND-OFF
6600C	.540 (13.72)	.800 (20.32)	.560 (14.22)	.460 (11.68)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM



WHITE DOT AT PIN #1
TERMINALS ARE CLOCKWISE FROM PIN #1.
NO CONNECTION TO PIN #2 AND #4 (MECHANICAL SUPPORT)

ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 5% DROP IN INDUCTANCE AND NEGLIGIBLE HEAT RISE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES SHOWN FOR EACH INDUCTOR TYPE. THE EXCITATION IS PLOTTED IN mA X $\sqrt{\text{mHy}}$. FOR EXAMPLE THE 10 mH INDUCTOR (64314) WITH 79 mA DC FLOWING WILL HAVE AN EXCITATION OF mA X $\sqrt{\text{mH}}$ = 79 X $\sqrt{10}$ = 250 AND THE INDUCTANCE WILL DROP FROM 10 mH TO 9mH. IF THE 79 mA WAS AC THE INDUCTANCE WOULD BE 9.65 mH.

"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."

PICO Electronics, Inc.

453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

"63000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
63120	1 Hy	1840	47	5.7	30 at (10 kHz)	14.99
63140	750 mH	1380	54	6.6	30 at (10 kHz)	14.46
63160	500 mH	920	66	8	30 at (10 kHz)	13.62
63180	200 mH	368	105	12.5	60 at (20 kHz)	13.62
63200	100 mH	185	148	18	60 at (20 kHz)	13.62
63220	75 mH	140	172	20.8	100 at (40 kHz)	13.62
63240	50 mH	90	210	25.5	100 at (40 kHz)	13.62
63260	30 mH	55	270	33	100 at (40 kHz)	13.62
63280	20 mH	37	332	40	100 at (40 kHz)	13.62
63300	15 mH	28	383	46	100 at (40 kHz)	13.62
63320	10 mH	18.5	470	57	100 at (40 kHz)	13.62
63340	5 mH	10	665	80	100 at (40 kHz)	13.62
63360	1 mH	2	1480	180	100 at (40 kHz)	14.99

"64000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
64114	5 Hy	3000	17	2.8	15 at (2 kHz)	16.30
64134	3 Hy	1800	22	3.6	30 at (4 kHz)	15.72
64154	2 Hy	1200	27	4.4	30 at (4 kHz)	14.99
64174	1 Hy	600	38	6.3	30 at (4 kHz)	13.62
64194	750 mH	450	44	7.3	30 at (4 kHz)	13.62
64214	500 mH	300	54	9	30 at (4 kHz)	13.62
64234	250 mH	150	76	13	65 at (10 kHz)	13.62
64254	100 mH	60	120	20	65 at (10 kHz)	13.62
64274	75 mH	45	139	23	120 at (20 kHz)	13.62
64294	50 mH	30	170	28	120 at (20 kHz)	13.62
64314	10 mH	6	380	63	200 at (40 kHz)	13.62
64334	5 mH	3	537	89	200 at (40 kHz)	13.62
64354	1 mH	.6	1200	200	200 at (40 kHz)	14.99

"65000" SERIES

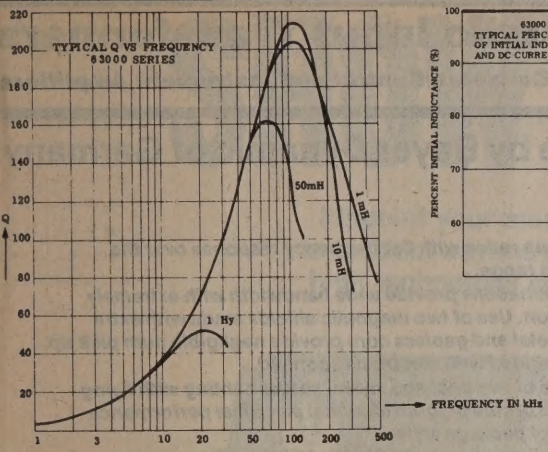
PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (kHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
65413	10 Hy	3800	11.7	2.8	28 at (2 kHz)	16.30
65433	5 Hy	1900	16.5	3.9	28 at (2 kHz)	15.72
65453	3 Hy	1140	21	5.1	28 at (2 kHz)	14.99
65473	2 Hy	760	26	6.3	56 at (4 kHz)	14.99
65493	1 Hy	380	37	8.8	56 at (4 kHz)	13.62
65513	500 mH	190	52	12.5	56 at (4 kHz)	13.62
65533	250 mH	95	74	17.7	140 at (10 kHz)	13.62
65553	100 mH	38	117	28	140 at (10 kHz)	13.62
65573	50 mH	19	165	39.6	240 at (20 kHz)	13.62
65593	10 mH	3.8	370	88.5	240 at (20 kHz)	13.62

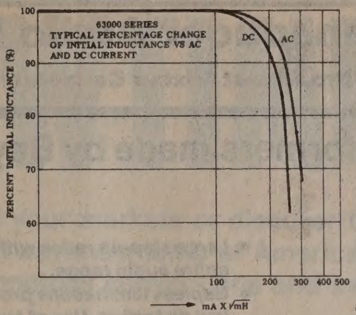
"66000" SERIES

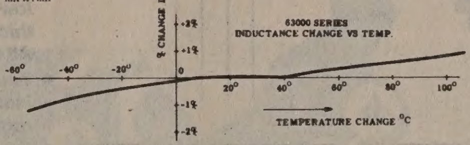
PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (kHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1-9)
66218	10 Hy	2200	11	4.2	50 at (2 kHz)	16.30
66238	5 Hy	1100	15.7	6	50 at (2 kHz)	15.72
66258	3 Hy	660	20	7.7	100 at (4 kHz)	15.72
66278	2 Hy	440	25	9.4	100 at (4 kHz)	13.62
66298	1 Hy	220	35	13	100 at (4 kHz)	13.62
66318	500 mH	110	49	18.8	100 at (4 kHz)	13.62
66338	250 mH	55	70	26.6	200 at (10 kHz)	13.62
66358	100 mH	22	110	42	200 at (10 kHz)	13.62
66378	50 mH	11	156	59	200 at (10 kHz)	13.62
66398	10 mH	2.2	350	133	200 at (10 kHz)	13.62

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

For More Information. Circle No. 506



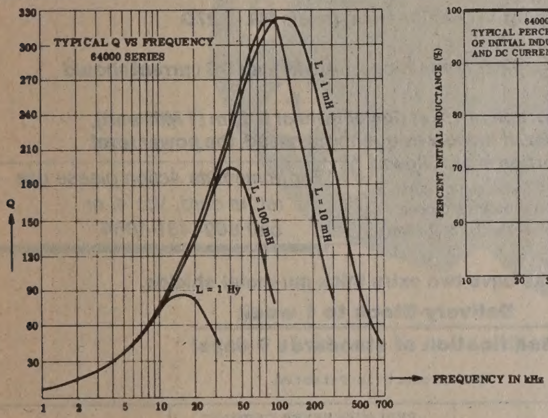


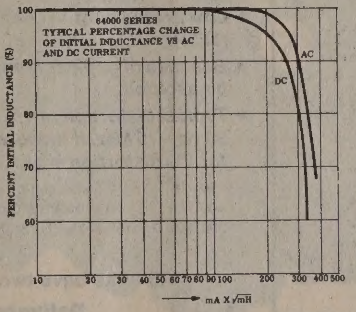


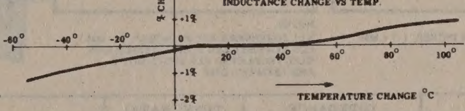
SPECIFICATIONS:

“63000” SERIES

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 4 kHz.
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 2.2 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD



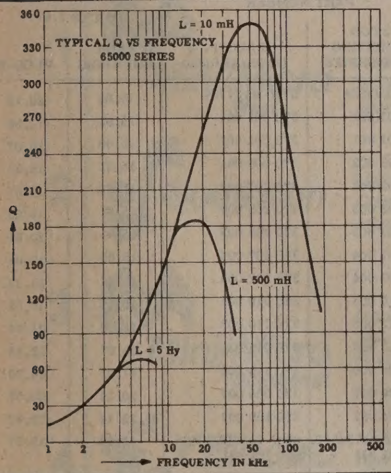


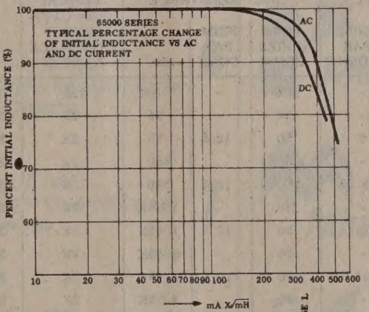


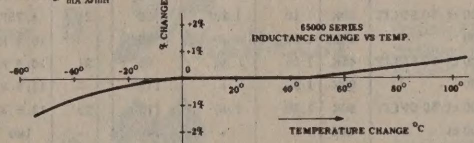
SPECIFICATIONS:

“64000” SERIES

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 2 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 3 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD



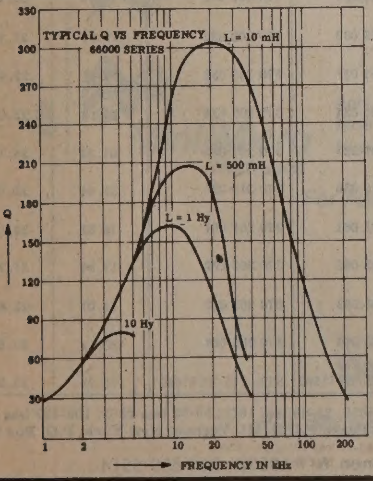


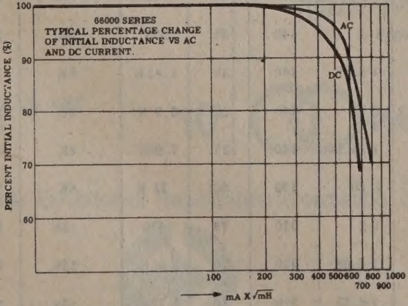


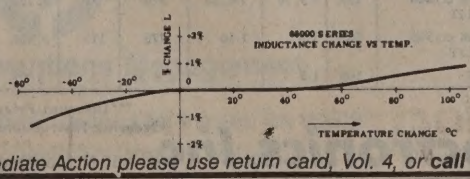
SPECIFICATIONS:

“65000” SERIES

- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 1 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 6 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD







SPECIFICATIONS:

“66000” SERIES

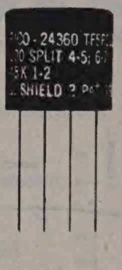
- INDUCTANCE TOLERANCE
  ± 2% AT .1V - 1 kHz
- INDUCTANCE STABILITY VS TEMP.
  ± 1% - 30°C TO + 105°C
  + 1%
  - 2% - 55°C TO + 105°C
- MEETS MIL -T-27D (MIL TYPE TF5R20ZZ)
- WEIGHT 13 GRAMS
- THERMAL SHOCK:
  100 CYCLES, METHOD 107D, MIL-STD 202E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

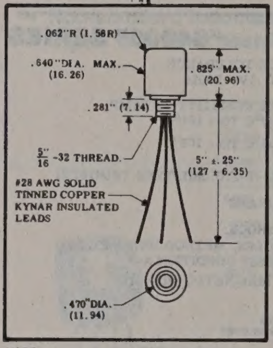
“For Immediate Action please use return card, Vol. 4, or call 800-431-1064.”

PICO Microphone/Transducer Audio Input Transformers

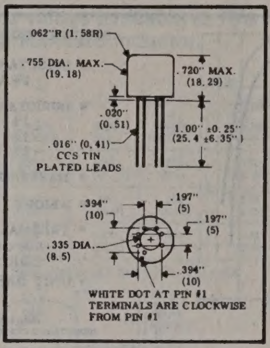
Used for Professional Sound Studios/Broadcast Mixing Consoles/Control and Instrument Amplifiers.

Interchangeable with transformers made by Beyer Dynamic of Germany.





NOTE:
ALL DIMENSIONS ARE IN INCHES, ( ) = MM



NOTES:
ALL DIMENSIONS ARE IN INCHES, ( )=MM.
CCS-COPPER CLAD STEEL, TINNED 100%.
ELECTROPLATED PER MIL-T-10727A
AND ASTM CCS B452.

- ***Large step-up ratios with flat frequency response over the entire audio range.***
- ***Gapless laminations provide wide bandwidth with extremely low distortion. Use of two magnetic shields made with extra thick mu-metal and gapless core provide negligible hum pick up. All units provided with electrostatic shield.***
- ***Your choice of two package styles, stud mounting with flying leads or low profile plug-in. Identical electrical performance regardless of package style.***
- ***Frequency response ±1 dB, 30 Hz–15 kHz.***
- ***Low profile plug-in (24000 series) meets MIL-T-27D (TF5R21ZZ).***
- ***Because of gapless laminations, unbalanced DC current should be avoided.***
- ***Typical distortion of 1% at power level of 0 dBm (1 Milliwatt), 30 Hz–15 kHz. If the low frequency is raised, the power level for 1% distortion is as follows:***

50 Hz	-	3 Milliwatts (4.7 dBm)
100 Hz	-	10 Milliwatts (10 dBm)
300 Hz	-	150 Milliwatts (21.7 dBm)

> *"For Immediate Action please use return card, Vol. 4, or call 800-431-1064."*

All units have two extra thick mu-metal shields.

Delivery-Stock to 1 week

Modification of standards 9 days!

This Product is Patented

PART NUMBER		IMPEDANCE OHMS		TURNS RATIO PRIM/SEC		D.C. RESISTANCE			TYPICAL PRIM OPEN CIRCUIT IMPEDANCE AT 50 Hz	REPLACES BEYER/GERMANY PART NUMBER		PRICES 1-9***	
STUD MOUNTING	PLUG-IN	PRIM	SEC	PRIM SERIES CONN	PRIM PAR CONN	PRIM SERIES CONN	PRIM PAR CONN	SEC		STUD MOUNTING (23000 SERIES)	PLUG-IN (24000 SERIES)	STUD MOUNTING	PLUG-IN
23120	24120	12.5	5K	1:20	-	4.6	-	1K	125	TR-BV35704	STR-BV37704	16.82	20.19
23140	24140	200	200	1:1	-	50	-	75	2K	351 001 001	370 001 001	15.91	18.56
23160	24160	200 ct/50 SPLIT	200	1:1	1:2	50	12.5	75	2K	351 201 001	370 201 001	15.69	19.07
23180	24180	200	2K	1:3.16	-	50	-	580	2K	351 003 002	370 003 002	15.91	18.56
23200	24200	200 ct/50 SPLIT	2K	1:3.16	1:6.33	50	12.5	580	2K	351 203 002	370 203 002	15.69	19.07
23220	24220	200	5K	1:5	-	50	-	1.45K	2K	351 005 003	370 005 003	15.91	18.56
23240	24240	200 ct/50 SPLIT	5K	1:5	1:10	50	12.5	1.45K	2K	351 205 003	370 205 003	15.91	20.81
23260	24260	200	10K	1:7.07	-	50	-	3.45K	2K	351 007 004	370 007 004	15.69	19.07
23280	24280	200 ct/50 SPLIT	10K	1:7.07	1:14.14	50	12.5	3.45K	2K	351 207 004	370 207 004	17.94	21.32
23300	24300	200	20K	1:10	-	85	-	4.75K	2K	351 010 005	370 010 005	16.31	19.69
23320	24320	200 ct/50 SPLIT	20K	1:10	1:20	85	21	4.75K	2K	351 210 005	370 210 005	18.56	21.94
23340	24340	200	45K	1:15	-	85	-	10.4 K	2K	351 015 006	370 015 006	19.07	22.44
23360	24360	200 ct/50 SPLIT	45K	1:15	1:30	85	21	10.4 K	2K	351 215 006	370 215 006	21.32	24.70
23380	24380	200	80K	1:20	-	115	-	13.5 K	2K	351 020 007	370 020 007	20.19	23.57
23400	24400	200 ct/50 SPLIT	80K	1:20	1:40	115	29	13.5 K	2K	351 220 007	370 220 007	22.44	25.82
23420	24420	600 ct	600	1:1	-	140	-	190	6K	TR-145/BV35508 351 101 031	STR-145/BV37508 370 101 031	15.69	19.07
23440	24440	600 ct/15C SPLIT	600	1:1	1:2	140	35	190	6K	351 201 031	370 201 031	16.82	20.19
23460	24460	600 ct/150 SPLIT	2.4K	1:2	1:4	140	35	575	6K	351 202 032	370 202 032	17.94	21.32
23480	24480	600 ct/150 SPLIT	6K	1:3.16	1:6.33	140	35	1.45K	6K	351 203 033	370 203 033	19.07	22.44
23500	24500	600 ct/150 SPLIT	15K	1:5	1:10	140	35	3.9 K	6K	351 205 034	370 205 034	20.19	23.57
23520	24520	600 ct/150 SPLIT	30K	1:7.07	1:14.14	140	35	7.05K	6K	351 207 035	370 207 035	21.32	24.70
23540	24540	600 ct/150 SPLIT	60K	1:10	1:20	199	50	11 K	6K	351 210 036	370 210 036	22.44	25.82
23560	24560	1.2K ct/300 SPLIT	1.2K	1:1	1:2	310	78	430	12K	351 201 061	370 201 061	16.82	20.19
23580	24580	1.2K ct/300 SPLIT	5K	1:2.04	1:4.08	310	78	1.4 K	12K	351 202 062	370 202 062	17.94	21.32
23600	24600	1.2K ct/300 SPLIT	12K	1:3.16	1:6.33	310	78	3.75K	12K	351 203 063	370 203 063	19.07	22.44
23620	24620	1.2K ct/300 SPLIT	30K	1:5	1:10	475	119	8.45K	12K	351 205 064	370 205 064	20.19	23.57
23640	24640	10K	10K	1:1	-	2.5 K	-	3.1K	100K	TR-145/BV35590	STR-145/BV37590	15.91	18.56

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York. P.O. Box 1206

PICO Electronics, Inc. 453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552 • 914-699-5514

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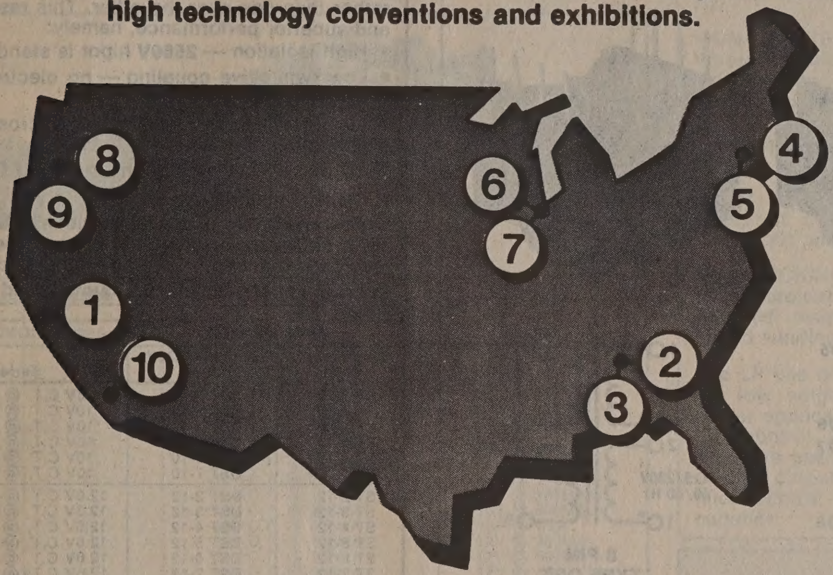

1	Mini/Micro West	February 5, 6, 7, 1985 Anaheim Hilton Exposition Center Anaheim, California
2	Southcon	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
3	Mini/Micro Southeast	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
4	Electro	April 23, 24, 25, 1985 New York Coliseum New York
5	Mini/Micro Northeast	April 23, 24, 25, 1985 Albert Hall New York
6	Midcon	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
7	Mini/Micro Midwest	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
8	Northcon	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
9	Mini/Micro Northwest	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
10	Wescon	November 19, 20, 21, 22, 1985 Anaheim Convention Center Anaheim, California

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For More Information. Circle No. 21

split/tran® p.c. board transformers

SPLIT BOBBIN—HIGHLY ISOLATED

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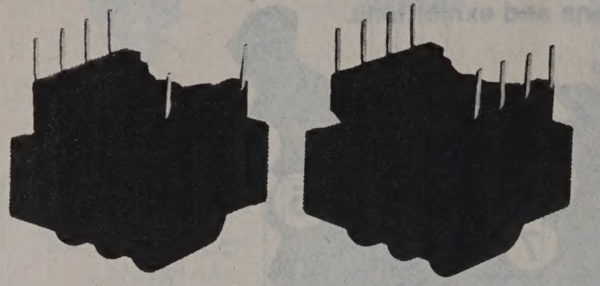
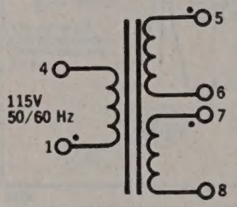
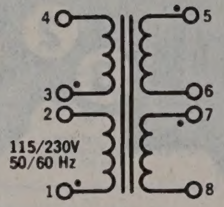
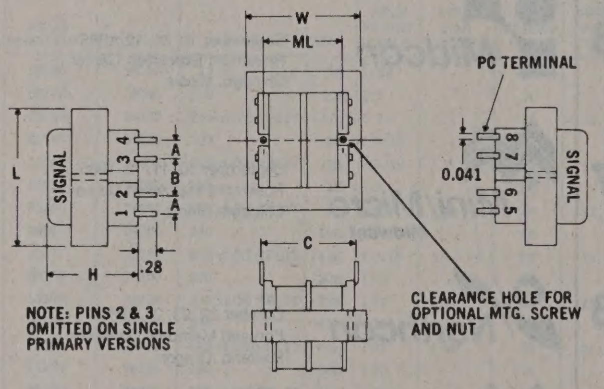




6 PIN
TYPE ST



8 PIN
TYPE DST


W
ML
PC TERMINAL
L
SIGNAL
4
3
2
1
A
B
A
H
.28
C
0.041
8
7
6
5
SIGNAL
CLEARANCE HOLE FOR OPTIONAL MTG. SCREW AND NUT
NOTE: PINS 2 & 3 OMITTED ON SINGLE PRIMARY VERSIONS

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut*	Lbs.
2	1.1	1⅜	1⅛	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1⅜	1⅛	1 3/16	—	.250	.250	1.200	None	0.25
4	6	1⅝	1 5/16	1 5/16	1 1/16	.250	.350	1.280	4-40 x 1⅜ Nylon	0.44
5	12	1⅞	1 9/16	1 7/16	1¼	.300	.400	1.410	4-40 x 1⅜ Nylon	0.70
6	20	2¼	1⅞	1 7/16	1½	.300	.400	1.600	4-40 x 1⅜ Nylon	0.80
7	36	2⅝	2 3/16	1 9/16	†	.400	.400	1.850	†	1.1

* Available from Signal: Part No. ST-MS (Screw) & Part No. ST-MN (Nut).
† Size 7 has 4 mtg. holes on 2 3/16 x 1¾ centers for a #6 screw. Need not be nylon.

"Split-Tran" transformers combine the best features of our "2-4-1" Series and Signal's pioneering line of pc board miniature transformers.

The use of a "split bobbin" allows the primaries and secondaries to be wound non-concentrically, i.e., side by side rather than one over the other. This results in cost savings and superior performance, namely:

- High isolation — **2500V** hipot is standard.
- Low capacitive coupling — no electro-static shield necessary.
- Less manufacturing time — no cross-overs of primary and secondary leads.
- PC pins — allow direct insertion in PC boards.
- Class S insulation — 130°C.

Each transformer is available with single 115V or dual 115/230V primaries. In addition, secondaries are split so that they can be series or parallel connected.

Special variations will be quoted and shipped promptly.

PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10	DST 2-10	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10	DST 3-10	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10	DST 4-10	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10	DST 5-10	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10	DST 6-10	10V C.T. @ 2A	5V @ 4A
ST 7-10	DST 7-10	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12	DST 2-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12	DST 3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12	DST 4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12	DST 5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12	DST 6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12	DST 7-12	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16	DST 2-16	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16	DST 3-16	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16	DST 4-16	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16	DST 5-16	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16	DST 6-16	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16	DST 7-16	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20	DST 2-20	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20	DST 3-20	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20	DST 4-20	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20	DST 5-20	20V C.T. @ 0.6A	10V @ 1.2A
ST 5-20	DST 6-20	20V C.T. @ 1A	10V @ 2A
ST 7-20	DST 7-20	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24	DST 2-24	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24	DST 3-24	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24	DST 4-24	24V C.T. @ 0.25A	12V @ 0.5A
ST 5-24	DST 5-24	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24	DST 6-24	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24	DST 7-24	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28	DST 2-28	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28	DST 3-28	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28	DST 4-28	28V C.T. @ 0.2A	14V @ 0.4A
ST 5-28	DST 5-28	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28	DST 6-28	28V C.T. @ 0.7A	14V @ 1.4A
ST 7-28	DST 7-28	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36	DST 2-36	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36	DST 3-36	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36	DST 4-36	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36	DST 5-36	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36	DST 6-36	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36	DST 7-36	36V C.T. @ 1A	18V @ 2A
ST 2-48	DST 2-48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48	DST 3-48	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48	DST 4-48	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48	DST 5-48	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48	DST 6-48	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48	DST 7-48	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56	DST 2-56	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56	DST 3-56	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56	DST 4-56	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56	DST 5-56	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56	DST 6-56	56V C.T. @ 0.35A	28C @ 0.7A
ST 7-56	DST 7-56	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120	DST 2-120	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120	DST 3-120	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120	DST 4-120	120V C.T. @ 0.1A	60V @ 0.1A
ST 5-120	DST 5-120	120V C.T. @ 0.05A	60V @ 0.2A
ST 6-120	DST 6-120	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120	DST 7-120	120V C.T. @ 0.3A	60V @ 0.6A

* Explanation of Part Number: Series - ST; Size 4; Series Secondary Volts - 36

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

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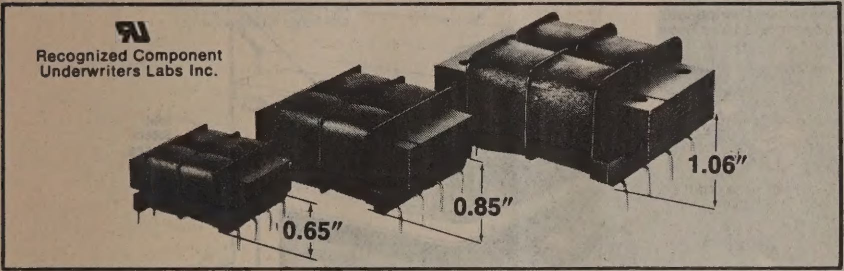
For More Information. Circle No. 507

flathead® plug in power transformers

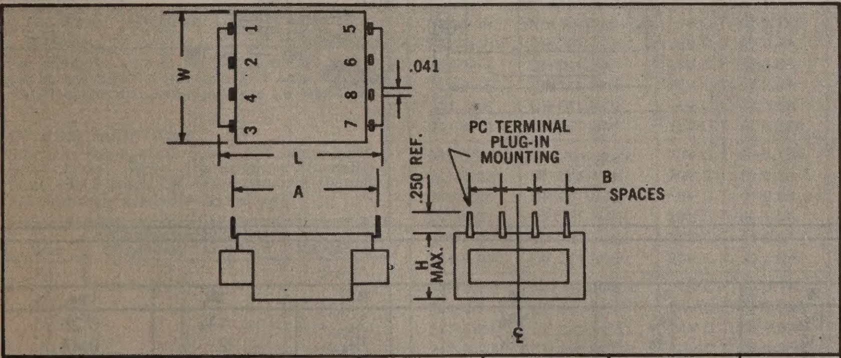
FOR PRINTED CIRCUIT APPLICATIONS

3 SIZES — 2.5VA — 0.650 inches high
6VA — 0.850 inches high
12VA — 1.065 inches high



Part No.	Size	SECONDARY*	
		Series	Parallel
LP 10-250	2	10V C.T. @ 250MA	5V @ 500MA
LP 10-600	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 12-200	2	12.6V C.T. @ 200MA	6.3V @ 400MA
LP 12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 16-150	2	16V C.T. @ 150MA	8V @ 300MA
LP 16-350	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700	12	16V C.T. @ 700MA	8V @ 1.4A
LP 20-125	2	20V C.T. @ 125MA	10V @ 250MA
LP 20-300	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600	12	20V C.T. @ 600MA	10V @ 1.2A
LP 24-100	2	24V C.T. @ 100MA	12V @ 200MA
LP 24-250	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500	12	24V C.T. @ 500MA	12V @ 1A
LP 30-85	2	30V C.T. @ 85MA	15V @ 170MA
LP 30-200	6	30V C.T. @ 200MA	15V @ 400MA
LP 30-400	12	30V C.T. @ 400MA	15V @ 800MA
LP 34-75	2	34V C.T. @ 75MA	17V @ 150MA
LP 34-170	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340	12	34V C.T. @ 340MA	17V @ 680MA
LP 40-60	2	40V C.T. @ 60MA	20V @ 120MA
LP 40-150	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300	12	40V C.T. @ 300MA	20V @ 600MA
LP 56-45	2	56V C.T. @ 45MA	28V @ 90MA
LP 56-100	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200	12	56V C.T. @ 200MA	28V @ 400MA
LP 88-28	2	88V C.T. @ 28MA	44V @ 56MA
LP 88-65	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-20	2	120V C.T. @ 20MA	60V @ 40MA
LP 120-50	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-10	2	230V C.T. @ 10MA	115V @ 20MA
LP 230-25	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50	12	230V C.T. @ 50MA	115V @ 100MA

* Regulation of Size 2 and 6 units is 30%, i.e., no load-secondary voltage is 30% higher than full load. Regulation of Size 12 units is 20%.



Size	L	W	H	A	B	Oz.
2	1⅞	1 9/16	0.650	1.600	0.375	5
6	1⅞	1 9/16	0.850	1.600	0.375	7
12	2½	2	1.065	2.000	0.500	11

LOW PROFILE: Allows ¾" card spacing for 2.5va units, 1 inch card spacing for 6va units, or 1¼" inch card spacing for 12va units.

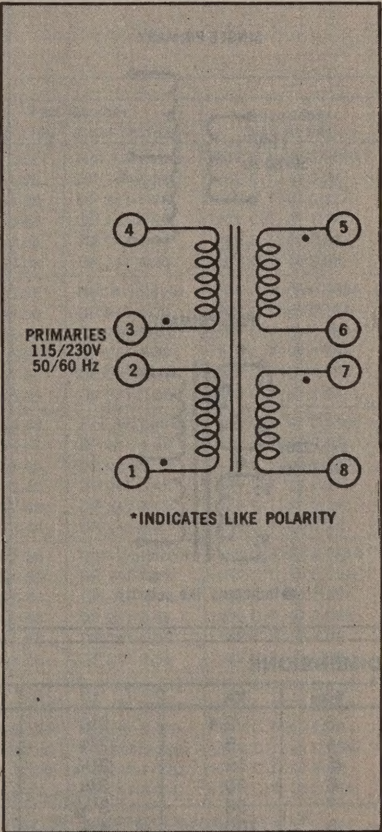
DUAL PRIMARIES: 115/230v, 50/60 Hz.

NON-CONCENTRIC WINDING: Where secondary is wound alongside primary rather than directly over it. This added isolation reduces inter-winding capacitance and **eliminates the need for an electro-static shield.**

1500V. RMS HIPOT: Is standard because of the advantage of non-concentric windings.

HUM-BUCKING CONSTRUCTION: (Semi-toroidal) results in reduced radiated magnetic field and balanced windings.

The LP line of transformers is ideal for low height, critical pc board power applications in semi-conductor control and instrumentation. They are used extensively in single or dual output dc supplies and isolated control circuit and reference supplies.



*INDICATES LIKE POLARITY

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cut size and weight with "2-4-1"

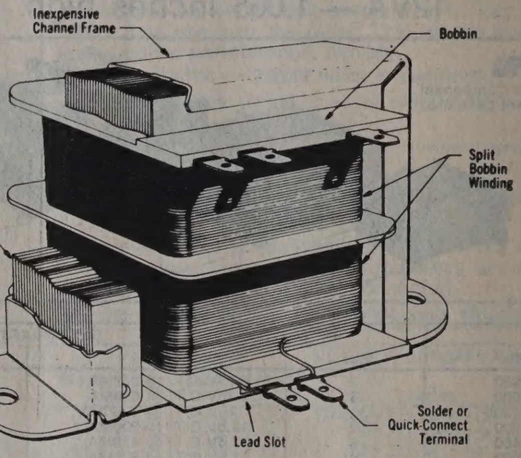
The 2-4-1 series is an illustration of the use of creative design applied to small power transformers. The result is a line where, for a given va rating, size and weight are reduced almost 50%. Hence the name "241" series.

- GRAIN ORIENTED CORE — High Saturation Density — Lower Core Loss — Less Steel and Copper.
- BOBBIN WOUND — Maximum Utilization of Winding Area — Space and Size Reduced.
- SPLIT BOBBIN — NON-CONCENTRIC WINDING — Lower Capacitance — Better Insulation — 2500V RMS Hipot — No need for Electro-Static Shield — High Isolation and Insulation Resistance. No Cross-Overs of Primary and Secondary Leads.
- SPECIAL TERMINAL — Solder or Quick-Connect.

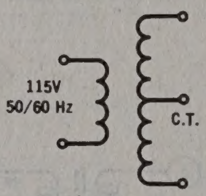
The series is available with single 115V or dual 115/230V primary, rated 50/60 Hz. Class S insulation is used for a maximum total temperature rating of 130°C continuous.

AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

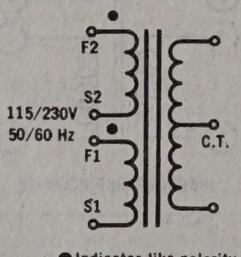
Recognized Component Underwriters Labs Inc.


Inexpensive Channel Frame
Bobbin
Split Bobbin Winding
Grain-Oriented Core
Lead Slot
Solder or Quick-Connect Terminal

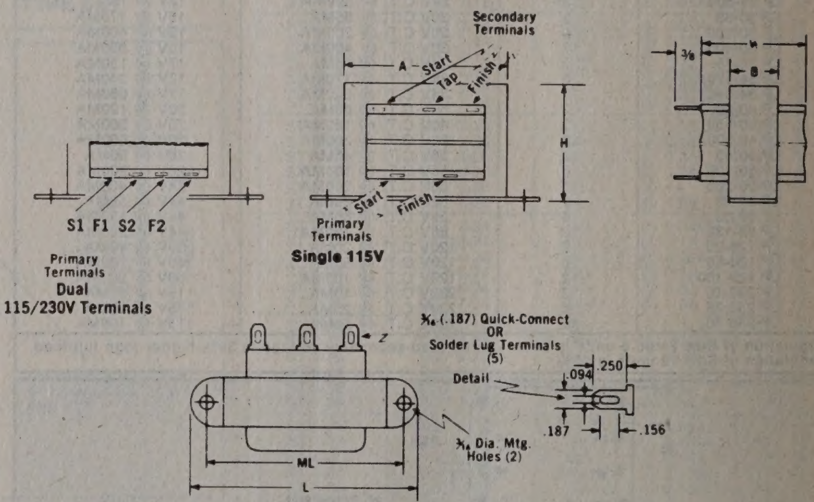
SINGLE PRIMARY


115V
50/60 Hz
C.T.

DUAL PRIMARY


F2
S2
115/230V
50/60 Hz
F1
S1
C.T.

● Indicates like polarity


Secondary Terminals
A
Start
Tap
Finish
H
Start
Finish
3/8
W
B
S1 F1 S2 F2
Primary Terminals
Dual 115/230V Terminals
Primary Terminals
Single 115V
3/16 (.187) Quick-Connect OR Solder Lug Terminals (5)
Detail
.094
.250
.187
.156
3/16 Dia. Mtg. Holes (2)
ML
L

DIMENSIONS

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

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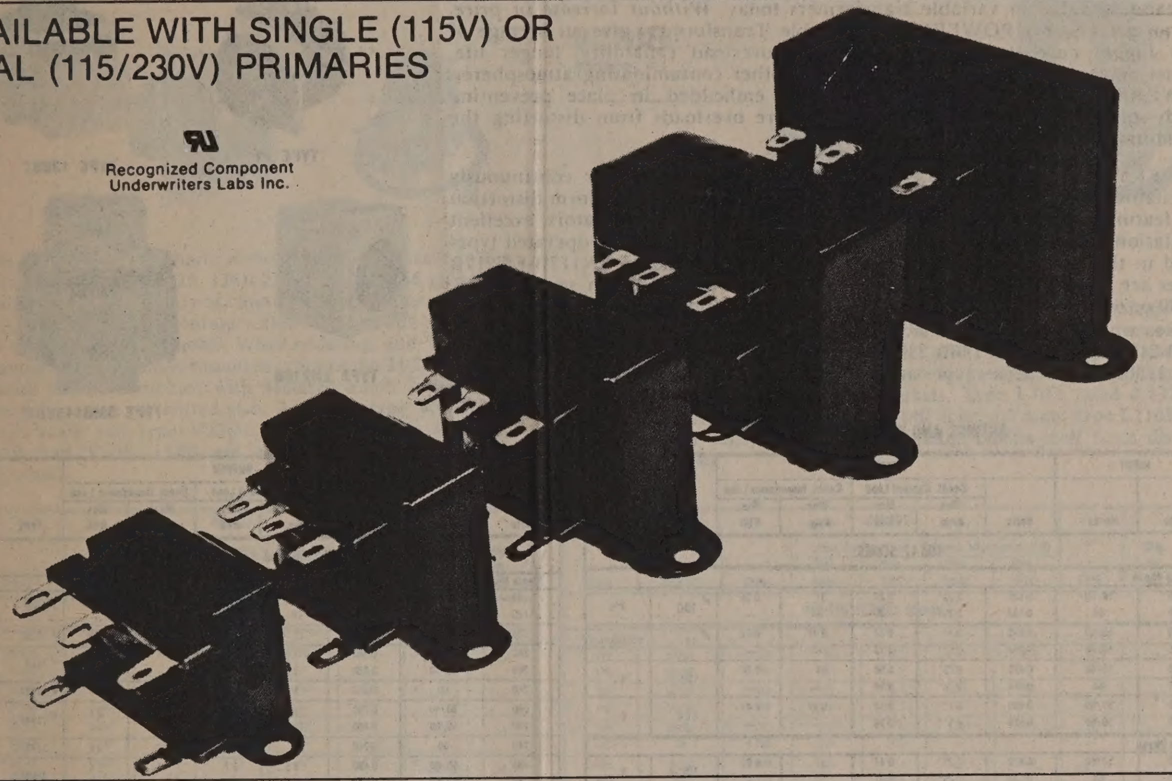
For More Information. Circle No. 507

series of small power transformers

AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

Recognized Component
Underwriters Labs Inc.



METHOD OF DETERMINING SECONDARY CURRENT RATINGS

The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F. W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.

CUSTOM VARIATIONS

Signal is equipped to quote on Custom Variations of "241" types. The secondary combinations are restricted by the number of secondary terminals available, as follows:

Size	Maximum Number of Secondary Terminals	VA Rating
3	3	2.4
4	4	6
5	4	12
6	5	30
7	5	56
8	5	100

We answer requests promptly and can deliver prototypes in one to three weeks. Production lead times can be scheduled with very reasonable lead times.

Part Number		Secondary RMS Ratng	Part Number		Secondary RMS Rating
Single 115V	Dual 115/230V		Single 115V	Dual 115/230V	
241-3-10	Not Available	10V C.T. @ 0.25A	241-3-28	Not Available	28V C.T. @ 0.085A
241-4-10	DP 241-4-10	10V C.T. @ 0.6A	241-4-28	DP 241-4-28	28V C.T. @ 0:2A
241-5-10	DP 241-5-10	10V C.T. @ 1.2A	241-5-28	DP 241-5-28	28V C.T. @ 0.42A
241-6-10	DP 241-6-10	10V C.T. @ 3.0A	241-6-28	DP 241-6-28	28V C.T. @ 1.1A
241-7-10	DP 241-7-10	10V C.T. @ 5.0A	241-7-28	DP 241-7-28	28V C.T. @ 2.0A
241-8-10	DP 241-8-10	10V C.T. @ 10A	241-8-28	DP 241-8-28	28V C.T. @ 3.6A
241-3-12	Not Available	12.6V C.T. @ 0.2A	241-3-36	Not Available	36V C.T. @ 0.065A
241-4-12	DP 241-4-12	12.6V C.T. @ 0.5A	241-4-36	DP 241-4-36	36V C.T. @ 0.17A
241-5-12	DP 241-5-12	12.6V C.T. @ 1.0A	241-5-36	DP 241-5-36	36V C.T. @ 0.35A
241-6-12	DP 241-6-12	12.6V C.T. @ 2.5A	241-6-36	DP 241-6-36	36V C.T. @ 0.85A
241-7-12	DP 241-7-12	12.6V C.T. @ 4.0A	241-7-36	DP 241-7-36	36V C.T. @ 1.5A
241-8-12	DP 241-8-12	12.6V C.T. @ 8.0A	241-8-36	DP 241-8-36	36V C.T. @ 2.8A
241-3-16	Not Available	16V C.T. @ 0.15A	241-3-48	Not Available	48V C.T. @ 0.05A
241-4-16	DP 241-4-16	16V C.T. @ 0.4A	241-4-48	DP 241-4-48	48V C.T. @ 0.125A
241-5-16	DP 241-5-16	16V C.T. @ 0.8A	241-5-48	DP 241-5-48	48V C.T. @ 0.25A
241-6-16	DP 241-6-16	16V C.T. @ 2.0A	241-6-48	DP 241-6-48	48V C.T. @ 0.63A
241-7-16	DP 241-7-16	16V C.T. @ 3.5A	241-7-48	DP 241-7-48	48V C.T. @ 1.2A
241-8-16	DP 241-8-16	16V C.T. @ 6.25A	241-8-48	DP 241-8-48	48V C.T. @ 2.0A
241-3-20	Not Available	20V C.T. @ 0.12A	241-3-56	Not Available	56V C.T. @ 0.045A
241-4-20	DP 241-4-20	20V C.T. @ 0.3A	241-4-56	DP 241-4-56	56V C.T. @ 0.11A
241-5-20	DP 241-5-20	20V C.T. @ 0.6A	241-5-56	DP 241-5-56	56V C.T. @ 0.22A
241-6-20	DP 241-6-20	20V C.T. @ 1.5A	241-6-56	DP 241-6-56	56V C.T. @ 0.54A
241-7-20	DP 241-7-20	20V C.T. @ 2.8A	241-7-56	DP 241-7-56	56V C.T. @ 1.0A
241-8-20	DP 241-8-20	20V C.T. @ 5.0A	241-8-56	DP 241-8-56	56V C.T. @ 1.8A
241-3-24	Not Available	24V C.T. @ 0.1A	241-3-120	Not Available	120V C.T. @ 0.02A
241-4-24	DP 241-4-24	24V C.T. @ 0.25A	241-4-120	DP 241-4-120	120V C.T. @ 0.05A
241-5-24	DP 241-5-24	24V C.T. @ 0.5A	241-5-120	DP 241-5-120	120V C.T. @ 0.1A
241-6-24	DP 241-6-24	24V C.T. @ 1.25A	241-6-120	DP 241-6-120	120V C.T. @ 0.25A
241-7-24	DP 241-7-24	24V C.T. @ 2.4A	241-7-120	DP 241-7-120	120V C.T. @ 0.5A
241-8-24	DP 241-8-24	24V C.T. @ 4.0A	241-8-120	DP 241-8-120	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts - 36 Prefix "DP" used tor dual primary versions

Always in Stock —"THE PRONTO CHALLENGE":—We ship your order (up to 4 pieces) in 48 hours and that's a promise we intend to keep."

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An Insilco Company

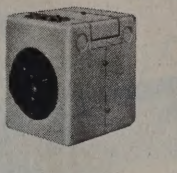
POWERSTAT® Variable Transformers

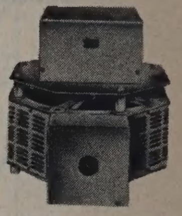
Epoxy-coated POWERKOTE Coils make the POWERSTAT line the most outstanding value in variable transformers today. *Without increase in price, size or weight,* only POWERSTAT Variable Transformers give an average of 20% higher current ratings, 10:1 greater overload capability, longer life, greater resistance to fungus, salt spray and other contaminating atmospheres. POWERKOTE Coil commutator bars are embedded in place preventing steady-state operating temperature and severe overloads from distorting the commutator.

POWERSTAT Variable Transformers are designed to deliver continuously adjustable voltage from a-c power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types listed in the charts except the 10B-12, EN116B-EN216B and EN117B-EN217B Series are available with motor drives if desired. Motor-driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types having -4, -5, or -6 suffixes which do not offer the 5-second speed. Single types in the 116B-216B, 117B-217B, 126-226 and 136B-236B Series are also offered with 3-wire cord-plug sets. 1156D-1256D Series types are available in ratings to 244 kva.

TYPE 21

TYPE 136BT


TYPE EN216B


TYPE 5MB1156DT

RATINGS AND SPECIFICATIONS

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
10B-12 SERIES								
Single Phase								
120	50/60	0-120	2.25*	0.27	3‡	0.36	✓ 10C	2½
120	60	0-132	2.25*	0.30	—	—		
240	50/60	0-240	0.7*	0.17	0.9‡	0.22	✓ 12	2½
240	50/60	0-264	0.5**	0.13	—	—		
240	50/60	0-240	2.25*	0.54	3‡	0.72	10C-2	6
240	60	0-264	2.25*	0.59	—	—		
480	50/60	0-480	0.7*	0.34	0.9‡	0.43	12-2	6
480	50/60	0-528	0.5**	0.26	—	—		
Three Phase								
120	50/60	0-120	2.25*	0.47	3‡	0.62	10C-2	6
120	60	0-132	2.25*	0.51	—	—		
240	50/60	0-240	0.7*	0.29	0.9‡	0.37	12-2	6
240	50/60	0-264	0.5**	0.23	—	—		
240	60	0-240	2.25*	0.94	3‡	1.2	10C-3	8½
480	50/60	0-480	0.7*	0.58	0.9‡	0.75	12-3	8½
480	60	0-528	0.5**	0.46	—	—		
21-22 SERIES								
Single Phase								
120	50/60	0-120	4.5	0.60	6.5	0.84	✓ 21	6
120	50/60	0-140	4.5	0.70	—	—		
240	50/60	0-240	2.25	0.54	3.25	0.78	✓ 22	6
240	50/60	0-280	2.25	0.63	—	—		
240	50/60	0-240	4.5	1.2	6.5	1.7	✓ 21-2	13½
240	50/60	0-280	4.5	1.4	—	—		
480	50/60	0-480	2.25	1.1	3.25	1.6	22-2	13½
480	50/60	0-560	2.25	1.3	—	—		
Three Phase								
120	50/60	0-120	4.5	1.0	6.5	1.5	21-2	13½
120	50/60	0-140	4.5	1.2	—	—		
240	50/60	0-240	2.25	0.94	3.25	1.4	22-2	13½
240	50/60	0-280	2.25	1.1	—	—		
240	50/60	0-240	4.5	2.1	6.5	2.9	21-3	19
240	60	0-280	4.5	2.4	—	—		
480	50/60	0-480	2.25	1.9	3.25	2.7	✓ 22-3	19
480	60	0-560	2.25	2.2	—	—		

INPUT		OUTPUT						
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA	TYPE	Ship. Wt. Lbs.
116B-216B and 117B-217B SERIES†								
Single Phase								
120	50/60	0-120	10	1.2	13	1.6	✓116B	12
120	50/60	0-140	10	1.4	—	—		
120	60	0-120	12	1.4	15	1.8	✓117BT	12
240	50/60	0-240	3.5	0.84	5	1.2	✓216B	12
240	50/60	0-280	3.5	0.98	—	—		
240	60	0-240	5	1.2	7	1.7	✓217BT	12
240	50/60	0-240	10	2.4	13	3.1	✓116BT-2	24
240	50/60	0-280	10	2.8	—	—		
240	60	0-240	12	2.9	15	3.6	117BT-2	24
480	50/60	0-480	3.5	1.7	5	2.4	216BT-2	24
480	50/60	0-560	3.5	2.0	—	—		
480	60	0-480	5	2.4	7	3.4	217BT-2	24
Three Phase								
120	50/60	0-120	10	2.1	13	2.7	✓116BT-2	24
120	50/60	0-140	10	2.4	—	—		
120	60	0-120	12	2.5	15	3.1	117BT-2	24
240	50/50	0-240	3.5	1.5	5	2.1	216BT-2	24
240	50/60	0-280	3.5	1.7	—	—		
240	60	0-240	5	2.1	7	2.9	217BT-2	24
240	50/60	0-240	10	4.2	13	5.4	✓116BT-3	36
240	60	0-280	10	4.8	—	—		
240	60	0-240	12	5.0	15	6.2	117BT-3	36
480	50/60	0-480	3.5	2.9	5	4.2	✓216BU-3	36
480	60	0-560	3.5	3.4	—	—		
480	60	0-480	5	4.2	7	5.8	✓217BU-3	36
EN116B-EN216B and EN117B-EN217B SERIES								
Single Phase								
120	50 60	0-120	8	0.96	13	1.6	✓EN116B	15
120	50 60	0-140	8	1.1	—	—		
120	60	0-120	10	1.2	14.5	1.7	✓EN117B	15
Three Phase								
480	50 60	0-480	3	2.5	4.5	3.7	✓EN216B-3	39
480	60	0-560	3	2.9	—	—		
40-VOLT SERIES								
Single Phase								
40	60	0-40	7	0.28	9	0.36	✓ 10B-40	3½
			18	0.72	22	0.88	✓ 21-40	6

LW136B SERIES

INPUT		OUTPUT‡‡				
Volts	Hertz	Volts	Max. Amps.	Max. KVA	TYPE	Ship. Wt. Lbs.
Single Phase						
120 240	50 60	15-0-15	35	0.52	✓ LW136B	25
120 240	50 60	0-30	25	0.75		

‡‡LW136B Series ratings are for use as low voltage isolated output transformer.

*Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 1.75 amp., 12 Series to 0.5 amp.

Rating when mounted on metal panel. On bracket or nonmetallic panel, derate 10B Series to 2.5 amp., 12 Series to 0.75 amp.

**0.7 amp. maximum in range from 0 to line voltage when mounted on metal panel.

†Also available with open construction. Suffix U when ordering.

✓ AVAILABLE OFF-THE-SHELF FROM DISTRIBUTOR STOCK

THE SUPERIOR ELECTRIC COMPANY

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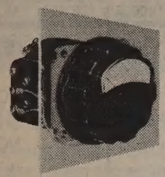
For More Information. Circle No. 508

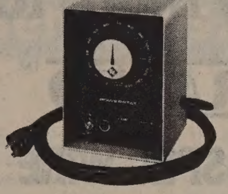
with POWERKOTE® COILS

STATIONARY METERED KNOB TYPES



Single units (those listed in charts without -2 or -3 suffixes) in the 116B-216B, 117B-217B, 126-226, 136B-236B and 146-246 series are also available with metered knobs. Stationary voltmeter does not turn with knob. Voltmeter accurate within ±3% of full scale and insensitive to stray magnetic fields. When ordering, add VS prefix to type number. *Back-of-panel* mounted types in the 21-22 through 146-246 series can be combined with Metered Knob Assemblies. Existing models can be retrofitted also. Assembly type VS150 has a 0-150 volt scale and type VS300 has 0-300. Types VS116B, VS3PN116B and VS3PN136B are available off-the-shelf from distributor stock.

ENCLOSED TYPES



TYPE L10B

TYPE L116B

Designed to meet OSHA requirements. Portable 120 volt, single-phase units have grounded NEMA cord-plug assembly, on-off switch, grounded output receptacle, pilot light and fuse. Panel controls are recessed for protection from accidental bumping. Slots at rear for wall hanger brackets. Type L10B rated 0-132 volts, 1.75 amp; type L21 rated 0-140 volts, 4.5 amp; type L116B rated 0-140 volts, 10 amp. All available off-the-shelf from distributor stock.

INPUT		OUTPUT					TYPE	Ship. Wt. Lbs.
			Const. Current Load		Const. Impedance Load			
Volts	Hertz	Volts	Max. Amp.	Max. KVA	Max. Amp.	Max. KVA		
126-226 SERIES†								
Single Phase								
120	50/60	0-120	15	1.8	20	2.4	✓ 126	17
120	50/60	0-140	15	2.1	—	—		
240	50/60	0-240	7.5	1.8	10	2.4	✓ 226	17
240	50/60	0-280	7.5	2.1	—	—		
240	50/60	0-240	15	3.6	20	4.8	126-2	32
240	50/60	0-280	15	4.2	—	—		
480	50/60	0-480	7.5	3.6	10	4.8	✓ 226U-2	32
480	50/60	0-560	7.5	4.2	—	—		
Three Phase								
120	50/60	0-120	15	3.1	20	4.2	126-2	32
120	50/60	0-140	15	3.6	—	—		
240	50/60	0-240	7.5	3.1	10	4.2	✓ 226U-2	32
240	50/60	0-280	7.5	3.6	—	—		
240	50/60	0-240	15	6.2	20	8.3	126-3	49
240	60	0-280	15	7.3	—	—		
480	50/60	0-480	7.5	6.2	10	8.3	✓ 226T-3	49
480	60	0-560	7.5	7.3	—	—		
136B-236B SERIES†								
Single Phase								
120	50/60	0-120	22	2.6	28	3.4	✓ 136B	25
120	50/60	0-140	22	3.1	—	—		
120	50/60	0-120	44	5.3	56	6.7	136B-2 §	52
120	50/60	0-140	44	6.2	—	—		
240	50/60	0-240	10	2.4	13	3.1	✓ 236B	25
240	50/60	0-280	10	2.8	—	—		
240	50/60	0-240	22	5.3	28	6.7	✓ 136B-2	52
240	50/60	0-280	22	6.2	—	—		
480	50/60	0-480	20	4.8	26	6.2	✓ 236B-2	52
480	50/60	0-560	20	5.6	—	—		
Three Phase								
120	50/60	0-120	22	4.6	28	5.8	✓ 136B-2	52
120	50/60	0-140	22	5.3	—	—		
240	50/60	0-240	10	4.2	13	5.4	✓ 236B-2	52
240	50/60	0-280	10	4.8	—	—		
240	50/60	0-240	22	9.1	28	11.6	✓ 136B-3	76
240	60	0-280	22	10.7	—	—		
480	50/60	0-480	10	8.3	13	10.8	✓ 236B-3	76
480	60	0-560	10	9.7	—	—		
146-246 SERIES†								
Single Phase								
120	50/60	0-120	30	3.6	35	4.2	✓ 146	38
120	50/60	0-140	30	4.2	—	—		
120	50/60	0-120	60	7.2	70	8.4	146-2 §§	83
120	50/60	0-140	60	8.4	—	—		
240	50/60	0-240	15	3.6	19	4.6	✓ 246	38
240	50/60	0-280	15	4.2	—	—		
240	50/60	0-240	30	7.2	35	8.4	146-2	83
240	50/60	0-280	30	8.4	—	—		
480	50/60	0-480	15	7.2	19	9.1	246-2	83
480	50/60	0-560	15	8.4	—	—		
146-246 SERIES† (contd.)								
Three Phase								
120	50/60	0-120	30	6.2	35	7.3	146-2	83
120	50/60	0-140	30	7.3	—	—		
240	50/60	0-240	15	6.2	19	7.9	246-2	83
240	50/60	0-280	15	7.3	—	—		
240	50/60	0-240	30	12.5	35	14.5	146-3	125
240	60	0-280	30	14.5	—	—		
480	50/60	0-480	15	12.5	19	15.8	246-3	125
480	60	0-560	15	14.5	—	—		
1156D-1256D SERIES†								
Single Phase								
120	50/60	0-120	50	6.0	55	6.6	✓ 1156D	82
120	50/60	0-140	50	7.0	—	—		
120	50/60	0-120	100	12.0	110	13.2	1156D-2P	169
120	50/60	0-140	100	14.0	—	—		
120	50/60	0-120	150	18.0	165	19.8	1156D-3P	272
120	50/60	0-140	150	21.0	—	—		
240	50/60	0-240	28	6.7	28	6.7	✓ 1256D	82
240	50/60	0-280	28	7.8	—	—		
240	50/60	0-240	50	12.0	55	13.2	1156D-2S	156
240	50/60	0-280	50	14.0	—	—		
240	50/60	0-240	56	13.4	56	13.4	✓ 1256D-2P	169
240	50/60	0-280	56	15.7	—	—		
240	50/60	0-240	84	20.2	84	20.2	1256D-3P	272
240	50/60	0-280	84	23.5	—	—		
240	50/60	0-240	100	24.0	110	26.4	1156D-4PS	361
240	50/60	0-280	100	28.0	—	—		
480	50/60	0-480	28	13.4	28	13.4	✓ 1256D-2S	156
480	50/60	0-560	28	15.7	—	—		
480	50/60	0-480	56	26.9	56	26.9	1256D-4PS	361
480	50/60	0-560	56	31.4	—	—		
Three Phase								
120	50/60	0-120	50	10.4	55	11.4	1156D-2D	155
120	50/60	0-140	50	12.1	—	—		
240	50/60	0-240	28	11.6	28	11.6	✓ 1256D-2D	155
240	50/60	0-280	28	13.6	—			
240	50/60	0-240	50	20.8	55	22.9	✓ 1156D-3Y	230
240	60	0-280	50	24.2	—	—		
240	50/60	0-240	100	41.6	110	45.7	1156D-6Y	507
240	50/60	0-280	100	48.5	—	—		
480	50/60	0-480	28	23.3	28	23.3	✓ 1256D-3Y	235
480	60	0-560	28	27.2	—	—		
480	50/60	0-480	56	46.6	56	46.6	1256D-6Y	507
480	60	0-560	56	54.3	—	—		

†Also available with open construction. Suffix U when ordering.

§Requires also one paralleling choke type T5000.

§§Requires also one paralleling choke type T6053.

✓ AVAILABLE OFF-THE-SHELF FROM DISTRIBUTOR STOCK

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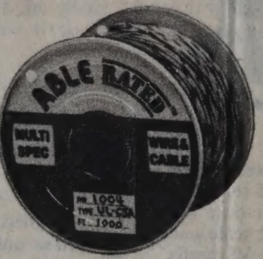

PART NO.	SPECIFICATIONS 1000 V	105°C	UL	CSA	PRICE per M ft.
ABLE-RATED MULTI-SPEC 22 Awg (7/30)	YES	YES	YES	YES	$18.00
ALPHA 1551 22 Awg (7/30)	YES	NO	NO	NO	$50.41
ALPHA 1831 22 Awg (7/30)	YES	YES	NO	NO	$76.77
ALPHA 3051 22 Awg (7/30)	NO	NO	YES	YES	$47.32
BELDEN 9921 22 Awg (7/30)	NO	YES	YES	YES	$47.35
BELDEN 8524 22 Awg (7/30)	YES	NO	NO	NO	$50.45

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1275	$115.00	9623	$125.00	$80.00	Meets applicable UL, CSA and MIL Specs. Prices per 100′ spool. Prices subject to change.
6012	$ 98.10	8778	$ 98.10	$65.00	

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Irradiated Polyolefin—4 foot lengths
(spools available)

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1/8	$42.78	**$19.40**
1/4	$65.76	**$29.90**
3/8	$73.24	**$33.30**
1/2	$82.70	**$37.60**
3/4	$110.50	**$50.30**
1	$154.90	**$70.50**
Meets UL, CSA & MIL Specs		

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Ty•ABLE CABLE TIES

MIL SPEC MS 3367-4	Ty•ABLE T35	Thomas & Betts TY 523	Panduit PLT-1M
*Tensile Strength	**37.90 lbs.**	36.37 lbs.	33.57 lbs.
Bundle Diameter	**15/16″**	5/8″	3/4″
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PRICE (1000 lot)	**$11.00**	$15.85	$16.42

*Certified Test Data in accordance with MIL-S-23190D on file

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ALPHA 545	$2.61	$1.90
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Prices subject to change

call ABLE

for wire, cable, tubing, ties & accessories, cord sets & cable assemblies

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For More Information. Circle No. 509

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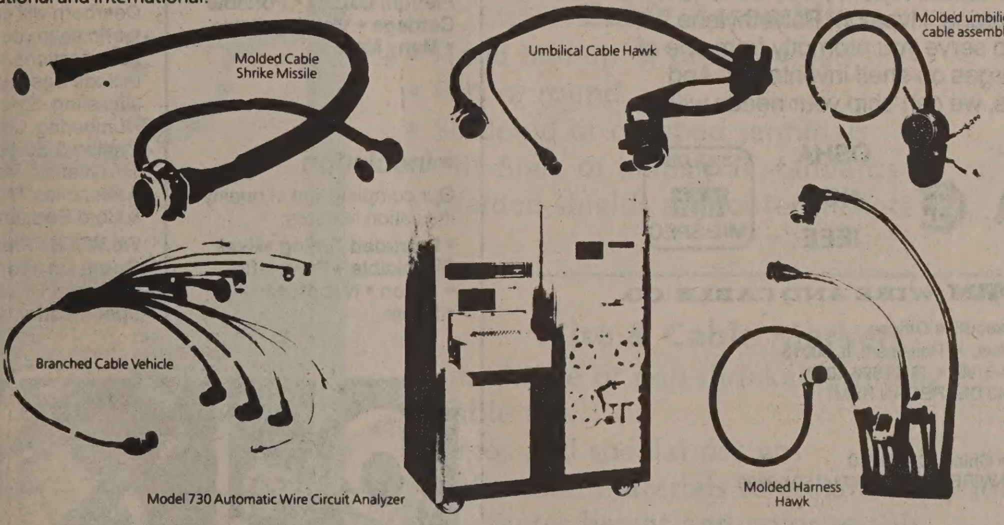
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Industrial Division

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- IEEE 488
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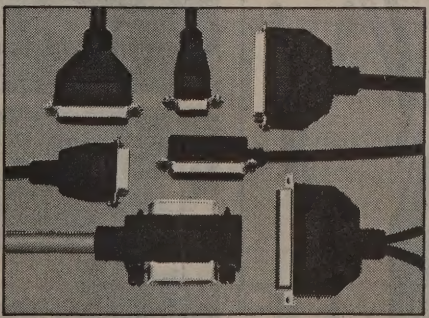
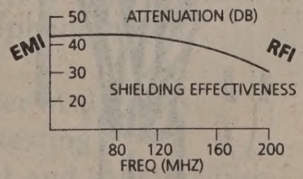
- CSA LR 50395-1





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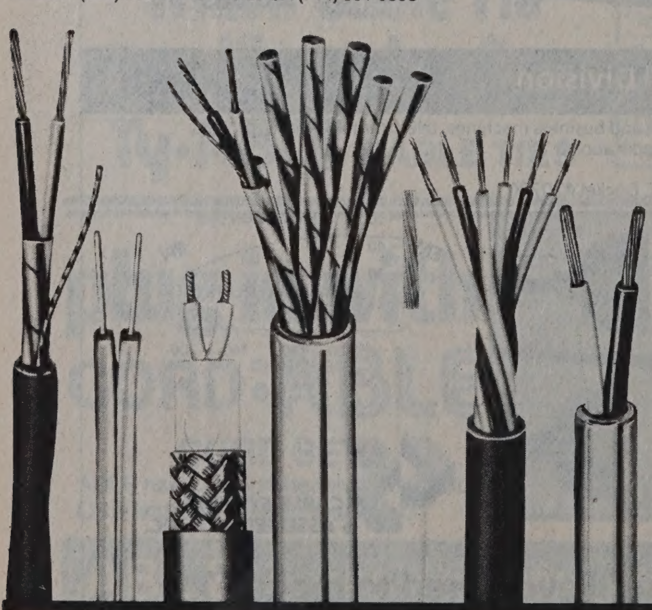

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We offer a complete selection of high-quality cables in a variety of constructions, including multiconductor, paired, unshielded, shielded, braided copper shields, spiral wrap shield or our exclusive Alumylar™ foil shield that offers 100% coverage.

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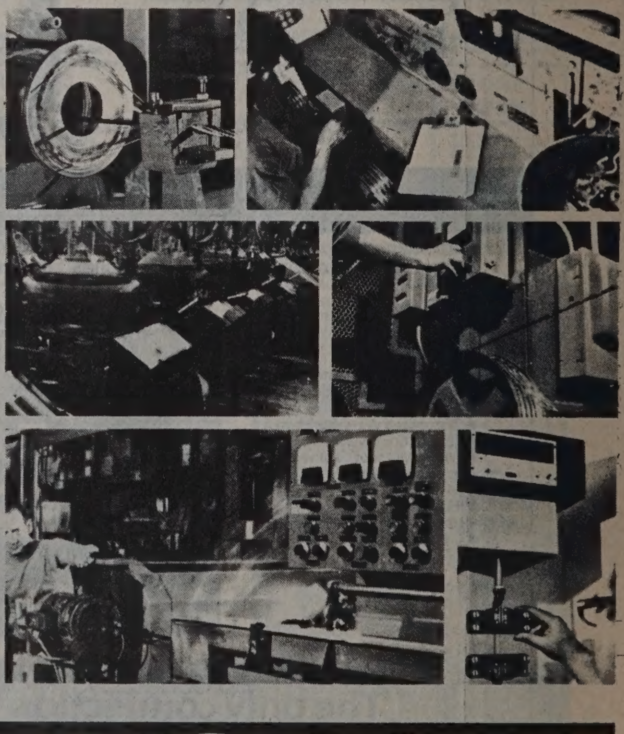
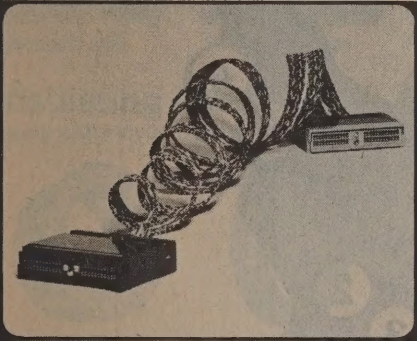


For More Information. Circle No. 511

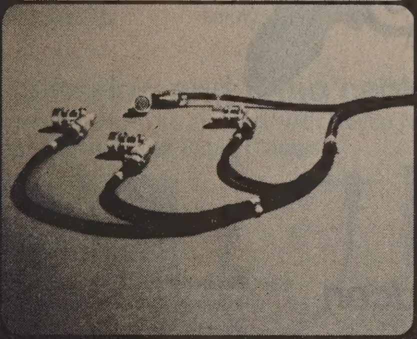
- Woven Cable
- Cable Assemblies
- Wire and Cable Identification

PROMPT DELIVERY, TOP QUALITY, COMPETITIVE COSTS, ANY SPECS



Electronic Woven Cable

- Great flexibility
- Long service life
- Flat and compact
- Any combination of conductors
- Electronics to suit the job
- 20 years aerospace and industrial experience



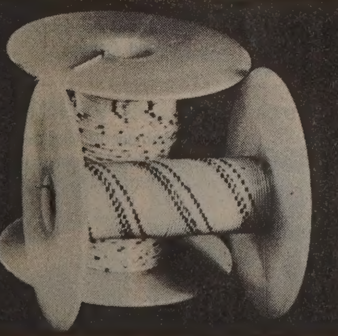
Cable Assemblies

- Hand laid-up or programmed
- Flat or round
- Soldered or crimped terminals
- MIL-Spec or industrial standards
- Braided shields and outer jackets

CG-1704/VRC
(4FT 0IN)
A16A2E4
W16E
SFT 710123-9
GSI

Wire & Cable Markers

- Shrinkable or non-shrinkable tubing
- Cable ties
- Logos and special designs
- Colors and materials to enhance any job
- Character height and color to suit
- Mil-Spec materials and procedures



Wire Marking

- Bands, stripes or alphanumerics
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- Teflon, PVC or other insulations
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- For military aircraft and submersibles

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3	Mini/Micro Southeast	March 5, 6, 7, 1985 Georgia World Congress Center Atlanta, Georgia
4	Electro	April 23, 24, 25, 1985 New York Coliseum New York
5	Mini/Micro Northeast	April 23, 24, 25, 1985 Albert Hall New York
6	Midcon	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
7	Mini/Micro Midwest	September 10, 11, 12, 1985 Rosemont Exposition Center Chicago, Illinois
8	Northcon	October 22, 23, 24, 1985 Portland Memorial Coliseum Portland, Oregon
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10	Wescon	November 19, 20, 21, 22, 1985 Anaheim Convention Center Anaheim, California

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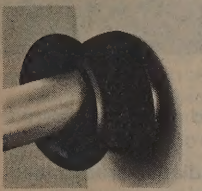
For More Information. Circle No. 21

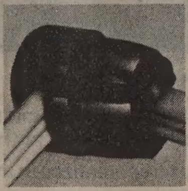
When the job calls for...

Relieving strain

Anchor, insulate and flex-protect cable with Heyco® Nylon Strain Relief Bushings.

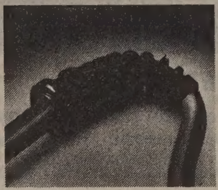

Bell-mouth type

Straight-thru type


Right angle type

Sealing out liquids

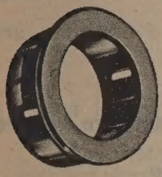
Keep the fluids where they belong with Heyco Nylon Liquid Tight Connectors.

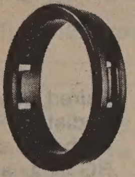

Flex liquid tight connector

Liquid tight connector

Insulating cables

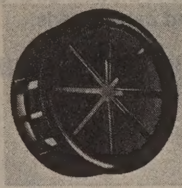
Smooth raw edged cable holes, protect cable and install easily with Heyco Nylon Insulating Bushings.


Snap bushing


Shorty bushing

Double insulated bushing

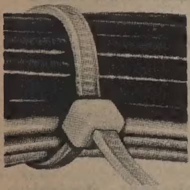
Open/closed bushing

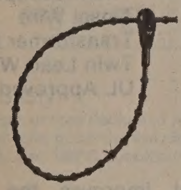

Universal bushing

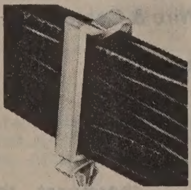
Snub bushing

Gathering and tying cables

Anchor, bundle, tie and hold with Heyco Nylon Cable Ties, Holders and Cable Clamps.


Nytye® cable tie


Beaded wire tie

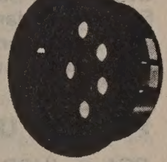

Wire and cable holder

Cable clamp

Plugging holes

Close unused holes or provide ventilation with Heyco Nylon Hole and Vent Plugs.

Hole plug

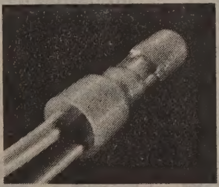

Vent plug

Connecting Wires

Make your connections thru Heyco turn-on or crimp-on wire connectors.

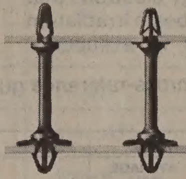
Polypropylene & phenolic turn-on wire connectors

Nylon turn-on wire connector


Closed end/crimp-on wire connector

Spacing printed circuit boards

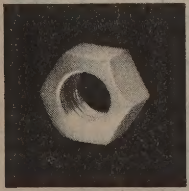
Provide needed spacing between printed circuit boards and chassis with Heyco Nylon Spacer Supports.

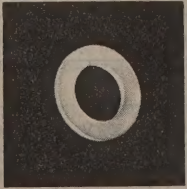

Spacer supports

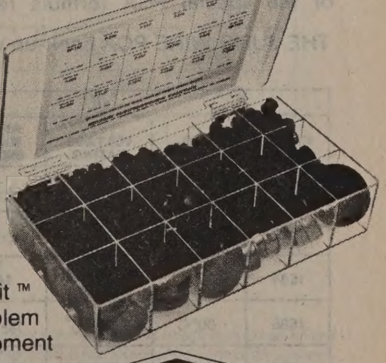
Assembly

Heyco nylon screws, nuts and washers are an inexpensive, long-lasting alternative to costly metal parts.

Screws


Nuts


Washers



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JUDD WIRE is a diversified wire and cable company offering hook-up wire, multiconductor cable and many specialized products for the electronics industry. Products are available for applications in the temperature range of -55°C to 200°C.

In addition to conventional products JUDD WIRE has pioneered and specializes in the manufacture of irradiation cross linked wire and cable product lines.

JUDD WIRE's design engineers work daily on providing solutions to wire and cable problems. Our customer count on JUDD WIRE to meet their requirements for engineering, manufacturing, testing, and packaging everything from the smallest hook-up wire to complex, state of the art multiconductor cables.

Decades of experience and thousands of design efforts back the commitment of JUDD WIRE to engineer solutions for today and tomorrow's wire and cable needs.

JUDD WIRE APPLICATION GUIDE

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Computer Cable
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Kynar Back Panel Wire
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PCA THE UNIVERSAL HOOK-UP WIRE

PCA is JUDD WIRE's tradename or an acronym for Polychloroalkene, which is an exclusive irradiation cross-linked polyvinylchloride insulation.

In order to process PVC by electron beam, it is necessary to improve the formulation of the plastic insulation to withstand the high energy electrons that bombard the wire insulation. Electron beam irradiation of the special PCA formula results in a superior thermoset that improves the inherent desirable characteristics of PVC.

Compare the product advantages of PCA with conventional non-irradiated PVC and learn why billions of feet are sold annually to a variety of industries which prefer the superior characteristics and cost savings of JUDD WIRE's PCA hook-up wire.

THE JUDD WIRE PCA hook-up wire cross-reference guide for tri-rated approvals

UL					CSA				MIL-W-16878E			
STYLE NO.	TEMP. RATING	VOLTAGE RATING	AWG WIRE SIZES	AVERAGE WALL THICK.	CLASS	TEMP. RATING	VOLTAGE RATING	AWG WIRE SIZES	SPEC. SHEET	TEMP. RATING	VOLTAGE RATING	AWG WIRE SIZES
1472	80°C	125 V	32-20	.007"	AWM	80°C	125 V	32-16				
1429	80°C	150 V	32-16	.011"	AWM	80°C	150 V	32-12	1	105°C	600 V	32-14
1534	80°C	No Voltage Specified	14	.012"	AWM	80°C	150 V	32-12	1	105°C	600 V	32-14
1536	80°C	No Voltage Specified	12-10	.013"	AWM	80°C	150 V	32-12	1	105°C	600 V	32-14
1787	80°C	300 V	32-16	.011"					1	105°C	600 V	32-14
1430	105°C	300 V	30-16	.016"	REW	105°C	300 V	26-10	2	105°C	1000 V	26-12
1557	105°C	No Voltage Specified	14-10	.016"	REW	105°C	300 V	26-10	2	105°C	1000 V	26-12
3317	105°C	300 V	14-10	.016"	REW	105°C	300 V	26-10	2	105°C	1000 V	26-12
1431	105°C	600 V	30-10 8 6-2	.032" .051" .065"	REW	105°C	600 V	24-10	3	105°C	3000 V	24-2

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FLEXRAD 125® HIGH TEMPERATURE HOOK-UP WIRE

FLEXRAD 125 is a flexible irradiation cross-linked polyethylene wire with a high temperature rating of 125°C. This proven high temperature hook-up wire with a flame retardant rating of VW-1 (FR-1), offers excellent abrasion and solder resistance and an unusual ability to withstand exposure to many chemicals and solvents.

FLEXRAD 125 has a variety of uses in many industries. Its high temperature and flame retardant ratings recommend it as a replacement for many other UL and CSA approved wires. It is also approved for military applications under Specification Mil-W-16878, Revision E, slash sheets 14, 15 and 16.

Electrical and electronic component and equipment manufacturers now have an alternative to solve the problems encountered while using conventional PVC. The problems of a limited temperature range, solder iron shrinkback, creeping insulation during automated cut and strip operations, and poor abrasion resistance can now be eliminated by utilizing FLEXRAD 125.

Silver plated copper wire conductors must be used in order to withstand the high heat encountered when processing many fluorocarbon constructions. Fluctuations in the precious metals market over the past several years have caused many users of fluorocarbon insulated wires to review their use of these expensive constructions and seek comparable alternatives that provide similar quality.

FLEXRAD 125, processed with tinned copper conductors, provides an ideal alternative to fluorocarbon insulations for most applications where the maximum operating temperature does not exceed 125°C.

Production problems associated with fluorocarbon insulations, such as poor cold flow, low adhesion, poor cut through resistance, short lengths, limited flexibility, and poor potability, will be alleviated by specifying FLEXRAD 125.

THE JUDD WIRE FLEXRAD 125 cross-reference guide for tri-rated approvals

UL					CSA				MIL-W-16878E			
STYLE NO.	TEMP. RATING	VOLTAGE RATING	AWG WIRE SIZES	AVERAGE WALL THICK.	CLASS	TEMP. RATING	VOLTAGE RATING	AWG WIRE SIZES	SPEC. SHEET	TEMP. RATING	VOLTAGE RATING	AWG WIRE SIZES
3265	125°C	150 V	32-16	.011″	AWM	125°C	150 V	30-16	14	125°C	600 V	32-14
3266	125°C	300 V	32-10	.016″	AWM	125°C	300 V	32-12	15	125°C	1000 V	26-12
3266	125°C	300 V	32-10	.016″	CL 1252	125°C	300 V	22-10	15	125°C	1000 V	26-12
3271	125°C	600 V	30-10 8 6-2	.032″ .047″ .063″	CL 1251	125°C	600 V	22-2	16	125°C	3000 V	26-12
3272	125°C	600 V	26-10 8-4	.032″ .047″	CL 1251	125°C	600 V	22-2	16	125°C	3000 V	26-12

CUSTOM CABLE DESIGN

JUDD WIRE can custom design, or manufacture to your specification, a broad spectrum of special cables. Cables are available without shielding, or with conventional braids, spiral braids, aluminum foils, or conductive plastics. JUDD WIRE's cable jacketing facilities extrude irradiation cross-linked compounds as well as vinyls, nylons, polyethylenes, polyurethanes, and 150°C fluorocarbons. JUDD WIRE is a completely integrated wire and cable manufacturing facility combining technology with superior customer service.

PCA cables offer all the advantages of JUDD WIRE's exclusive irradiation cross-linked polychloro alkene insulation in a multi-conductor package.

Manufacturers of computers, data processing equipment, communication systems, and test equipment can use the superior characteristics and cost saving benefits of PCA cables.

THE JUDD WIRE PCA multi-conductor cable cross-reference for tri-rated approvals

CABLE UL STYLE	PRIMARY UL STYLE	CABLE CSA STYLE	PRIMARY MILITARY SPECIFICATION	PRIMARY NOMINAL WALL	JACKET NOMINAL WALL	TEMPERA-TURE	VOLTAGE RATING	WIRE AWG SIZES
2584	1472	AWM		.007″	.031-.060″	80°C	125 V	30-20
2576	1429	AWM	Mil-W-16878E/1	.011″	.030″	80°C[1]	150 V[2]	30-10
2095	1787		Mil-W-16878E/1	.011″	.015-.060″	80°C[1]	300 V[2]	30-16
2464	1787		Mil-W-16878E/1	.011″	.030-.060″	80°C[1]	300 V[2]	30-16
2517	1430	AWM	Mil-W-16878E/2	.016″	.030-.060″	105°C	300 V[3]	30-10
2586	1431	AWM	Mil-W-16878E/3	.031″	.031-.060″	105°C	600 V[4]	30-10

[1] Military Temperature Rating: 105°C
[2] Military Voltage Rating: 600 V
[3] Military Voltage Rating: 1000 V
[4] Military Voltage Rating: 3000 V

FLEXRAD 125 MULTI-CONDUCTOR CABLES

Industrial Automation and Central Process Computer Control cables manufactured with JUDD WIRE's FLEXRAD 125 primary conductors and irradiation cross-linked polyethylene jacket compound, are a superior instrumentation cable for applications utilizing data processing systems interfaced with manufacturing control equipment.

THE JUDD WIRE FLEXRAD 125 high temperature multi-conductor cable cross-reference guide

CABLE UL STYLE	CABLE CSA STYLE	PRIMARY MILITARY SPECIFICATIONS	PRIMARY NOMINAL WALL	JACKET NOMINAL WALL	TEMPERA-TURE	VOLTAGE RATING	WIRE AWG SIZES
4311	AWM	Mil-W-16878E/14	.011″	.030-.045″	125°C	150 V[1]	28-16
4312	AWM	Mil-W-16878E/15	.016″	.030-.060″	125°C	300 V[2]	28-10
4313	AWM	Mil-W-16878E/16	.032″	.045-.080″	125°C	600 V[3]	26-10

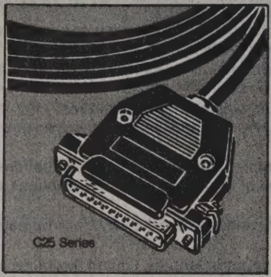
Military Voltage : [1] 600 V, [2] 1000 V, [3] 3000 V

Call or write for complete product catalogs

For More Information. Circle No. 514

RS-232C Data Cables

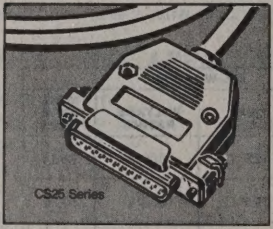
L-com



MODEL	NO. WIRES	GENDER	LGT. FT.	1-4	5-9	10-24

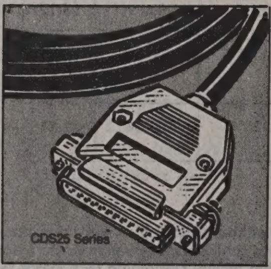
UNSHIELDED — Most economical data cables. Suitable for short distance connections or extensions. Not recommended for areas with fluorescents which radiate noise. Excellent home use.

MODEL	NO. WIRES	GENDER	LGT. FT.	1-4	5-9	10-24
C25MM-2.5	25	Male/Male	2.5	24.85	23.86	22.61
C25MM-5	25	Male/Male	5.0	26.45	25.39	24.07
C25MM-10	25	Male/Male	10.0	29.70	28.51	27.03
C25MM-15	25	Male/Male	15.0	32.95	31.63	29.98
C25MM-25	25	Male/Male	25.0	39.45	37.87	35.90
C25MF-2.5	25	Male/Female	2.5	26.05	25.01	23.71
C25MF-5	25	Male/Female	5.0	27.65	26.54	25.16
C25MF-10	25	Male/Female	10.0	30.90	29.66	28.12
C25MF-15	25	Male/Female	15.0	34.15	32.78	31.08
C25MF-25	25	Male/Female	25.0	40.65	39.02	36.99


CS25 Series

FULLY SHIELDED — Meets all FCC system requirements at a most reasonable cost. Incorporates our exclusive inner shield design. Recommended for short, intermediate, and long runs.

MODEL	NO. WIRES	GENDER	LGT. FT.	1-4	5-9	10-24
CS25MM-5	25	Male/Male	5.0	37.00	35.52	33.67
CS25MM-10	25	Male/Male	10.0	41.00	39.36	37.31
CS25MM-15	25	Male/Male	15.0	45.00	43.20	40.95
CS25MM-25	25	Male/Male	25.0	53.00	50.88	48.23
CS25MM-50	25	Male/Male	50.0	73.00	70.08	66.43
CS25MF-5	25	Male/Female	5.0	38.20	36.67	34.76
CS25MF-10	25	Male/Female	10.0	42.20	40.51	38.40
CS25MF-15	25	Male/Female	15.0	46.20	44.35	42.04
CS25MF-25	25	Male/Female	25.0	54.20	52.03	49.32
CS25MF-50	25	Male/Female	50.0	74.20	71.23	67.52


CDS25 Series

DOUBLE SHIELDED — A premium line, optimum protection from radiation. Mylar foil plus copper braid with inner shield and outer metalized connectors desirable for longer runs.

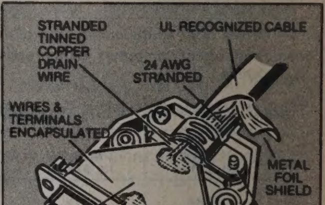
MODEL	NO. WIRES	GENDER	LGT. FT.	1-4	5-9	10-24
CDS25MM-5	25	Male/Male	5.0	51.75	49.68	47.09
CDS25MM-10	25	Male/Male	10.0	56.50	54.24	51.42
CDS25MM-15	25	Male/Male	15.0	61.25	58.80	55.74
CDS25MM-25	25	Male/Male	25.0	70.75	67.92	64.38
CDS25MM-50	25	Male/Male	50.0	94.50	90.72	86.00
CDS25MM-100	25	Male/Male	100.0	142.00	136.32	129.22
CDS25MF-5	25	Male/Female	5.0	52.95	50.83	48.18
CDS25MF-10	25	Male/Female	10.0	57.70	55.39	52.51
CDS25MF-15	25	Male/Female	15.0	62.45	59.95	56.83
CDS25MF-25	25	Male/Female	25.0	71.95	69.07	65.47
CDS25MF-50	25	Male/Female	50.0	95.70	91.87	87.09
CDS25MF-100	25	Male/Female	100.0	143.20	137.47	130.31

RS-232C CABLES BUILT FOR A LIFE TIME OF WEAR & TEAR!

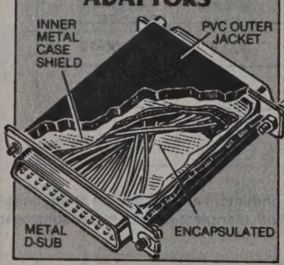
The drawing shows how our CS or CDS series cables are built to last a lifetime. Optimum shielding is achieved by use of a conductive-Mylar-foil or copper braid and a metal cover for the wires under the hood.

In addition, these cables are built to take years of abuse by encapsulating and fusing all twenty-five wires and the connector pins together resulting in an indestructible integral component. We know that almost all cable defects stem from breaks or shorts in the cable end, but this is now totally eliminated — forever!

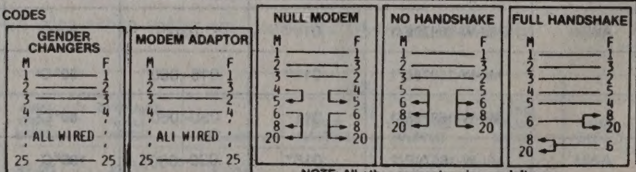
All data cable comply with EIA RS232C standards and have 25 conductors solder connected through to both **D-Sub Connectors**. CS & CDS series cable assemblies are designed to meet or exceed the new FCC requirements for maximum RFI/EMI protection under Docket 20780.


STRANDED TINNED COPPER DRAIN WIRE
UL RECOGNIZED CABLE
24 AWG STRANDED
WIRES & TERMINALS ENCAPSULATED
METAL FOIL SHIELD
STRAIN RELIEF
UNDER HOOD SHIELD
PINS MACHINED GOLD PLATED
MOLDED HOOD UL-94VO
D-SUBS W/METAL SHIELD

RS-232C 25-PIN SHIELDED GENDER/MODEM ADAPTORS


INNER METAL CASE SHIELD
PVC OUTER JACKET
METAL D-SUB
ENCAPSULATED

CODES


GENDER CHANGERS
M F
1 1
2 2
3 3
4 4
ALL WIRED
25 25
MODEM ADAPTOR
M F
1 1
2 3
3 2
4 4
ALL WIRED
25 25
NULL MODEM
M F
1 1
2 3
3 2
4 4
5 5
6 6
8 8
20 20
NO HANDSHAKE
M F
1 1
2 3
3 2
5 5
6 6
8 8
20 20
FULL HANDSHAKE
M F
1 1
2 3
3 2
4 5
5 4
6 8
20
8 6
20

NOTE: All other connector pins are left open.

GENDER CHANGER — needed when cables won't mate. Two models fill all requirements. Ours are shielded and encapsulated; built to last a lifetime. Keep several around for emergency needs.

MODEM ADAPTORS — eliminate the need for modems when connecting local terminals together or terminals to computer. Identical construction to our Gender Changers.

MG-25F	Gender Changer, Female-Female	27.95	26.83	25.43
MG-25M	Gender Changer, Male-Male	27.95	26.83	25.43
MA-25A	Modem Adaptor	27.95	26.83	25.43
MA-25B	Null Modem	27.95	26.83	25.43
MA-25C	No Handshake	27.95	26.83	25.43
MA-28D	Full Handshake	27.95	26.83	25.43

NOTE:
Mixing allowed for quantity pricing:

L-com DATA PRODUCTS
1755 Osgood St., No. Andover, MA 01845

TOLL FREE 800-343-1455
Ma 617 682 6936
Telex 882157 LCOM UD
FAX 617-689-9484

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

For More Information. Circle No. 515

D-Sub Connectors/Cables

SOLDER CUP TERMINATIONS — 9 thru 25 positions are provided with goldplated screw machined (male) and stamped metal contacts (female). These connectors **intermate** with all **D-Sub Connectors.**

MODEL	NO. WIRES	GENDER/COLOR		1-9	10-24	25-99
SD9P	9	Male		1.80	1.71	1.58
SD15P	15	Male		2.45	2.33	2.16
SD25P	25	Male		3.65	3.47	3.21
SD9S	9	Female		2.40	2.28	2.11
SD15S	15	Female		3.20	3.04	2.82
SD25S	25	Female		4.85	4.61	4.27

PRINTED CIRCUIT SOLDER PINS — goldplated machined or stamped metal contacts with closed entry seal.

MODEL	NO. WIRES	GENDER/COLOR		1-9	10-24	25-99
SD9P-PC	9	Male		2.25	2.14	1.98
SD15P-PC	15	Male		2.70	2.57	2.38
SD25P-PC	25	Male		3.95	3.75	3.48
SD9S-PC	9	Female		3.15	2.99	2.77
SD15S-PC	15	Female		4.25	4.04	3.74
SD25S-PC	25	Female		5.95	5.65	5.24

PC MOUNT RIGHT ANGLE — for use in high density electronic products. Metal shells provide EMI/RFI shielding.

MODEL	NO. WIRES	GENDER/COLOR		1-9	10-24	25-99
SD9P-RA	9	Male		3.25	3.09	2.86
SD15P-RA	15	Male		3.90	3.71	3.43
SD25P-RA	25	Male		4.95	4.70	4.36
SD9S-RA	9	Female		5.55	5.27	4.88
SD15S-RA	15	Female		6.65	6.32	5.85
SD25S-RA	25	Female		8.45	8.03	7.44

GRAY HOOD — for use with **D-Sub Connectors.** Plastic material. Cable clamp and hardware supplied with all hoods.

MODEL	NO. WIRES	GENDER/COLOR		1-9	10-24	25-99
SDC-9G	9	Gray	(Package of 2)	2.70	2.57	2.38
SDC-15G	15	Gray	(Package of 2)	2.90	2.76	2.55
SDC-25G	25	Gray	(Package of 2)	3.10	2.95	2.73
SDH-50	Conversion hardware for cable use		(Package of 50)	4.95	4.70	4.36
SDG-50	Conversion hardware for panel use		(Package of 50)	8.95	8.50	7.88

BLACK HOOD — for use with **D-Sub Connectors.** Plastic material. Cable clamp and hardware supplied.

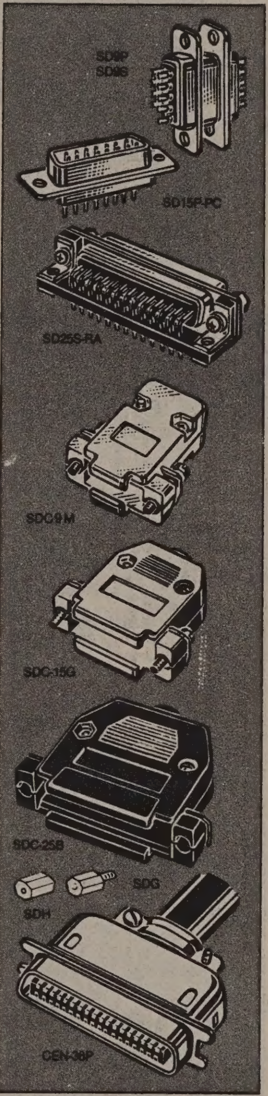
MODEL	NO. WIRES	GENDER/COLOR		1-9	10-24	25-99
SDC-9B	9	Black	(Package of 2)	2.70	2.57	2.38
SDC-15B	15	Black	(Package of 2)	2.90	2.76	2.55
SDC-25B	25	Black	(Package of 2)	3.10	2.95	2.73
SDH-50	Conversion hardware for cable use		(Package of 50)	4.95	4.70	4.36
SDG-50	Conversion hardware for panel use		(Package of 50)	8.95	8.50	7.88

METALIZED HOOD — all plastic surfaces metalplated to provide a conductive surface. Meets EMI requirements.

MODEL	NO. WIRES	GENDER/COLOR		1-9	10-24	25-99
SDC-9M	9	Metalized	(Package of 2)	3.50	3.33	3.08
SDC-15M	15	Metalized	(Package of 2)	3.70	3.52	3.26
SDC-25M	25	Metalized	(Package of 2)	3.90	3.71	3.43
SDH-50	Female-Female hardware for cable use 4-40		(Package of 50)	4.95	4.70	4.36
SDG-50	Female-Male hardware for panel use 4-40		(Package of 50)	8.95	8.50	7.88

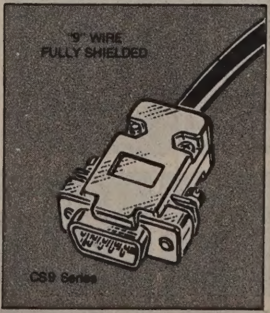
CENTRONICS* TYPE — with metal cover or panel use. Metal covers, goldplated contacts, solder terminations.

MODEL	NO. WIRES	GENDER/COLOR		1-9	10-24	25-99
CEN-36PC	36	Male Cable		7.95	7.55	7.00
CEN-36PF	36	Male Flat Cable		7.95	7.55	7.00
CEN-36PN	36	Male Panel		6.95	6.60	6.12
CEN-36SC	36	Female Cable		8.95	8.50	7.88
CEN-36SF	36	Female Flat Cable		8.95	8.50	7.88
CEN-36SN	36	Female Panel		7.95	7.55	7.00



9-CONDUCTOR RS-449 CABLES — Mylar foil shielded cable and cast aluminun hoods meet EMI (FCC) radiation requirements. All 9 wires terminate to Sub D-9 Pin Connectors.

MODEL	NO. WIRES	GENDER	LGT. FT.	1-4	5-9	10-24
CS9MM-2.5	9	Male/Male	2.5	15.85	15.22	14.42
CS9MM-5	9	Male/Male	5.0	17.25	16.56	15.70
CS9MM-10	9	Male/Male	10.0	20.00	19.20	18.20
CS9MM-15	9	Male/Male	15.0	22.75	21.84	20.70
CS9MM-25	9	Male/Male	25.0	28.25	27.12	25.71
CS9MF-2.5	9	Male/Female	2.5	16.30	15.65	14.83
CS9MF-5	9	Male/Female	5.0	17.65	16.94	16.06
CS9MF-10	9	Male/Female	10.0	20.40	19.58	18.56
CS9MF-15	9	Male/Female	15.0	23.15	22.22	21.07
CS9MF-25	9	Male/Female	25.0	28.65	27.50	26.07



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BNC Cables/Connectors

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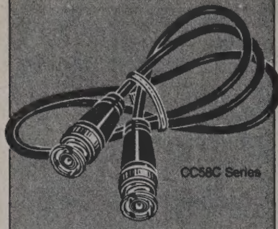
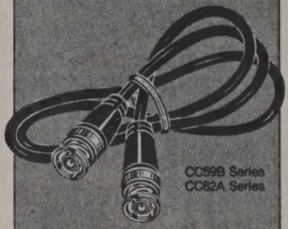
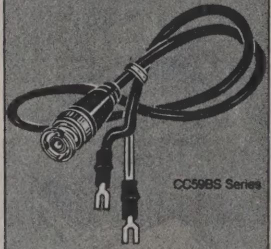




CC59BX Series
CC62AX Series



BAC-10
BAC-10A

MODEL	GENDER	LENGTH	CABLE	1-4	5-9	10-24

RG58C/U - 50 ohm Coaxial Cables with Molded BNC's for Instrumentation Use

CC58C-1	Male/Male	1.0	RG-58C/U	3.55	3.41	3.23
CC58C-2.5	Male/Male	2.5	RG-58C/U	3.95	3.79	3.59
CC58C-5	Male/Male	5.0	RG-58C/U	4.65	4.46	4.23
CC58C-10	Male/Male	10.0	RG-58C/U	6.05	5.81	5.51
CC58C-15	Male/Male	15.0	RG-58C/U	7.45	7.15	6.78
CC58C-25	Male/Male	25.0	RG-58C/U	10.25	9.84	9.33
CC58C-50	Male/Male	50.0	RG-58C/U	17.25	16.56	15.70
CC58C-100	Male/Male	100.0	RG-58C/U	31.25	30.00	28.44

RG59B/U - 75 ohm Coaxial Cables with Molded BNC's for Video & General Use

CC59B-1	Male/Male	1.0	RG-59B/U	3.65	3.50	3.32
CC59B-2.5	Male/Male	2.5	RG-59B/U	4.00	3.84	3.64
CC59B-5	Male/Male	5.0	RG-59B/U	4.75	4.56	4.32
CC59B-10	Male/Male	10.0	RG-59B/U	6.25	6.00	5.69
CC59B-15	Male/Male	15.0	RG-59B/U	7.75	7.44	7.05
CC59B-25	Male/Male	25.0	RG-59B/U	10.75	10.32	9.78
CC59B-50	Male/Male	50.0	RG-59B/U	18.25	17.52	16.61
CC59B-100	Male/Male	100.0	RG-59B/U	33.25	31.92	30.26

RG62A/U - 93 ohm Coaxial Cables with Molded BNC's for Computer Applications

CC62A-1	Male/Male	1.0	RG-62A/U	3.60	3.46	3.28
CC62A-2.5	Male/Male	2.5	RG-62A/U	3.95	3.79	3.59
CC62A-5	Male/Male	5.0	RG-62A/U	4.70	4.51	4.28
CC62A-10	Male/Male	10.0	RG-62A/U	6.15	5.90	5.60
CC62A-15	Male/Male	15.0	RG-62A/U	7.60	7.30	6.92
CC62A-25	Male/Male	25.0	RG-62A/U	10.50	10.08	9.56
CC62A-50	Male/Male	50.0	RG-62A/U	17.75	17.04	16.15
CC62A-100	Male/Male	100.0	RG-62A/U	32.25	30.96	29.35

Extension Cables with Molded Male & Female BNC Connectors

CC59BX-10	Male/Female	10.0	RG-59B/U	6.45	6.19	5.87
CC59BX-15	Male/Female	15.0	RG-59B/U	7.95	7.63	7.23
CC59BX-25	Male/Female	25.0	RG-59B/U	10.95	10.51	9.96
CC62AX-10	Male/Female	10.0	RG-62A/U	6.35	6.10	5.78
CC62AX-15	Male/Female	15.0	RG-62A/U	7.80	7.49	7.10
CC62AX-25	Male/Female	25.0	RG-62A/U	10.70	10.27	9.74
CC62AX-50	Male/Female	50.0	RG-62A/U	17.95	17.23	16.33
CC62AX-100	Male/Female	100.0	RG-62A/U	32.45	31.15	29.53

Cable Adaptors with Molded BNC and Spade Lug Terminations

CC59BS-1	Male/Spade Lug	1.0	RG-59B/U	3.30	3.17	3.00
CC59BS-2	Male/Spade Lug	2.0	RG-59B/U	3.60	3.46	3.28
CC59BS-4	Male/Spade Lug	4.0	RG-59B/U	4.20	4.03	3.82

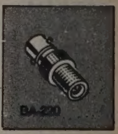
L-COM offers a full line of Data Cables meeting EIA RS-232C and RS-449 standards. Call customer service for information.

BNC Connectors for Panel and Cable Use

			1-9	10-24	25-99
BAC-10	Male Cable Plug for RG-59B/U	(Package of 2)	3.50	3.33	3.08
BAC-10A	Male Cable Plug for RG-58C/U	(Package of 2)	3.70	3.52	3.26
BAC-70	Female Panel Receptacle	(Package of 2)	3.50	3.33	3.08
BAC-260	Female Bulkhead Receptacle	(Package of 2)	3.90	3.71	3.43

BNC Adaptors

		1-4	5-9	10-24
BA-50	BNC Female to UHF Male	2.95	2.83	2.68
BA-60	BNC Male to UHF Female	3.95	3.79	3.59
BA-80	BNC Female to Female	2.95	2.83	2.68
BA-100	BNC Male to Male	2.95	2.83	2.68
BA-230	BNC Female to UHF Female	2.95	2.83	2.68
BA-240	BNC "L" Female to Male	2.95	2.83	2.68
BA-250	BNC "T" Female, Male, Female	4.85	4.66	4.41
BA-90	BNC Female to RCA Male	1.95	1.87	1.77
BA-120	BNC Female to "F" Male	2.15	2.06	1.96
BA-220	BNC Female to "F" Female	2.35	2.26	2.14



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Heli-Tube®

Spirally Cut Expandable Plastic Cable Harness

Exceptional Features and uses include . . .

- **BUNDLES WIRES, CABLES, or HOSES FIRMLY BUT ALLOWS FLEXIBILITY**
- **RESISTS ABRASION & INSULATES**
- **DAMPENS VIBRATION**

This Heli-Tube is recognized under the Component Program of Underwriter's Laboratories, Inc.

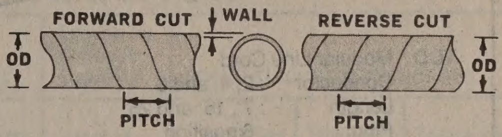
Standard Materials	Max. Oper. Temp.	Min. Oper. Temp.	Abrasion Resistance Lower Better mg loss per M cycles	Effect of Solvents	Effect of Acids	Effect of Alkalies	Flammability	Mil Spec. & Approvals
CLEAR POLYETHYLENE Low cost material . . . ideal for general applications. Not affected by ordinary solvents and extremely resistant to abrasion.	215°F 101°C	-105°F -76°C	22	None below 122°F 50°C	None	None	Flammable	Fed. Spec. LP390 MIL I 631D MIL P 26692
BLACK POLYETHYLENE Ultraviolet-resistant for outdoor use. This has the same qualities as Clear Polyethylene and, in addition, contains an ultraviolet absorber which permits it to be used in direct sunlight for long periods of time.	215°F 101°	-105°F -76°C	20	None below 122°F 50°C	None	None	Flammable	Fed. Spec. LP390 MIL I 631 D MIL P 26692
FIRE-RESISTANT POLYETHYLENE SELF EXTINGUISHING, yet has lower cost than Nylon or Teflon. Made of duPont White Rulan. (Also available in Black).	200°F 93°C	-1°F -19°C	27	None below 122°F 50°C	None	None	UL 94V-0	
NYLON Natural - Offers combination of light weight, temperature range, and high abrasion resistance. Self-extinguishing. Recommended for use in enclosed environments where possibility of fire exists. Even at temperatures beyond its operating range, or on exposure to flame, Nylon does not give off any toxic or irritating by-products. Nylon is six times as strong as Polyethylene.	250°F 121°C	-121°F -85°C	6-8	None	Satisfactory except for strong acids	None	UL 94V-2	MIL M-20693A Type I MIL M 22096 LP 410A
BLACK NYLON Has the same characteristics as Nylon Natural, but, in addition, has an ultraviolet absorber which permits use in direct sunlight. This Nylon is heat stabilized.	250°F 121°C	-121°F -85°	6-8	None	Satisfactory except for strong acids	None	UL 94V-2	MIL M-20693A Type II MIL M 22096 LP 410A
TEFLON Natural (TFE) - Has the widest temperature range. Can be used from -450°F to 500°F. Chemically inert. Non-flammable.	500°F 260°C	-450°F -85°C	7	None	None	None	Non-Flammable	MIL M-20693 AMS 3651B AMS 3653 AMS 3654 AMS 3655

Convenient Packaging

Heli-Tube
M. M. NEWMAN CORP
PAYOUT BOX

Size	Spools Feet	Payout Box Feet
⅛"	100 or 500	
¼"	100 or 500	250
⅜"	100 or 500	100
½"	100 or 500	50 or 100
¾"	100 or 200	25 or 50
1"	100	200
Special Packaging Available		

TO ORDER please state size, material and spooling requirement.



Dimensions & Weights

Material	Part No.	Outside Dia.	Wall Thickness	Pitch Decimal	Max. Bundle Range	Weight Lbs./ M Ft.
Clear Polyethylene	HT 1/8C	.125	.032	.187	1/16 to 1/2	4
	HT 1/4C2	.250	.035	.375	3/16 to 2	9
	HT 1/4C	.250	.045	.375	3/16 to 2	12
	HT 3/8C	.375	.052	.438	5/16 to 3	22
	HT 1/2C	.500	.062	.563	3/8 to 4	35
	HT 3/4C	.750	.065	.750	3/4 to 5	58
	HT 1C	1.00	.095	1.00	1 to 7	105
Black Polyethylene Ultraviolet-Resistant for Outdoor Use	HT 1/8UR	.125	.032	.187	1/16 to 1/2	4
	HT 1/4UR	.250	.045	.375	3/16 to 2	12
	HT3/8UR	.375	.052	.438	5/16 to 3	22
	HT 1/2UR	.500	.062	.500	3/8 to 4	35
	HT 3/4UR	.750	.065	.750	3/4 to 5	58
	HT 1UR	1.00	.095	1.00	1 to 7	105
Fire-Resistant White Rulan	HT 1/8FR	.125	.032	.187	1/16 to 1/2	6
	HT 1/4FR	.250	.045	.375	3/16 to 2	17
	HT 3/8FR	.375	.052	.438	5/16 to 3	29
	HT 1/2FR	.500	.062	.563	3/8 to 4	52
	HT 3/4FR	.750	.065	.750	3/4 to 5	85
	HT 1FR	1.00	.095	1.00	1 to 7	156
Fire-Resistant Black Rulan	HT 1/4FR-B	.250	.045	.375	3/16 to 2	17
	HT 1/2FR-B	.500	.062	.563	3/8 to 4	52
Nylon	HT 1/8N	.125	.015	.187	1/16 to 1/2	3
	HT 1/4N	.250	.025	.375	3/16 to 2	9
	HT 3/8N	.375	.035	.438	5/16 to 3	18
	HT 1/2N	.500	.035	.500	3/8 to 4	25
	HT 3/4N	.750	.032	.750	1/2 to 5	38
	HT 1N	1.00	.032	1.00	1 to 7	50
Black Nylon Heat Stabilized	HT 1/8N-B	.125	.015	.187	1/16 to 1/2	3
	HT 1/4N-B	.250	.025	.375	3/16 to 2	9
	HT 3/8N-B	.375	.035	.438	5/16 to 3	18
	HT 1/2N-B	.500	.035	.500	3/8 to 4	25
	HT 3/4N-B	.750	.032	.750	1/2 to 5	38
	HT 1N-B	1.00	.032	1.00	1 to 7	50
Teflon	HT 1/8T1	.125	.030	.187	1/16 to 1/2	9.4
	HT 1/8T2	.125	.020	.187	1/16 to 1/2	7.4
	HT 3/16T	.187	.030	.250	1/8 to 1-1/12	15.2
	HT 1/4T	.250	.030	.375	3/16 to 2	20.7
	HT 3/8T	.375	.030	.438	5/16 to 2-1/2	36.5
	HT 1/2T	.500	.030	.500	3/8 to 3	50.5
	HT 3/4T	.750	.032	.750	1/2 to 4	81.3
	HT 1T	1.00	.040	1.00	3/4 to 5	175.0

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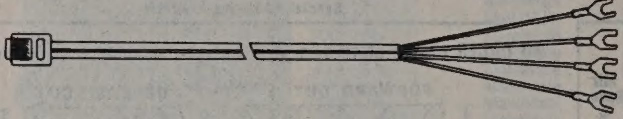
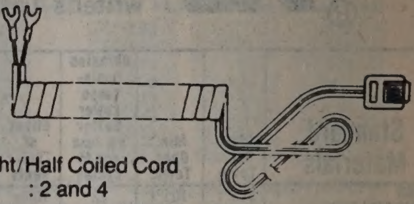
All products are manufactured to FCC requirements under the license of Western Electric. Modern manufacturing automation and technique assures a high quality and uniformly made product. Each production lot undergoes a MIL-STD-105D single sample inspection at General inspection level II, AQL 1.0% for performance and 1.25% for appearance.

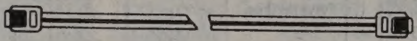
If you are looking for a professional supplier with consistency, economy and reliability, call us.



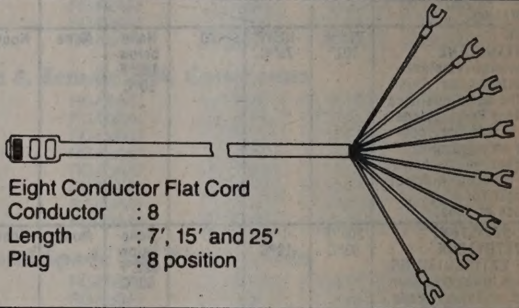
TCO Modular Line Cord
Conductor : 2, 4, and 6
Length : 7′, 15′ and 25′
Plug : 6 position



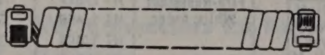
TC10 Half Straight/Half Coiled Cord
Conductor : 2 and 4
Length : 14′
Plug : 6 position



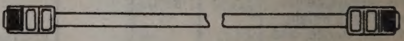
TCO1 Modular Extension Cord
Conductor : 2, 4, and 6
Length : 7′, 15′ and 25′
Plug : 6 position



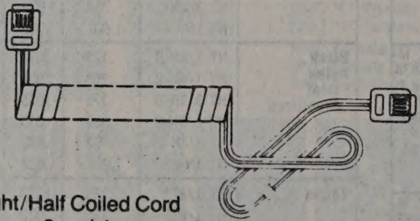
TC14 Eight Conductor Flat Cord
Conductor : 8
Length : 7′, 15′ and 25′
Plug : 8 position



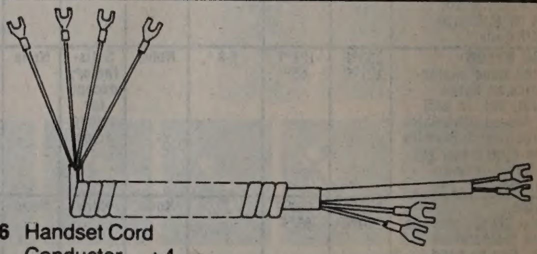
TC8 Modular Handset Cord
Conductor : 4
Length : 7′, 15′ and 25′
Plug : 4 position



TC15 Conductor Flat Cord
Conductor : 8
Length : 7′, 15′ and 25′
Plug : 8 position



TC9 Half Straight/Half Coiled Cord
Conductor : 2 and 4
Length : 14′
Plug : 6 position

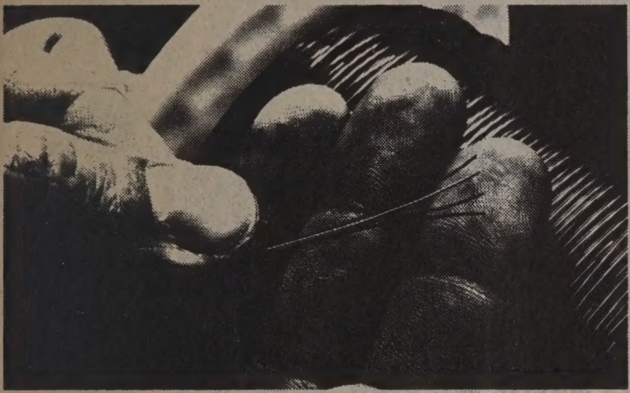


TC16 Handset Cord
Conductor : 4
Length : 7′, 15′ and 25′

ALSO AVAILABLE–
Mura offers a complete line of Modular Jack Connectors for 2, 4, 6 and 8 wire connections.

For More Information. Circle No. 517

MULTIFILAR® MAGNET WIRE



Whenever two or more magnet wires travel together, MULTIFILAR magnet wire is worth a closer look. This parallel-bonded, color-coded magnet wire offers many benefits for both small and large users.

Engineers should specify it when they're concerned with space, weight and reliability. Where consistent capacitance and impedance characteristics are needed, MULTIFILAR magnet wire outperforms windings where two separate magnet wires are used.

Production users benefit from increased layer winding speeds, reduced labor and handling. Color-coding assists in conductor identification and reduces termination errors.

MULTIFILAR magnet wires are custom produced by MWS. We guarantee flat, parallel construction in an array of sizes 16 AWG and finer, with up to 20 conductors in some sizes.

Both round and flat constructions are available. Color-coded conductors are available in most insulations with up to 10 different colors in some sizes. Conductor separation is also guaranteed with certain bonding mediums.

For an even closer look, send for a free sample, specifications and ordering information. Production minimums are as low as 500 feet.

GENERAL PRODUCT INFORMATION

Code No.	INSULATIONS	Thermal Rating	NEMA MW1000	MILW583 Class/Type
1	**Polyurethane***	105°C	MW2C	CL-105 T thru T-4
2	**Poly-Nylon***	130°C	MW28C	CL-130 B thru B-4
4	**Modified Polyester**	180°C	MW30C	CL-180 H thru H-4
5	**Armored Polyester**	200°C	MW35C	CL-200 K thru K-4
6	**Solderable Polyester***	180°C	MW26C	CL-155
7	**Formvar**	105°C	MW15C	CL-105 T thru T-4
8	**Pyre M.L.†**	220°C	MW16C	CL-220 M thru M-4

Code No.	Bonding Films (operating temp.)	Solvents for Conductor Separation
1	**Polyvinyl Butyral** (105°C)	Alcohol Isopropyl or Denatured
2	**Polyamide (Nylon)** (105°C)	None
3	**Epoxy** (130°C)	Acetone

BOND THICKNESS STANDARDS

AWG Size	Thickness	Tolerances
16-20	.0007"	±.0002"
21-28	.0005"	±.0002"
29-32	.0004"	±.0001"
33-36	.0003"	±.0001"
37-41	.0002"	±.0001"
42-finer	.0001"	+.0001" -.0

* Solderable Insulations † Trademark of DuPont

NOTE: The above referenced insulations, bonding films, and bond thickness are standard. Other insulations, films and thicknesses are available upon request. CONDUCTOR SEPARATION: Bonding films can be softened and removed by immersion in appropriate solvents. Some mechanical action (i.e. wiping wires following immersion in solvent) may be required to affect conductor separation.

PART NUMBER ORDERING SYSTEM

Make your own 8 digit part number by following the guidelines outlined below.

EXAMPLE **B-2 3 8 1 1 1 1**

- Product letter for all multifilar magnet wire
- Number of conductors. Use ( ) for more than 9 conductors
- AWG gauge sizes
- Insulation thickness
  - 1= single
  - 2=heavy
  - 3=triple
  - 4=quadruple
- Insulation type "See above chart for correct code number"
- Color coded conductors
  - 0=none required
  - 1=red/green
  - 2=green/clear
  - 3=red/green/clear
  - *9=special — call for color code
- Bonding film "See above chart for correct code number"

EXAMPLE = 2 Conductors—38AWG Single Polyurethane—Red/Green—Butyral Bond

* Denotes Change

If you have any questions regarding how to specify a correct part number for the **multifilar** wire you need, don't hesitate to call us. Our salesmen or engineering staff will be happy to assist you.

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In California: 1 800 992-8553 In Los Angeles Area: (818) 991-8553.

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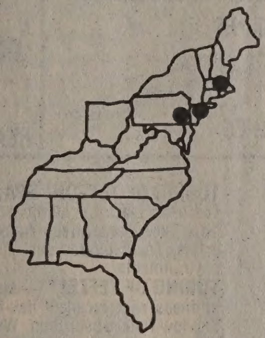

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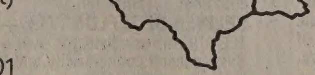

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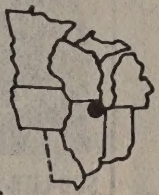

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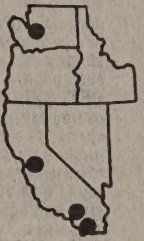

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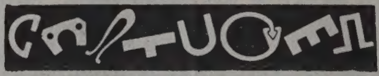
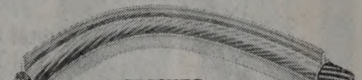
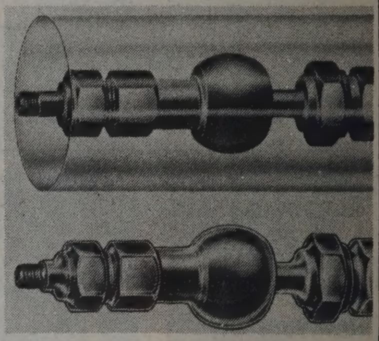


SHAPES



SPLINES



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SUB-LITE-WALL™ TUBING OF TEFLON* — The world's smallest tubing. Rivals nature's own capillaries. Walls as thin as 0.0015″ in I.D.s of 0.022″ and larger. Also I.D.s less than 0.002″ with wall thicknesses of 0.007″ or greater, or an 0.060″ I.D. with wall thickness of only 0.0015″! (Note: The average dimension of a human hair is 0.003″.) Superior lubricity — slides easily into tiny convoluted passages. Chemically inert and stable. Available for heat-shrink applications. Withstands extremes of heat (up to 500°F). Zero water absorption. I.D.s and wall thicknesses absolutely uniform!

HEAT SHRINK TUBING OF TEFLON* TFE — Now your components can overpower hell, high water, and the acid test when protected by Zeus heat shrink TFE tubing! Provided in the expanded state. A brief application of heat produces a skin-tight protective jacket to items that will be subjected to extremes of heat, corrosion, shock, moisture! Shrink ratios up to 4 to 1. Wide range of AWG, fractional inch, and industrial sizes. Standard wall, thin wall, and lightweight wall. Outstanding electrical, thermal, and mechanical properties.

DUAL-SHRINK TUBING OF TEFLON* TFE/FEP — Features an outer tubing of heat-shrink TFE and an inner tubing of FEP. TFE shrinks for tight fit when heat is applied. FEP melts and flows to form an encapsulation with a fit so tight that it can withstand severe stresses of pull or vibration and protect against moisture, acids, etc. Ideal for wires, cables, connectors, etc. Service temperature up to 450°F.

HEAVY CONSTRUCTION TUBING OF TEFLON* TFE — For extra strength, durability, and easy handling. For automotive, chemical, electrical and mechanical applications. Features low coefficient of friction, high heat and abrasion resistance, inertness and stability.

SPAGHETTI TUBING OF TEFLON* TFE — The ultimate in heat resistance, continuous use at 500°F, chemical stability, and dielectric properties. Unmatched concentricity and close tolerances. Standard wall, thin wall, and lightweight wall. Inert to solvents, acids, alkalies, and salts. Wide range of AWG sizes, fractional inch and industrial grade. Commercial and Mil Specs. UL File No. E-64007A.

TUBING OF TEFLON* FEP — Chemically inert, excellent dielectric properties. Continuous use at 400°F. Non-aging, anti-stick. Great tensile strength. UL File No. E-64007.

TUBING OF TEFLON* PFA — Tough, flexible. Continuous use near 500°F. Features clarity, chemical inertness, excellent flex-life, and chemical flow. Exceptional stress-crack resistance combined with great dielectric properties. For extended service in critical electrical, chemical, and thermal environments.

TUBING OF TEFZEL® — Mechanically superior, tough material of medium stiffness with excellent flex-life, impact resistance, cut-through resistance and low water absorption. Weather-resistant, and inert to most solvents and chemicals. Excellent resistance to high energy radiation. Low-loss dielectric. Continuous use at 300°F.

SNAPTUBE™ — A cost-effective protective wrapping of Teflon TFE for the restoration and reutilization of conductors with damaged insulations. Snaps quickly into place over wires or cables. Conductors can be left in place so that cost and installation of the conductor is not lost. Can also be used as a chafing guard over wire, cable, or wire bundles to form a homogeneous cable structure. Cut into small sections SNAPTUBE can be used as CABLE TIES. Available also in long lengths and sizes to accommodate wire bundles. Also available for color coding.

SPIRAL-CUT CABLE WRAPS OF TEFLON* — For harnessing and insulating wires, cables, etc. Expandable, abrasion-resistant. Over wire bundles, openings provide individual leads to be broken out at any point while creating a rugged, homogeneous harness assembly which can be channeled, bent, or flexed. Available in TFE, FEP, PFA, or TEFZEL.®

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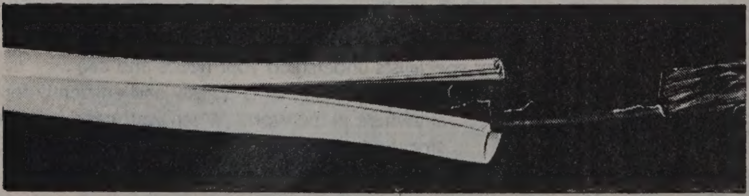

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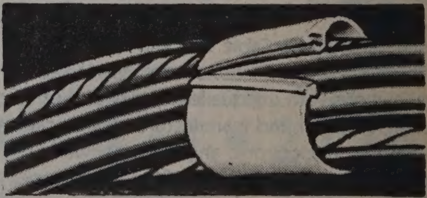

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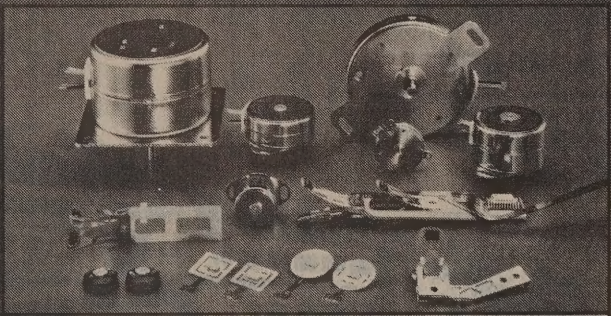

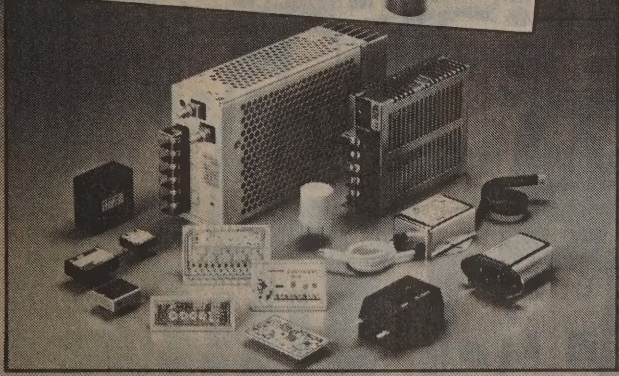

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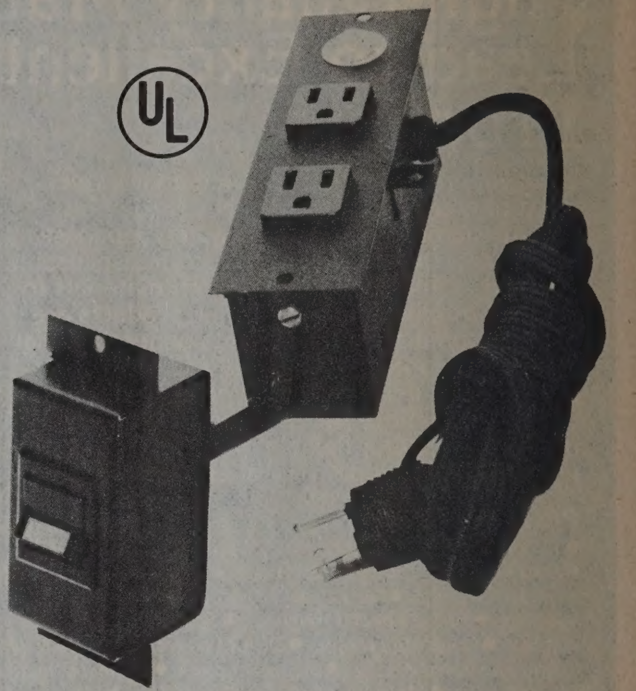

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- Relocation of components
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- 1 amp to 20 amps; 1 volt to 250 volts AC
- Length, type, and size of power supply cord
- Special configurations to meet local code requirements
- Over 480 UL Listed and 310 CSA Certified non-stocking designs are available to meet your specific need
- Other unusual characteristics

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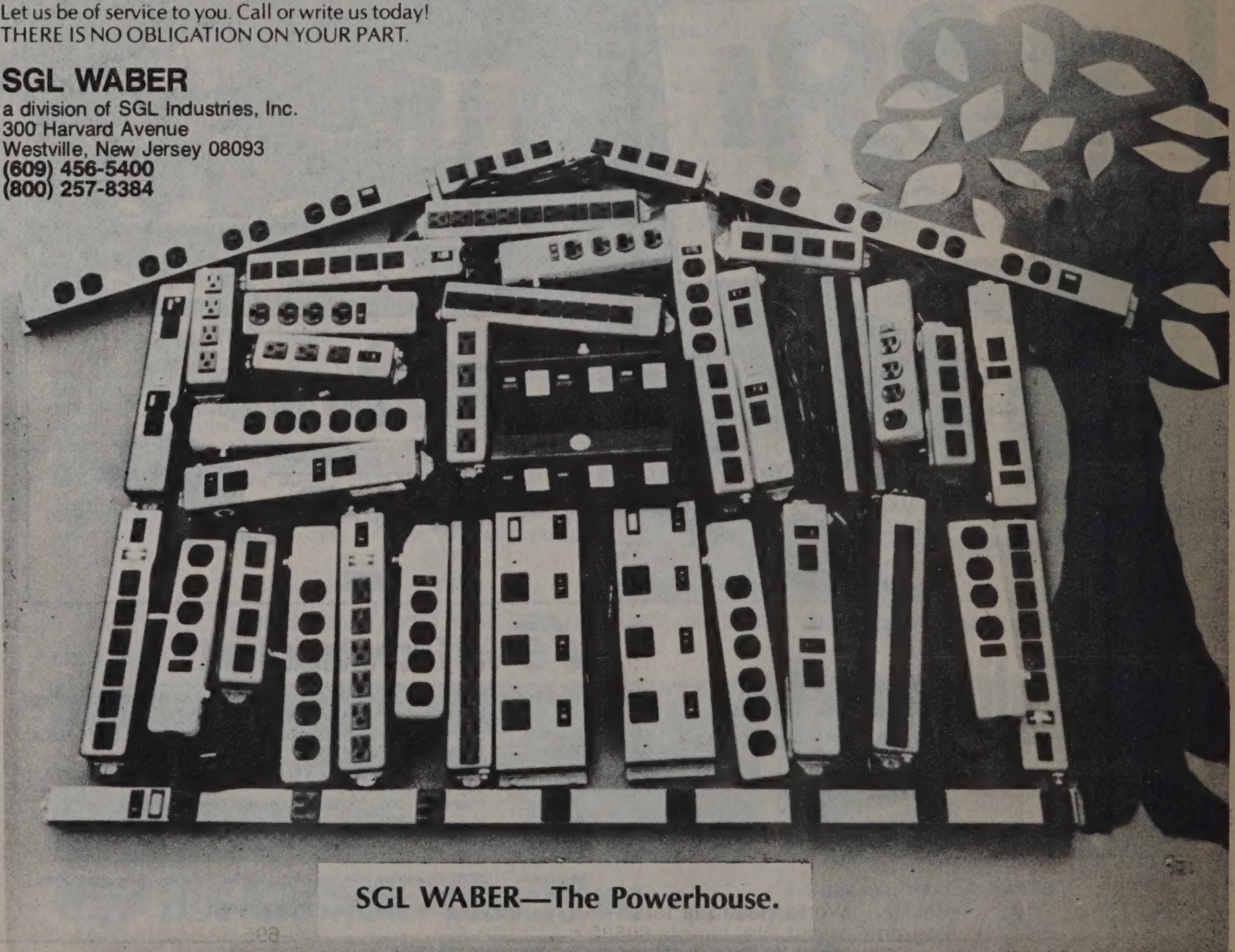


SGL WABER—The Powerhouse.

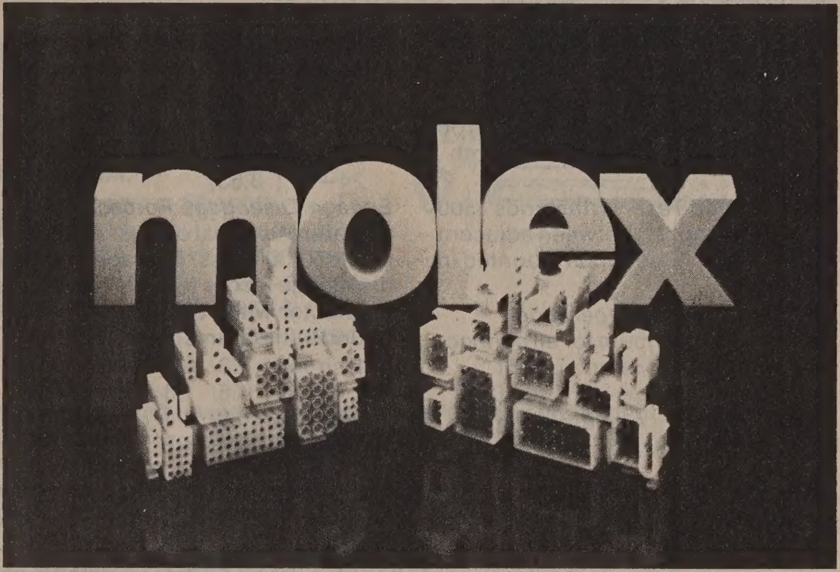
.062" (1,58 mm) Connectors

molex

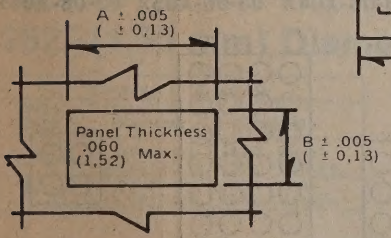
1625, 1649, 1772 & 2004 Series

features/dimensions

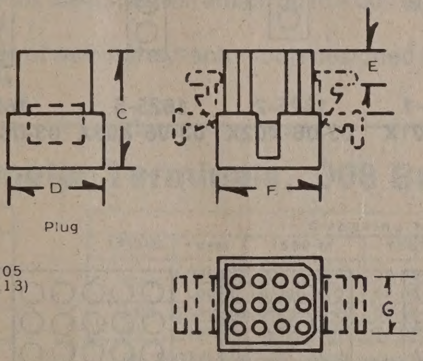
- Integrally molded polarization
- 94V-2 rated nylon
- Accept Molex .062" (1,58 mm) crimp type or P.C. terminals
- U.L. and C.S.A. approvals
- 1, 2, 3, 4, 5, 6, 8, 9, 12, 15, 24, 36 circuit
- Friction lock
- Integrally molded mounting ears available
- Standard color natural can be color coded in black, brown, green, grey, orange, amber, red or yellow (ask your distributor)
- .145" (3,96 mm) spacing in a grid pattern .165" (4,20 mm) grid pattern on 36 circuit version
- 5 Amps



Plug

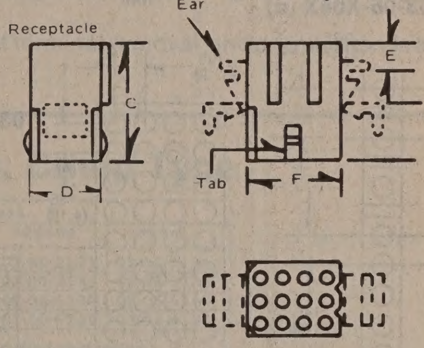


Mounting Hole Detail



Plug

Receptacle



Dimensions: inches (mm)

Dimensional Information

inches / mm

Circuits	Model No.	Receptacle Dimensions A	B	C	D	E	F	Plug Dimensions A	B	C	D	E	F	G
1	1625-1	–	–	.78 (19,8)	—	—	.193 (4,90)dia.	—	—	.75 (19,1)	—	—	—	—
2	1625-2	.505 (12,83)	.265 (6,73)	.81 (20,6)	.192 (4,88)	.21 (5,3)	.340 (8,64)	.609 (15,47)	.318 (8,08)	.78 (19,8)	.30 (7,6)	.21 (5,3)	.44 (11,2)	.19 (4,8)
3	1625-3	.650 (16,51)	.265 (6,73)	.78 (19,8)	.192 (4,88)	.21 (5,3)	.484 (12,30)	.754 (19,15)	.318 (8,08)	.75 (19,1)	.30 (7,6)	.21 (5,3)	.59 (15,0)	.19 (4,8)
4	1625-4	.785 (19,94)	.260 (6,60)	.78 (19,8)	.192 (4,88)	.21 (5,3)	.630 (16,00)	.865 (21,97)	.312 (7,93)	.75 (19,1)	.295 (7,49*)	.21 (5,3)	.73 (18,5)	.19 (4,8)
4	2004	.506 (12,85)	.400 (10,16)	.75 (19,05)	.339 (8,61)	.21 (5,3)	.339 (8,61)	.615 (15,63)	.465 (11,80)	.75 (19,1)	.442 (11,23)	.21 (5,3)	.44 (11,2)	.25 (6,4)
5	1625-5	.940 (23,88)	.265 (6,73)	.78 (19,8)	.192 (4,88)	.21 (5,3)	.775 (19,69)	1.044 (26,52)	.318 (8,08)	.75 (19,1)	.31 (7,87)	.21 (5,3)	.89 (22,6)	.19 (4,8)
6	1625-6	.552 (14,02)	.505 (12,83)	.78 (19,8)	.494 (12,55)	.21 (5,3)	.344 (8,74)	.615 (15,62)	.607 (15,42)	.75 (19,1)	.60 (15,2)	.21 (5,3)	.45 (11,4)	.38 (9,7)
8	1649	1.715 (43,56)	.330 (8,38)	.78 (19,8)	.220 (5,58)	.21 (5,3)	1.505 (38,23)	— —	— —	.75 (19,1)	.308 (7,82)	.21 (5,3)	1.601 (40,67)	— —
9	1625-9	.650 (16,51)	.552 (14,02)	.78 (19,8)	.494 (12,55)	.21 (5,3)	.489 (12,42)	.752 (19,10)	.615 (15,62)	.75 (19,1)	.590 (15,00)	.21 (5,3)	.59 (15,0)	.38 (9,7)
12	1625-12	.795 (20,19)	.563 (14,30)	.78 (19,8)	.494 (12,55)	.21 (5,3)	.634 (16,10)	.903 (22,94)	.614 (15,60)	.75 (19,1)	.590 (15,00)	.21 (5,3)	.74 (18,8)	.38 (9,7)
15	1625-15	.934 (23,72)	.563 (14,30)	.78 (19,8)	.487 (12,34)	.21 (5,3)	.776 (19,71)	1.042 (26,47)	.614 (15,60)	.75 (19,1)	.590 (15,00)	.21 (5,3)	.88 (22,4)	.38 (9,7)
24	1625-24	1.079 (27,41)	.715 (18,16)	.75 (19,05)	.634 (16,10)	.21 (5,3)	.918 (23,32)	1.182 (30,02)	.765 (19,43)	.75 (19,1)	.74 (18,8)	.21 (5,3)	1.04 (26,4)	.50 (12,7)
36	1772	1.677 (42,60)	.707 (17,96)	.78 (19,84)	.689 (17,50)	.21 (5,3)	1.505 (38,23)	1.795 (45,59)	.825 (20,96)	.75 (19,1)	.802 (20,37)	.21 (5,3)	1.618 (41,1)	.63 (15,9)
36	1772-3*	1.677 (42,60)	.786 (19,10)	.781 (19,84)	.689 (17,50)	.21 (5,3)	1.505 (38,23)	1.795 (45,59)	.825 (20,96)	.75 (19,1)	.802 (20,37)	.21 (5,3)	1.618 (41,1)	.63 (15,9)

.062" (1,58 mm) Connectors

Specifications

Electrical:

Resistance - MV voltage drop per amp, ±10%: • 1st engagement 3.2 • 10th engagement 3.4 Probe about 1" (2,54 cm) from crimp barrel on 18 AWG stranded wire. Voltage drop includes mated terminals and both crimps.

High Voltage Test - Withstands 1500 volts RMS applied between adjacent terminals for 60 seconds mounted in housing.

Temperature Rise/Operating Range - 30° maximum for all connectors at maximum rated current. Temperature range -40°C to 105°C

Current Rating - Amperage rating UL recognized.

Mechanical:

Terminal Crimp Strength - Minimum pull-out force in pounds (kilograms) for AWG wire sizes:

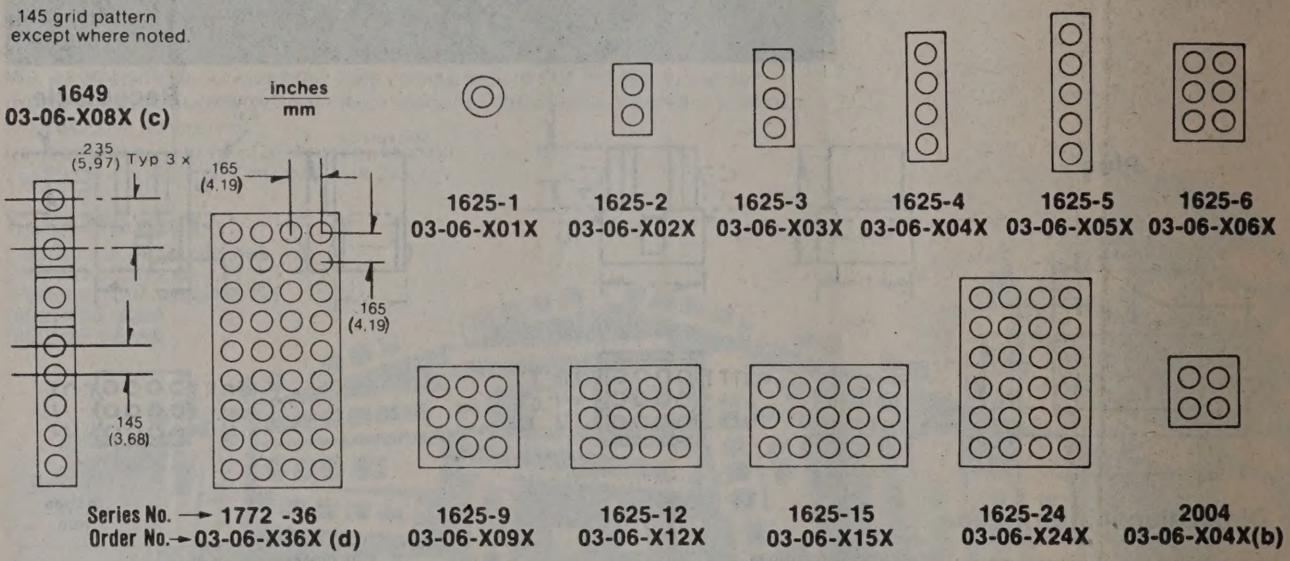
18—20 (9,07)
20—15 (6,80)
22—10 (4,54)
24— 8 (3,63)
26—5 (2,27)
28—3 (1,36)
30—2 (0,91)

Engage/Disengage Forces - Miniature terminal of .008" (0,20 mm) stock 70/30 brass. Average engage/disengage forces in plug/receptacle connector with +30% tolerance in pounds (kilograms) by circuit:

1-circuit	2.3/ 0.8 (1,04/ 0,36)
2-circuit	4.6/ 1.6 (2,09/ 0,73)
3-circuit	6.9/ 2.4 (3,13/ 1,09)
4-circuit	9.2/ 3.2 (4,17/ 1,45)
5-circuit	11.5/ 4.0 (5.22/ 1,81)
6-circuit	13.8/ 4.8 (6.26/ 2,18)
8-circuit	18.4/ 6.4 (8,35/ 2,90)
9-circuit	20.7/ 7.2 (9,39/ 3,27)
12-circuit	27.4/ 9.6 (12,43/ 4,35)
15-circuit	34.5/12.0 (15,65/ 5,44)
24-circuit	55.2/19.2 (25,04/ 8,71)
36-circuit	82.8/28.8 (37,56/13,06)

Grid Patterns

.145 grid pattern except where noted.



Specifications and Ordering Information 1625, 1649, 1772 and 2004

Circuits (a)	Max. Amps	Max. Volts	Model No.	Receptacle Order Numbers		Plug Order Numbers	
				With Ears And Tabs	W/O Ears With Tabs	With Mounting Ears	W/O Mounting Ears
1	5	250	1625-1	—	03-06-1011	—	03-06-2011
2	5	250	1625-2	03-06-1022	03-06-1023	03-06-2022	03-06-2023
3	5	250	1625-3	03-06-1031	03-06-1032	03-06-2031	03-06-2032
4	5	250	1625-4	03-06-1041	03-06-1042	03-06-2041	03-06-2042
4 (b)	5	250	2004	03-06-1043	03-06-1044	03-06-2043	03-06-2044
5	5	250	1625-5	03-06-1055	03-06-1056	03-06-2054	03-06-2055
6	5	250	1625-6	03-06-1061	03-06-1062	03-06-2062	03-06-2061
8 (c)	5	250	1649	03-06-1081	—	—	03-06-2081
9	5	250	1625-9	03-06-1091	03-06-1092	03-06-2091	03-06-2092
12	5	250	1625-12	03-06-1121	03-06-1122	03-06-2121	03-06-2122
15	5	250	1625-15	03-06-1151	03-06-1152	03-06-2151	03-06-2152
24	5	250	1625-24	03-06-1241	03-06-1242	03-06-2241	03-06-2242
36 (d)	5	250	1772	03-06-1361	03-06-1362	03-06-2361	03-06-2362

(a) Electrical ratings are per circuit; UL and CSA recognized. Molex UL File Card No. E29179, CSA File Card No. 19980.

(b) 4 Circuits in square grid pattern.

(c) Terminal center spacings —
Circuits 1,2,3,4 — .235"
Circuits 5,6,7,8 — .145"

(d) Center spacing (Grid Pattern) .165" has no holding tabs available with mounting ears and positive lock. See chart for ordering data.

.062" (1,58 mm) Diameter Terminals

molex®

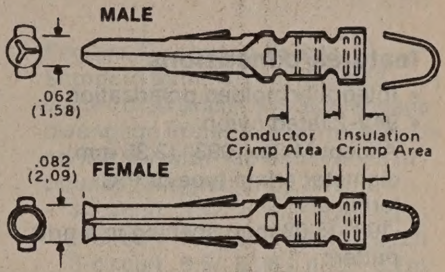
Specifications:

Electrical:
Resistance - MV voltage drop per amp, ±10%: • 1st engagement 3.2 • 10th engagement 3.3 Probe about 1" (2,54 cm) from crimp barrel on 18 AWG stranded wire. Voltage drop includes mated terminals and both crimps. Brass material and tin plating.
High Voltage Test - Withstands 1500 volts RMS applied between adjacent terminals for 60 seconds mounted in housing.

Temperature Rise/Operating Range - 30°C maximum for all connectors at maximum rated current. Temperature range -40°C to 105°C
Current Rating - Amperage rating UL recognized.

Mechanical:
Terminal Crimp Strength - Minimum pull-out force in pounds (kilograms) for AWG wire sizes:

18—20 (9,07)
20—15 (6,80)
22—10 (4,54)
24— 8 (3,63)
26—5 (2,27)
28—3 (1,36)
30—2 (0,91)



Molex tools for crimping include hand operated, semi-automatic, and fully automatic equipment.

Rachet hand crimping tools are recommended for prototype, repair work, or small production runs. When using these sturdy tools, loose (individual) terminals must be specified.

Molex bench crimping machines crimp terminals fed in chain form up to 3,000 terminals per hour, depending upon the length of the wire lead and the operator's skill. The bench machines are available for purchase, or on a lease or a lease-purchase basis.

For high volume users, the fully automatic Artos machine—which cuts and strips wire leads, and then crimps them to the terminals—is suggested. Artos machines will attach up to 8,000 terminals per hour, depending upon wire length and the machine model specified.

Molex also has a complete range of terminal extractor tools designed for fast terminal removal, and an insertion tool for the smaller diameter terminals.

.062" (1,58 mm) Diameter Terminals, .008 Brass, Crimp Type

Terminal Information		
Wire Size	Insulation Diameter	Model No.
18-24	.060/.120 (1,52/3,05)	1560 - Male 1561 - Female
24-30	.040/.090 (1,02/2,29)	1854 - Male 1855 - Female

inches
mm

Ordering Numbers					
Finish	Form	1560-M	1561-F	1854-M	1855-F
Tin	Chain(b)	02-06-2101	02-06-1101	02-06-2131	02-06-1131
	Loose	02-06-2103	02-06-1103	02-06-2132	02-06-1132
Gold (a)	Chain(b)	02-06-6100	02-06-5100	02-06-6130	02-06-5130
	Loose	02-06-6103	02-06-5103	02-06-6135	02-06-5135

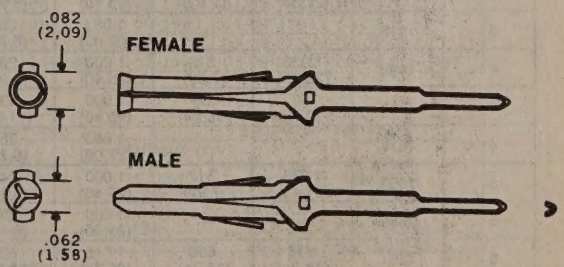
(a) .000020 gold over .000030 nickel terminals overall gold plated after forming. Special platings available upon request.

(b) 7,000 terminals per reel. All chain form orders are rounded to nearest full reel. Chain form reels for Model 1854 and 1855 contain 20,000 terminals.

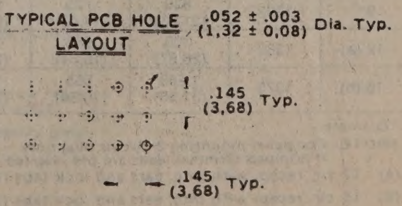
.062" (1,58 mm) Diameter, .008 Brass, Solder Tail

Terminal Information		
Used With Connector Model	Terminal Model No.	P.C.B. Thickness
Std. .062" Dia. Connectors	1778 - Male 1779 - Female	.062"

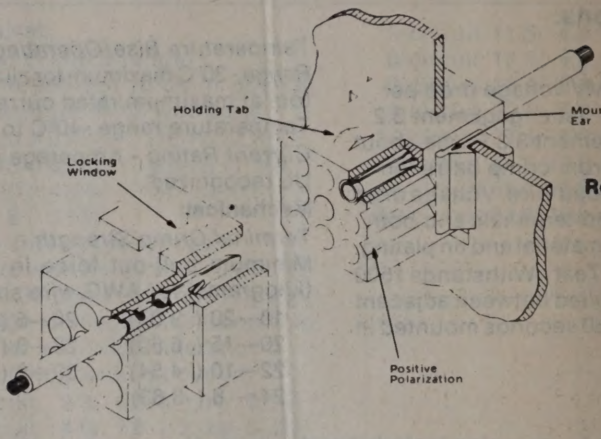
Ordering Numbers			
Finish	Form	1778-M	1779-F
Tin	Loose	02-06-8103	02-06-7103



inches
mm



.093" (2,36 mm) Connectors

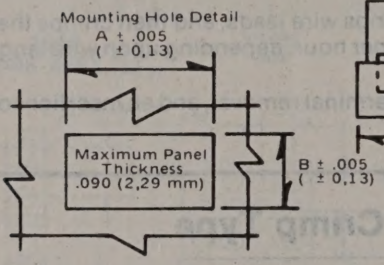


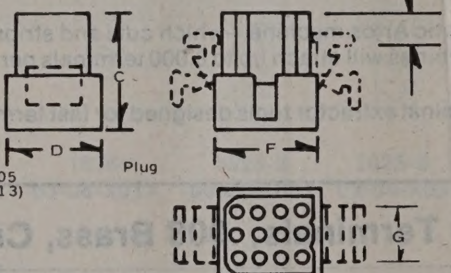
Plug

features/dimensions

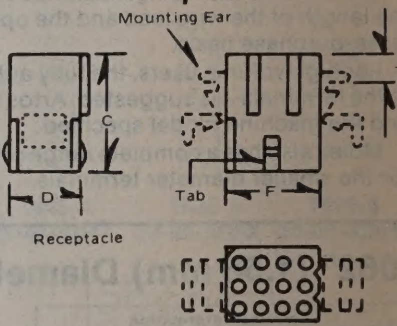
- Integrally molded polarization
- 94V-2 rated nylon
- Accept Molex .093" (2.36 mm) diameter crimp type or P.C terminals
- .198" (5,03 mm) spacing in a grid pattern
- U.L. and C.S.A. approvals
- Integrally molded mounting ears available
- Friction lock
- Standard color natural can be color coded in black, brown, green, gray, orange, amber, red or yellow
- 1, 2, 3, 4, 5, 6, 9, 12, 15 circuit versions

Plug





Receptacle



inches
mm

Dimensional Information

Circuits	Model No.	Receptacle Dimensions A	B	C	D	F	Plug Dimensions A	B	C	D	F	G
1	1951	—	—	1.859 (47,27)	.312 (*7,92)	—	—	—	2.25 (57,15)	.437 (*18,10)	—	—
1	1619	—	—	1.00 (25,40)	.234 (5,94)	—	—	—	.968 (24,59)	.358 (9,09)	—	—
2	1545	.725 (18,42)	.312 (7,92)	1.00 (25,40)	.250 (6,35)	.536 (13,61)	.800 (20,32)	.375 (9,53)	.968 (24,59)	.352 (8,94)	.639 (16,23)	.250 (6,35)
2	1816	—	—	1.063 (27,00)	.265 (6,73)	.531 (13,49)	—	—	1.031 (26,19)	.359 (9,12)	.656 (16,66)	—
3	1396	.84 (21,34)	.312 (7,92)	1.015 (25,78)	.236 (5,99)	.670 (17,02)	.933 (23,70)	.375 (9,52)	.97 (24,64)	.34 (8,64)	.77 (14,56)	.250 (6,35)
3	1816	—	—	1.063 (27,00)	.265 (6,73)	.784 (19,91)	—	—	1.031 (26,19)	.359 (9,12)	.921 (23,29)	—
4	1490	1.038 (26,37)	.312 (7,92)	1.000 (25,40)	.236 (5,99)	.868 (22,05)	1.131 (28,73)	.375 (9,53)	.969 (24,61)	.338 (8,59)	.971 (24,66)	.240 (6,10)
4	2163	.50 (12,70)	.60 (15,24)	1.000 (25,40)	.434 (11,02)	.434 (11,02)	.555 (14,10)	.695 (17,65)	.969 (24,61)	.538 (13,67)	.538 (13,67)	.312 (7,92)
4	1816	—	—	1.063 (27,00)	.265 (6,73)	1.032 (26,21)	—	—	1.031 (26,19)	.359 (9,12)	1.156 (29,36)	—
5	1653	1.238 (31,45)	.312 (7,92)	1.000 (25,40)	.243 (6,17)	1.066 (27,08)	1.331 (33,81)	.375 (9,53)	.969 (24,61)	.338 (8,59)	1.169 (29,69)	.252 (6,40)
5	2629	—	—	1.000 (25,40)	.24 (6,10)	1.07 (27,18)	—	—	.969 (24,61)	.35 (8,89)	1.17 (29,72)	—
6	1261	.718 (18,24)	.600 (15,24)	1.015 (25,78)	.632 (16,05)	.434 (11,02)	.750 (19,05)	.695 (17,65)	.969 (24,61)	.733 (18,62)	.536 (13,61)	.563 (14,30)
9†	1292	.828 (21,03)	.725 (18,42)	1.015 (25,78)	.625 (15,93)	.666 (16,92)	.937 (23,80)	.660 (17,65)	.970 (24,64)	.730 (18,54)	.770 (19,56)	.56 (14,0)
12 (a)	1360	1.05 (26,67)	.655 (16,64)	1.015 (25,78)	.633 (16,08)	.871 (22,12)	1.155)29,34)	.760 (19,30)	.969 (24,61)	.737 (18,72)	.975 (24,77)	.563 (14,30)
15 (b)	1375	1.240 (31,50)	.655 (16,64)	1.015 (25,78)	.632 (16,05)	1.066 (27,08)	1.343 (34,11)	.760 (19,30)	.969 (24,61)	.734 (18,64)	1.169 (29,69)	.563 (14,30)

*Diameter

†NOTE: For panel mounting 9-circuit plug only —: wire harness must pull through mounting-ear panel cutout so that mounting ears can engage panel edge, if crimped terminal leads are pre-inserted in plug housing.

(a) 12 cir. recep. with mtg. ears and lock tabs (03-09-1125) mtg. hole Dim. "B" is .725 min.

(b) 15 cir. recep. with mtg. ears and lock tabs (03-09-1154) mtg. hole Dim. "B" is .725 min.

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.093" (2,36 mm) Connectors

molex®

Specifications:

Electrical:

Resistance - MV voltage drop per amp, +10%: • 1st engagement 3.0 • 10th engagement 3.1 Probe about 1" (2,54 cm) from crimp barrel on 18 AWG stranded wire. Voltage drop includes mated terminals and both crimps.

High Voltage Test - Withstands 1500 volts RMS applied between adjacent terminals for 60 seconds mounted in housing.

Temperature Rise/Operating Range - 30° maximum for all connectors at maximum rated current. Temperature range -40°C to 105°C

Current Rating - Amperage rating UL recognized.

Mechanical:

Terminal Crimp Strength - Minimum pull-out force in pounds (kilograms) for AWG wire sizes:

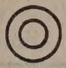
14—35 (15,88)	24—8 (3,63)
16—30 (13,61)	26—5 (2,27)
18—25 (11,34)	28—3 (1,36)
20—15 (6,80)	30—2 (0,91)
22—10 (4,54)	

Engage/Disengage Forces - Standard terminal of .010" (0,25 mm) stock 70/30 brass. Average engage/disengage forces in plug/receptacle connector with +30% tolerance in pounds (kilograms) by circuit:

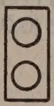
1-circuit	3.5/ 2.75	(1,59/ 1,25)
2-circuit	7.0/ 5.5	(3,18/ 2,50)
3-circuit	9.5/ 8.26	(4,77/ 3,75)
4-circuit	14.0/11.02	(6,36/ 5,00)
5-circuit	17.5/13.7	(7.95/ 6,24)
6-circuit	21.0/16.5	(9.53/ 7,50)
9-circuit	31.5/24.8	(14,30/11,24)
12-circuit	42.0/33.07	(19,06/15,00)
15-circuit	52.5/41.3	(23,84/18,73)

Grid Patterns

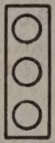
.198 Grid Pattern



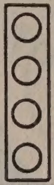
1951 1619
03-09-X01X



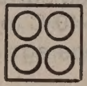
1545
03-09-X02X



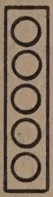
1396
03-09-X03X



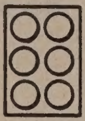
1490
03-09-X04X



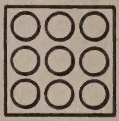
2163 ← Series No.
03-09-X04X(c) ← Order No.



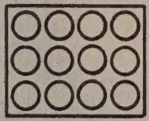
2629
03-09-X057(d)



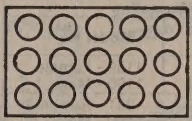
1261
03-09-X06X



1292
03-09-X09X



1360
03-09-X12X



1375
03-09-X15X(e, f)

Ordering Information

Style		Electrical		Receptacle Order Numbers				Plug Order Numbers	
Circuits (a)	Model No.	Max. Amps	Max. Volts	With Mtg. Ears Only	With • Holding Tabs Only	With Ears And Tabs	Without Ears Or Tabs	With Mtg. Ears	Without Mtg. Ears
1 (a)	1951	12	5,000	N/A	03-09-1014	N/A	N/A	N/A	03-09-2014
1	1619	12	250	N/A	03-09-1011	N/A	N/A	N/A	03-09-2011
2 (b)	1545	12	250	N/A	03-09-1022	03-09-1021	N/A	03-09-2021	03-09-2022
3	1396	12	250	N/A	03-09-1032	03-09-1031	N/A	03-09-2031	03-09-2032
4	1490	9	250	N/A	03-09-1042	03-09-1041	N/A	03-09-2041	03-09-2042
4 (c)	2163	9	250	N/A	03-09-1049	03-09-1040	N/A	03-09-2040	03-09-2049
5	1653	9	250	N/A	03-09-1052	N/A	N/A	N/A	03-09-2052
5 (d)	2629	9	250	N/A	03-09-1057	N/A	N/A	N/A	03-09-2057 (d)
6	1261	9	250	03-09-1062	03-09-1064	03-09-1061	03-09-1063	03-09-2061	03-09-2062
9	1292	9	250	03-09-1092	03-09-1094	03-09-1091	03-09-1093	03-09-2091	03-09-2092
12 (g)	1360	7.5	250	03-09-1121	03-09-1126	03-09-1125	03-09-1122	03-09-2122	03-09-2121
15 (e,f)	1375	7.5	250	03-09-1151	N/A	03-09-1154 (e)	03-09-1152	03-09-2152	03-09-2153 (f)

Ordering Information 1816

Style		Electrical		Receptacle Order Numbers				Plug Order Numbers	
Circuits (a)	Model No.	Max. Amps	Max. Volts	With Mtg. Ears Only	With Holding Tabs Only	With Ears And Tabs	Without Ears Or Tabs	With Mtg. Ears	Without Mtg. Ears
2 (b)	1816	12	600	N/A	03-09-1028	N/A	N/A	N/A	03-09-2028
3 (b)	1816	9	600	N/A	03-09-1038	N/A	N/A	N/A	03-09-2038
4 (b)	1816	9	600	N/A	03-09-1047	N/A	N/A	N/A	03-09-2048

(a) Electrical ratings are per circuit; UL and CSA recognized; except for Model 1951. Molex UL file card No. E29179; CSA file card No. 19980.

(b) Center spacing .248". Will accommodate: 14, 16 and 18 AWG with 1/32" insulation — 16 with 18 AWG (double crimp), each with 1/32" insulation. Model 1816 housings have positive lock rather than holding tabs.

(c) 4 circuits in square grid pattern.

(d) Has positive lock rather than holding tabs; plug 03-09-2057 will mate also with 5-circuit receptacle Model 1653, part 03-09-1051, and 4-circuit receptacle Model 1490, part 03-09-1042.

(e) To order mating plug for receptacle part 03-09-1154 (with ears and locking tabs) specify only plug part 03-09-2158 (has window, no mounting ears)

(f) Plug also is available with pull tabs without mounting ears. Order part 03-09-2151.

.093" (2,36 mm) Diameter Terminals

molex

Specifications:

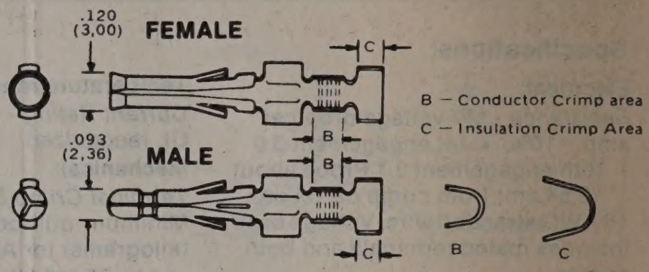
Electrical:

Resistance - MV voltage drop per amp, ±10%: • 1st engagement 3.0 • 10th engagement 3.1 Probe about 1" (2,54 cm) from crimp barrel on 18 AWG stranded wire. Voltage drop includes mated terminals and both crimps. Brass material and tin plating.

High Voltage Test - Withstands 1500 volts RMS applied between adjacent terminals for 60 seconds mounted in all housings.

Temperature Rise/Operating Range - 30° maximum for all connectors at maximum rated current. Temperature range -40°C to 105°C

Current Rating - Amperage rating UL recognized.



Mechanical:

Terminal Crimp Strength - Minimum pull-out force in pounds (kilograms) for AWG wire sizes:

14—35 (15,9)	24—8 (3,63)
16—30 (13,6)	26—5 (2,27)
18—25 (9,07)	28—3 (1,36)
20—15 (6,80)	30—2 (0,91)
22—10 (4,54)	

.093" (2,36 mm) Diameter, .010 Brass, Crimp Type

inches
mm

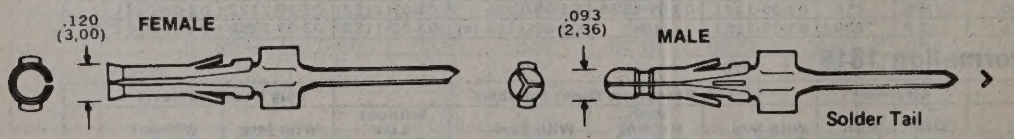
Terminal Information		
Wire Size	Insulation Diameter	Model No.
14-20	.065/.160 (1,65/4,06)	1189 - Female 1190 - Male
18-22	.060/.120 (1,52/3,05)	1381 - Female 1380 - Male
24-30	.030/.060 (0,76/1,52)	1433 - Female 1434 - Male

(b) 7,000 terminals per reel - all chain form orders rounded to nearest full reel. Chain form reels for Models 1433, 1434 contain 8,000 terminals.

Ordering Numbers — Female Terminals					
Finish	Form	Dimple	1189-F	1381-F	1433-F
Tin	Chain (b)	Yes	02-09-1101	02-09-1116	02-09-1141
		No	02-09-1102	02-09-1117	02-09-1142
	Loose	Yes	02-09-1103	02-09-1118	02-09-1143
		No	02-09-1104	02-09-1119	02-09-1144

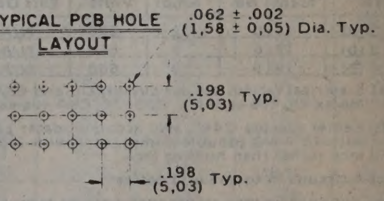
Ordering Numbers — Male Terminals				
Finish	Form	1190-M	1380-M	1434-M
Tin	Chain (b)	02-09-2101	02-09-2116	02-09-2141
	Loose	02-09-2103	02-09-2118	02-09-2143

.093" (2,36 mm) Diameter, .010 Brass, Solder Tail



inches
mm

TYPICAL PCB HOLE LAYOUT



Terminal Information		
Used With Connector Model	Terminal Model No.	P.C.B. Thickness
Std. .093" Dia. Connectors	1376 - Male 1377 - Female	.062"

Ordering Numbers — Female Terminals			
Finish	Form	Dimple	1377-F
Tin	Loose	Yes	02-09-1133
		No	02-09-1134

Ordering Numbers — Male Terminals		
Finish	Form	1376-M
Tin	Loose	02-09-2133

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Application Tooling

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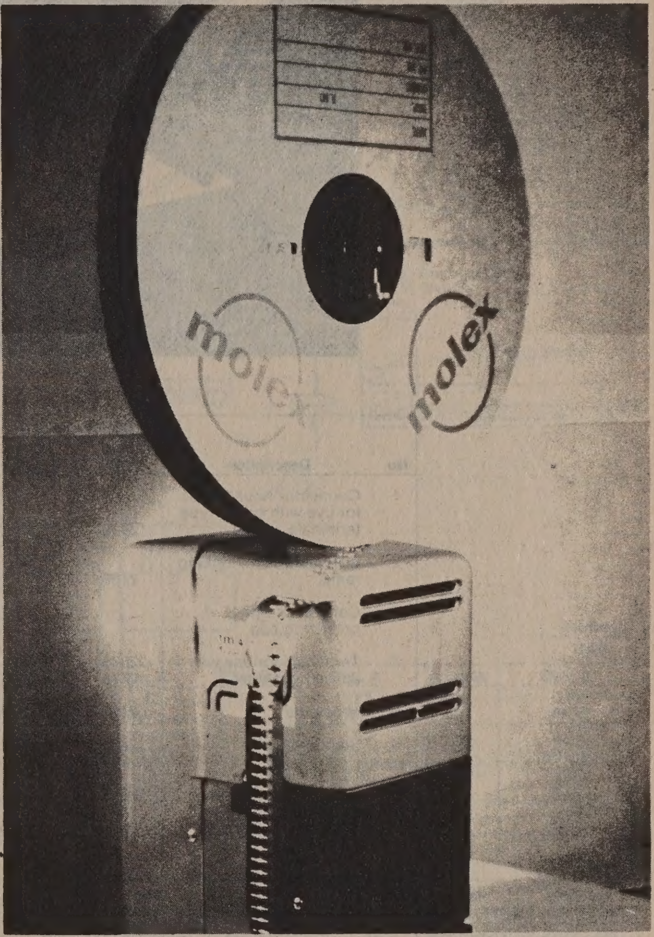
TM40™ Terminating Machine

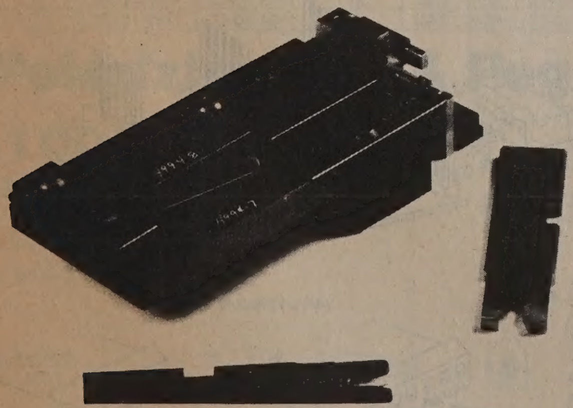
Features/Dimensions:

- Utilized "plug in" terminator dies (approx. 2½" x 5")
- Independent conductor and insulator adjustments, with position indicator
- Quick release tooling feature for fast, simple changeover
- Universal feed adjustable to all Molex terminals
- 1" stroke, no ram adjustment required
- No lubrication required
- Rams guided by precision ball bushings and demountable leader pins for positive alignment
- Roller bearing throughout
- Smooth quiet spring wrap clutch
- Totally enclosed for operator safety
- 12V in press work light
- Long life 24V solenoid
- Compact space saving design
- Easy eye tinted die guard with interlock
- Solid state control box
- Operator hand rest

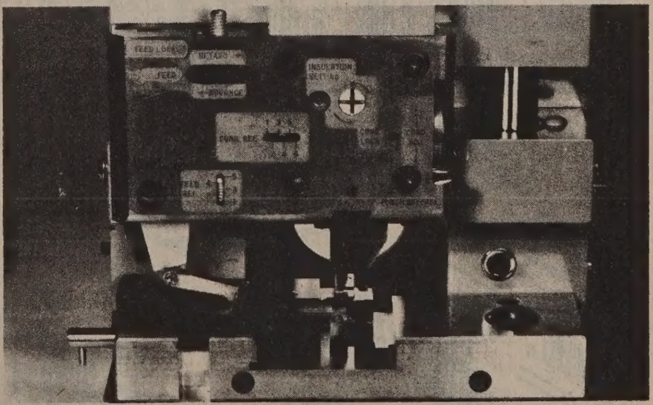


Specifications:

Weight	190 lbs. approx.
Electrical Specs	110V 60Hz/220V 50 Hz
Size	Height 45" (with reel)
Bench Space	Front 21" x 13" deep (with reel)



Tooling Required for Changeover



Tooling Adjustments

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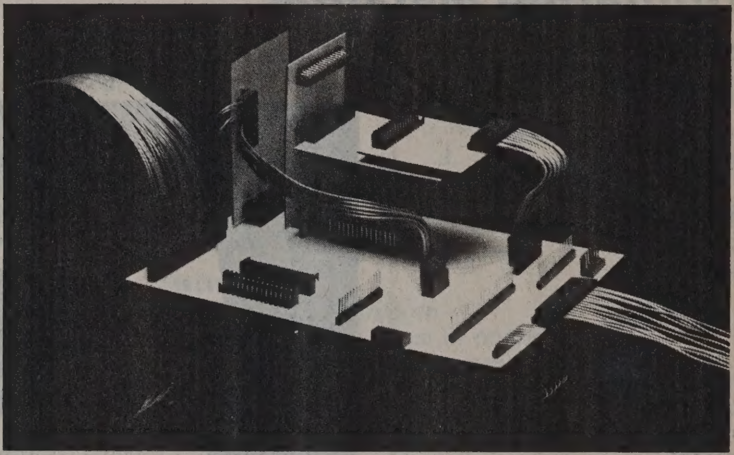
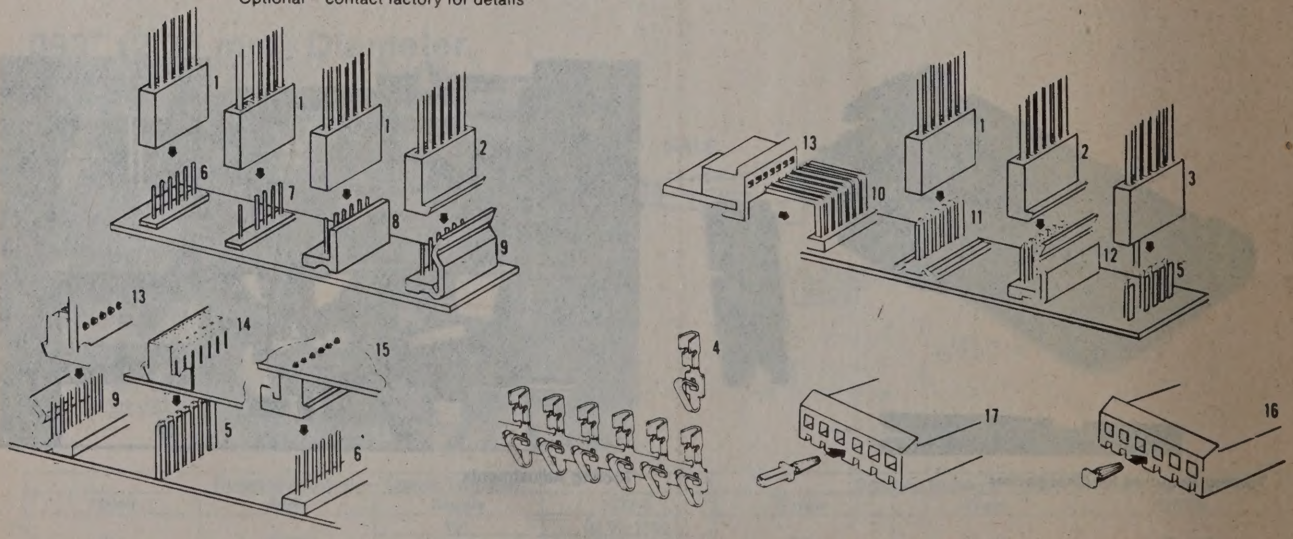
KK® Modular Interconnection System

molex



No.	Description	Center Spacing .156" (3,96)	Center Spacing .100" (2,54)
1	Connector housing for for use with crimp-type terminals	2139	2695
2	Connector with locking ramp	2139	2695
3	Connector with polarizing peg	*	*
4	Terminals for use with above housings	2578 2478	2759
5	Male pins	2161	2766/4166
6	Standard wafer	2461 2402	4030
7	Standard wafer with pin omitted for polarization (contact factory)	2803 *	*
8	Polarizing wafer	2403	*
9	Polarizing and locking wafer round pins	2391	
10	Right angle wafer	2373	4094
11	Chassis mount wafer	2220	*
12	Polarizing and locking wafer with square pins	2630 6393	6373
13	(Right angle) connector to inter-connect perpendicular P.C. boards	2420 2534 2145	7478
14	Connector to inter-connect parallel bottom entry P.C. boards	2145	4455
15	Connector to inter-connect parallel P.C. boards	2145	4455
16	Polarizing key without peg	2560-1	4161-1
17	Polarizing key with peg	2560-2	4161-2

*Optional - contact factory for details



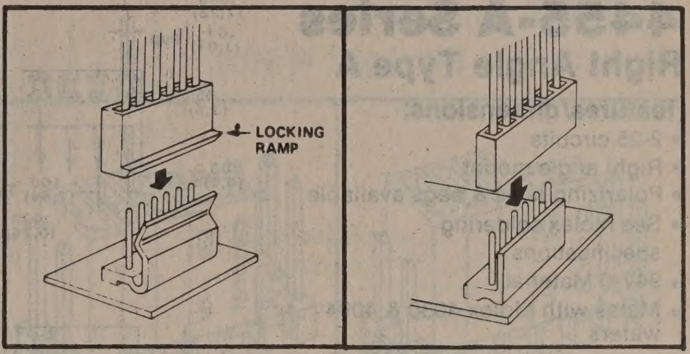
.100" (2,54 mm) Center Crimp Terminal Housing

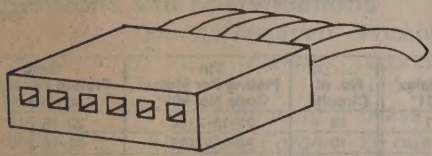
molex

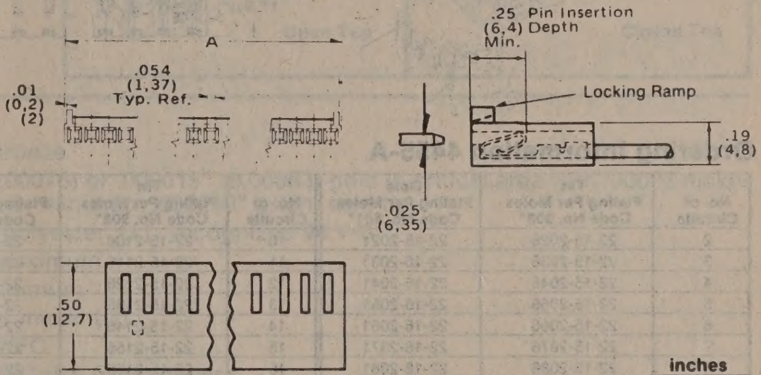
2695

features/dimensions

- 2695 Series uses 2759 terminal only (See page 28)
- With or without locking ramp
- Mates with .025" pins
- 94V-0 Nylon
- Polarizing keys or pegs available
- 2 - 25 circuits available
- Optional polarization or locking ramp version
- Mates with Molex KK .100" (2,54 mm) center wafers or pins







inches
mm

Dimensional Information

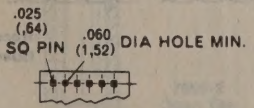
Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A
2	.22 (5,6)	6	.62 (15,8)	10	1.02 (25,9)	14	1.42 (36,1)	18	1.82 (46,2)	22	2.22 (56,4)
3	.32 (8,1)	7	.72 (18,3)	11	1.12 (28,5)	15	1.52 (38,6)	19	1.92 (48,8)	23	2.32 (59,9)
4	.42 (10,7)	8	.82 (20,9)	12	1.22 (31,0)	16	1.62 (41,2)	20	2.02 (51,3)	24	2.42 (61,5)
5	.52 (13,2)	9	.92 (23,4)	13	1.32 (33,5)	17	1.72 (43,7)	21	2.12 (53,9)	25	2.52 (64,0)

Ordering Information 2695

Circuits	With Locking Ramp	Without Locking Ramp	Circuits	With Locking Ramp	Without Locking Ramp	Circuits	With Locking Ramp	Without Locking Ramp	Circuits	With Locking Ramp	Without Locking Ramp
2	22-01-2027	22-01-2021	8	22-01-2087	22-01-2081	14	22-01-2147	22-01-2141	20	22-01-2207	22-01-2201
3	22-01-2037	22-01-2031	9	22-01-2097	22-01-2091	15	22-01-2157	22-01-2151	21	22-01-2217	22-01-2211
4	22-01-2047	22-01-2041	10	22-01-2107	22-01-2101	16	22-01-2167	22-01-2161	22	22-01-2227	22-01-2221
5	22-01-2057	22-01-2051	11	22-01-2117	22-01-2111	17	22-01-2177	22-01-2171	23	22-01-2237	22-01-2231
6	22-01-2067	22-01-2061	12	22-01-2127	22-01-2121	18	22-01-2187	22-01-2181	24	22-01-2247	22-01-2241
7	22-01-2077	22-01-2071	13	22-01-2137	22-01-2131	19	22-01-2197	22-01-2191	25	22-01-2257	22-01-2251

Polarizing Key & Peg

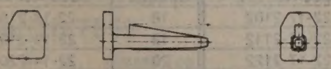
.100"(2,54 mm)



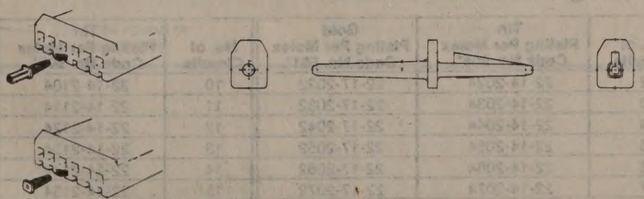
General Features:

- Snap fit into KK Series Housings
- Polarizing peg or key
- 94V-2 Nylon

Polarizing Key



Polarizing Peg



inches
mm

	Eng. No.	Order No.
Polarizing key	4161-1	15-04-9209
Polarizing peg	4161-2	15-04-9210

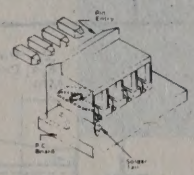
.100″ (2,54 mm) Center P.C. Board Connectors

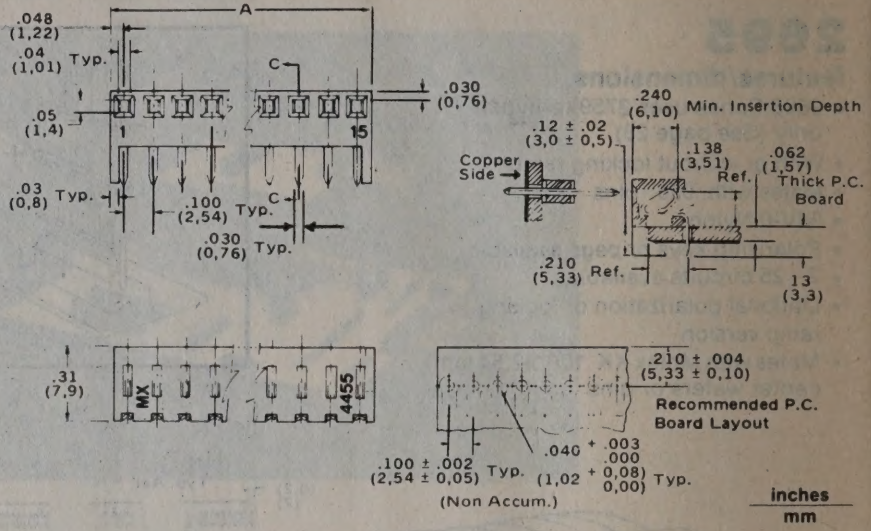
4455-A Series

Right Angle Type A

features/dimensions:

- 2-25 circuits
- Right angle mount
- Polarizing keys & pegs available
- See Molex soldering specifications
- 94V-0 Material
- Mates with Molex 4030 & 4094 wafers




.048
(1,22)
.04
(1,01) Typ.
A
C
.030
(0,76)
.05
(1,4)
1
15
.03
(0,8) Typ.
.100
(2,54) Typ.
C
.030
(0,76) Typ.
.240
(6,10) Min. Insertion Depth
.12 ± .02
(3,0 ± 0,5)
Copper
Side
.138
(3,51)
Ref.
.062
(1,57)
Thick P.C.
Board
.210
(5,33) Ref.
13
(3,3)
.31
(7,9)
MX
4455
.210 ± .004
(5,33 ± 0,10)
Recommended P.C.
Board Layout
.100 ± .002
(2,54 ± 0,05) Typ.
.040 + .003 .000
(1,02 + 0,08 0,00) Typ.
(Non Accum.)
inches
mm

Ordering Information 4455-A

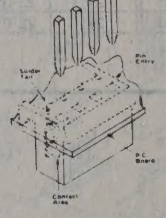
No. of Circuits	Tin Plating Per Molex Code No. 908*	Gold Plating Per Molex Code No. 501*	No. of Circuits	Tin Plating Per Molex Code No. 908*	Gold Plating Per Molex Code No. 501*	No. of Circuits	Tin Plating Per Molex Code No. 908*	Gold Plating Per Molex Code No. 501*
2	22-15-2026	22-16-2021	10	22-15-2106	22-16-2101	18	22-15-2186	22-16-2181
3	22-15-2036	22-16-2031	11	22-15-2116	22-16-2111	19	22-15-2196	22-16-2191
4	22-15-2046	22-16-2041	12	22-15-2126	22-16-2121	20	22-15-2206	22-16-2201
5	22-15-2056	22-16-2051	13	22-15-2136	22-16-2131	21	22-15-2216	22-16-2211
6	22-15-2066	22-16-2061	14	22-15-2146	22-16-2141	22	22-15-2226	22-16-2221
7	22-15-2076	22-16-2071	15	22-15-2156	22-16-2151	23	22-15-2236	22-16-2231
8	22-15-2086	22-16-2081	16	22-15-2166	22-16-2161	24	22-15-2246	22-16-2241
9	22-15-2096	22-16-2091	17	22-15-2176	22-16-2171	25	22-15-2256	22-16-2251

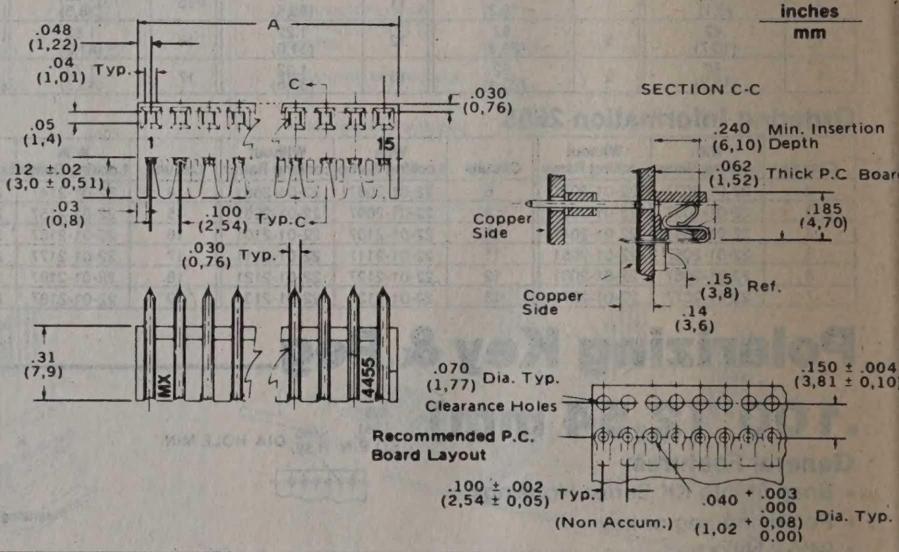
4455-B Series

Bottom Entry Type B

features/dimensions:

- 2-25 circuits
- Bottom entry mount
- See Molex soldering specification
- 94V-0 Material




inches
mm
.048
(1,22)
.04
(1,01) Typ.
A
C
.030
(0,76)
.05
(1,4)
1
15
12 ±.02
(3,0 ± 0,51)
.03
(0,8)
.100
(2,54) Typ. C
.030
(0,76) Typ.
SECTION C-C
.240 Min. Insertion
(6,10) Depth
.062
(1,52) Thick P.C Board
.185
(4,70)
Copper
Side
.15
(3,8) Ref.
Copper
Side
.14
(3,6)
.31
(7,9)
MX
4455
.070
(1,77) Dia. Typ.
Clearance Holes
.150 ± .004
(3,81 ± 0,10)
Recommended P.C.
Board Layout
.100 ± .002
(2,54 ± 0,05) Typ.
.040 + .003 .000
(1,02 + 0,08 0,00) Dia. Typ.
(Non Accum.)

Ordering Information 4455-B

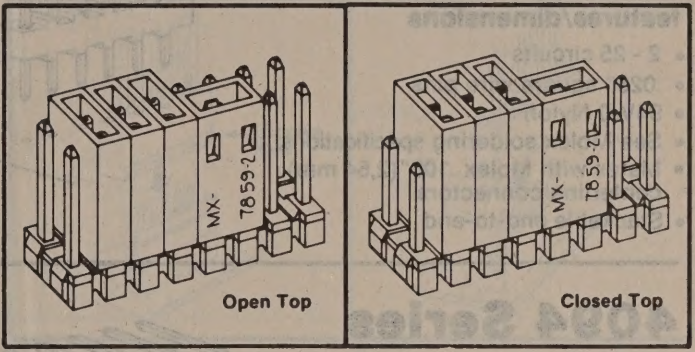
No. of Circuits	Tin Plating Per Molex Code No. 908*	Gold Plating Per Molex Code No. 501*	No. of Circuits	Tin Plating Per Molex Code No. 908*	Gold Plating Per Molex Code No. 501*	No. of Circuits	Tin Plating Per Molex Code No. 908*	Gold Plating Per Molex Code No. 501*
2	22-14-2024	22-17-2022	10	22-14-2104	22-17-2102	18	22-14-2184	22-17-2182
3	22-14-2034	22-17-2032	11	22-14-2114	22-17-2112	19	22-14-2194	22-17-2192
4	22-14-2044	22-17-2042	12	22-14-2124	22-17-2122	20	22-14-2204	22-17-2202
5	22-14-2054	22-17-2052	13	22-14-2134	22-17-2132	21	22-14-2214	22-17-2212
6	22-14-2064	22-17-2062	14	22-14-2144	22-17-2142	22	22-14-2224	22-17-2222
7	22-14-2074	22-17-2072	15	22-14-2154	22-17-2152	23	22-14-2234	22-17-2232
8	22-14-2084	22-17-2082	16	22-14-2164	22-17-2162	24	22-14-2244	22-17-2242
9	22-14-2094	22-17-2092	17	22-14-2174	22-17-2172	25	22-14-2254	22-17-2252

.100″ (2,54 mm) Center Shunt

molex®

7859 Series

Two Circuit Shunt or Jumper

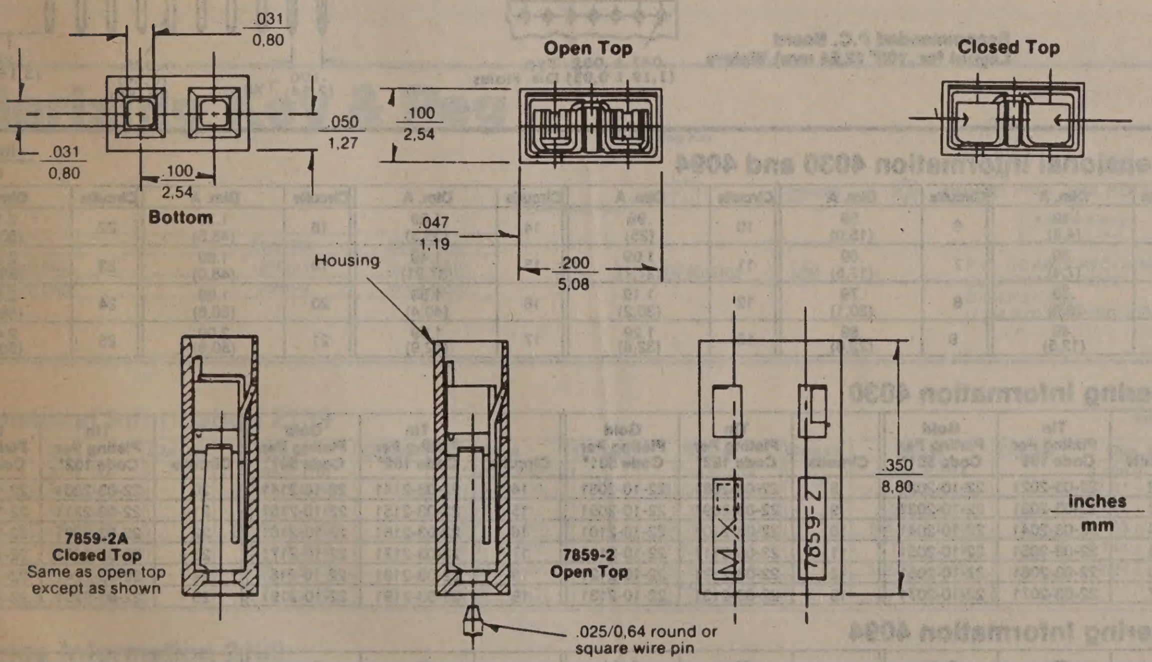

MX-
7859-2
Open Top
MX-
7859-2
Closed Top

Features/Dimensions:

- Press fit - no soldering
- Reliable - no accidental disconnects
- Low cost alternative to DIP switches
- Fully stackable
- 94V-0 housing
- Unitized dual box terminals
- 2 Points of contact with each pin
- For .025″ pins on .100″ spacing
- Available in open and closed top versions
- Closed top prevents upside down mating

Dimensions and Specifications

Terminal Material:	Phosphor Bronze
Plating:	.000030″ (0,00076) or .000015″ (0,00063) gold in critical area with .00005 nickel underplate. Or minimum .000200″ bright acid tin.
Housing:	Glass filled polyester. U.L. recognized 94 V-0
Engaging Force:	26 ounces maximum
Extraction Force:	8 ounces minimum
Contact Resistance:	15 milliohms maximum
Temperature Range:	-55°C to +125°C
Current Rating:	2 amps at 30°C rise over ambient


.031
0,80
.031
0,80
.100
2,54
Bottom
Open Top
.050
1,27
.100
2,54
.047
1,19
Housing
.200
5,08
Closed Top
7859-2A
Closed Top
Same as open top
except as shown
7859-2
Open Top
.025/0,64 round or
square wire pin
MX
7859-2
.350
8,80
inches
mm

Ordering Information 7859

Open Top		Closed Top	
Order No.	**Plating**	**Order No.**	**Plating**
15-29-1024	Gold	15-29-1025	Gold
15-38-1024	Tin	15-38-1027	Tin

Applicator Tooling: Not required

.100" (2,54 mm) Center Wafers

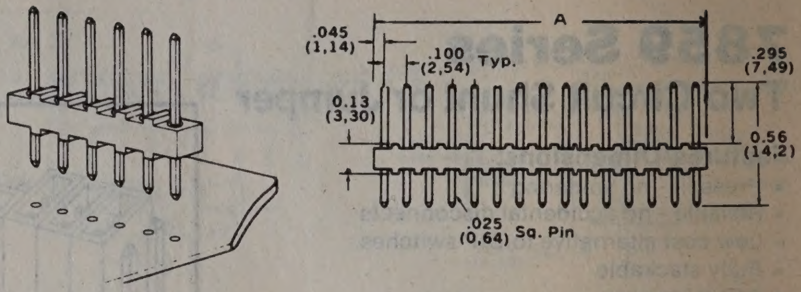
molex

4030 Series

Square Pin Straight Wafer

features/dimensions

- 2 - 25 circuits
- .025" square wire pins
- 94V-0 Nylon
- See Molex soldering specifications
- Mates with Molex .100"(2,54 mm) centerline connectors
- Stackable end-to-end

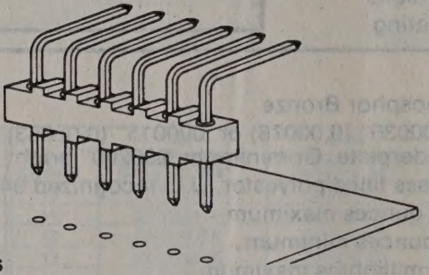


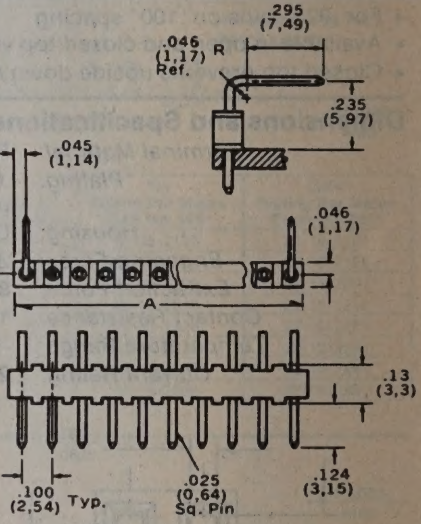
4094 Series

Square Pin Right Angle Wafer

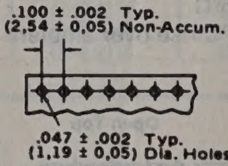
features/dimensions

- 2 - 25 circuits
- .025" right angle square wire pins
- 94V-0 Nylon
- See Molex soldering specifications
- Mates with Molex .100" (2,54 mm) center connectors
- Stackable end-to-end





Recommended P.C. Board Layout for .100" (2,54 mm) Wafers



Dimensional Information 4030 and 4094

Inches / mm

Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A
2	.19 (4,8)	6	.59 (15,0)	10	.99 (25)	14	1.39 (35,3)	18	1.79 (45,5)	22	2.10 (53,3)
3	.29 (7,4)	7	.69 (17,5)	11	1.09 (27,7)	15	1.49 (37,91)	19	1.89 (48,0)	23	2.20 (55,9)
4	.39 (9,9)	8	.79 (20,1)	12	1.19 (30,2)	16	1.59 (40,4)	20	1.99 (50,6)	24	2.30 (58,4)
5	.49 (12,5)	9	.89 (22,6)	13	1.29 (32,8)	17	1.69 (42,9)	21	2.00 (50,8)	25	2.40 (60,9)

Ordering Information 4030

Circuits	Tin Plating Per Code 102*	Gold Plating Per Code 501*	Circuits	Tin Plating Per Code 102*	Gold Plating Per Code 501*	Circuits	Tin Plating Per Code 102*	Gold Plating Per Code 501*	Circuits	Tin Plating Per Code 102*	Gold Plating Per Code 501*
2	22-03-2021	22-10-2021	8	22-03-2081	22-10-2081	14	22-03-2141	22-10-2141	20	22-03-2201	22-10-2201
3	22-03-2031	22-10-2031	9	22-03-2091	22-10-2091	15	22-03-2151	22-10-2151	21	22-03-2211	22-10-2211
4	22-03-2041	22-10-2041	10	22-03-2101	22-10-2101	16	22-03-2161	22-10-2161	22	22-03-2221	22-10-2221
5	22-03-2051	22-10-2051	11	22-03-2111	22-10-2111	17	22-03-2171	22-10-2171	23	22-03-2231	22-10-2231
6	22-03-2061	22-10-2061	12	22-03-2121	22-10-2121	18	22-03-2181	22-10-2181	24	22-03-2241	22-10-2241
7	22-03-2071	22-10-2071	13	22-03-2131	22-10-2131	19	22-03-2191	22-10-2191	25	22-03-2251	22-10-2251

Ordering Information 4094

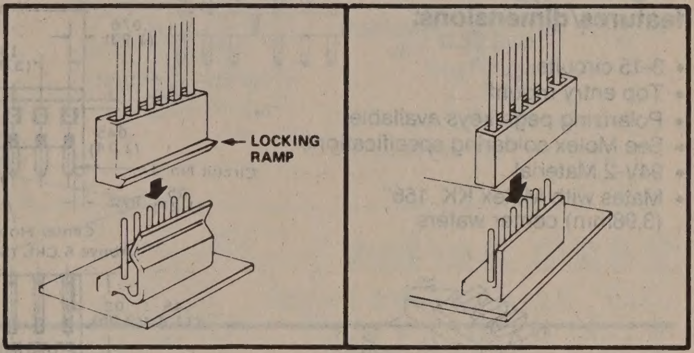
Circuits	Tin Plating Per Code 102*	Gold Plating Per Code 501*	Circuits	Tin Plating Per Code 102*	Gold Plating Per Code 501*	Circuits	Tin Plating Per Code 102*	Gold Plating Per Code 501*	Circuits	Tin Plating Per Code 102*	Gold Plating Per Code 501*
2	22-05-2021	22-12-2021	8	22-05-2081	22-12-2081	14	22-05-2141	22-12-2141	20	22-05-2201	22-12-2201
3	22-05-2031	22-12-2031	9	22-05-2091	22-12-2091	15	22-05-2151	22-12-2151	21	22-05-2211	22-12-2211
4	22-05-2041	22-12-2041	10	22-05-2101	22-12-2101	16	22-05-2161	22-12-2161	22	22-05-2221	22-12-2221
5	22-05-2051	22-12-2051	11	22-05-2111	22-12-2111	17	22-05-2171	22-12-2171	23	22-05-2231	22-12-2231
6	22-05-2061	22-12-2061	12	22-05-2121	22-12-2121	18	22-05-2181	22-12-2181	24	22-05-2241	22-12-2241
7	22-05-2071	22-12-2071	13	22-05-2131	22-12-2131	19	22-05-2191	22-12-2191	25	22-05-2251	22-12-2251

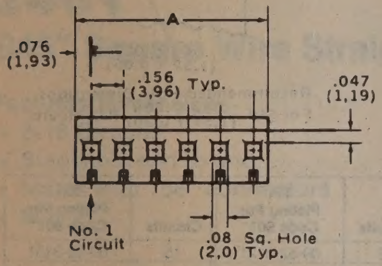
.156" (3,96 mm) Center Crimp Terminal Housing

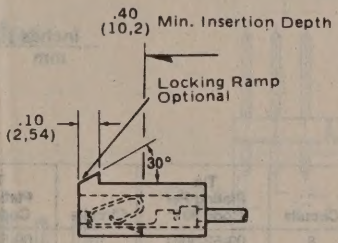
2139 Series

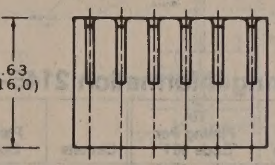
features/dimensions

- With or without locking ramp
- Mates with .045" round or square pins
- Accepts Molex double cantilever crimp terminals
- 94V-2 Nylon
- 2 - 24 circuits available
- Mates with Molex KK .156" (3,96 mm) center wafers or staked pins
- Uses 2478 or 2578 terminals (see page 28)


LOCKING RAMP

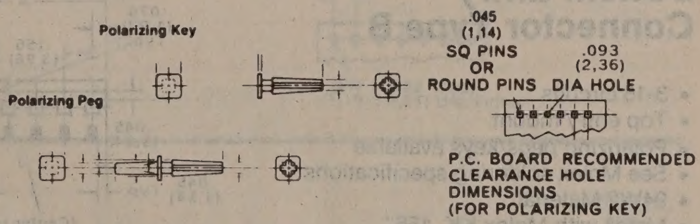

A
.076
(1,93)
.156
(3,96) Typ.
.047
(1,19)
No. 1
Circuit
.08 Sq. Hole
(2,0) Typ.


.40
(10,2) Min. Insertion Depth
Locking Ramp
Optional
.10
(2,54)
30°



Polarizing Key & Peg

	Eng. No.	Order No.
Polarizing key	2560-1	15-04-0219
Polarizing peg	2560-2	15-04-0220


Polarizing Key
Polarizing Peg
.045
(1,14)
SQ PINS
OR
ROUND PINS
.093
(2,36)
DIA HOLE
P.C. BOARD RECOMMENDED
CLEARANCE HOLE
DIMENSIONS
(FOR POLARIZING KEY)

Dimensional Information 2139

inches / mm

Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A
2	.31 ± .007 (7,82 ± 0,18)	6	.93 ± .010 (23,67 ± 0,25)	10	1.56 ± .012 (39,52 ± 0,30)	14	2.18 ± .014 (55,37 ± 0,36)	18	2.804 ± .014 (71,22 ± 0,35)	22	3.428 ± .018 (87,07 ± 0,46)
3	.46 ± .010 (11,79 ± 0,25)	7	1.09 ± .012 (27,64 ± 0,30)	11	1.71 ± .012 (43,48 ± 0,30)	15	2.34 ± .014 (59,33 ± 0,36)	19	2.960 ± .014 (65,18 ± 0,36)	23	3.584 ± .018 (91,03 ± 0,46)
4	.62 ± .010 (15,75 ± 0,25)	8	1.24 ± .012 (31,60 ± 0,30)	12	1.87 ± .012 (47,45 ± 0,30)	16	2.492 ± .014 (63,30 ± 0,35)	20	3.116 ± .018 (79,15 ± 0,46)	24	3.740 ± .018 (95,00 ± 0,46)
5	.78 ± .010 (19,71 ± 0,25)	9	1.40 ± .012 (35,56 ± 0,38)	13	2.02 ± .014 (51,41 ± 0,36)	17	2.648 ± .014 (67,26 ± 0,35)	21	3.272 ± .018 (83,11 ± 0,46)		

Ordering Information 2139

Circuits	With Locking Ramp	Without Locking Ramp	Circuits	With Locking Ramp	Without Locking Ramp	Circuits	With Locking Ramp	Without Locking Ramp	Circuits	With Locking Ramp	Without Locking Ramp
2	09-50-3021	09-50-7021	8	09-50-3081	09-50-7081	14	09-50-3141	09-50-7141	20	09-50-3201	09-50-7201
3	09-50-3031	09-50-7031	9	09-50-3091	09-50-7091	15	09-50-3151	09-50-7151	21	09-50-3211	09-50-7211
4	09-50-3041	09-50-7041	10	09-50-3101	09-50-7101	16	09-50-3161	09-50-7161	22	09-50-3221	09-50-7221
5	09-50-3051	09-50-7051	11	09-50-3111	09-50-7111	17	09-50-3171	09-50-7171	23	09-50-3231	09-50-7231
6	09-50-3061	09-50-7061	12	09-50-3121	09-50-7121	18	09-50-3181	09-50-7181	24	09-50-3241	09-50-7241
7	09-50-3071	09-50-7071	13	09-50-3131	09-50-7131	19	09-50-3191	09-50-7191			

.156" (3,96 mm) Center P.C. Board Connectors

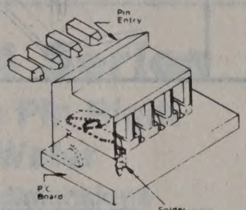
molex

2145-A

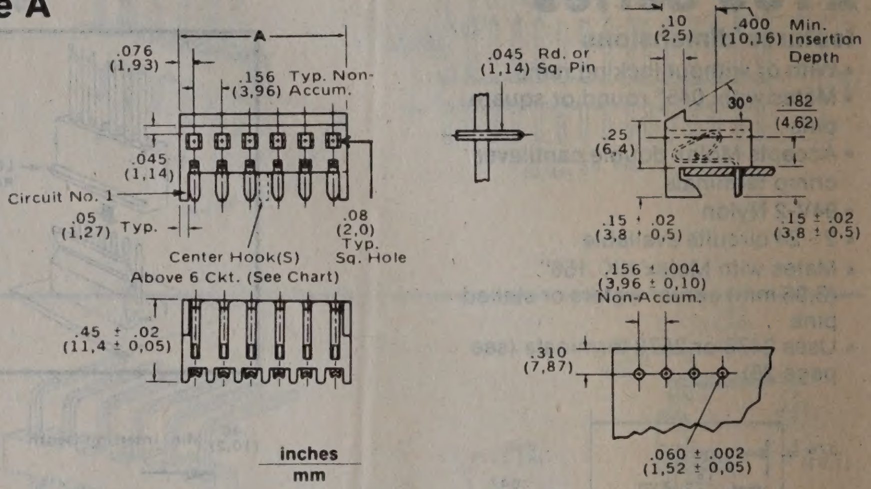
Right Angle Mount Type A

features/dimensions:

- 3-15 circuits
- Top entry mount
- Polarizing pegs/keys available
- See Molex soldering specifications
- 94V-2 Material
- Mates with Molex KK .156" (3,96mm) center wafers



Pin Entry
P.C. Board
Solder Tail



A
.076 (1,93)
.156 Typ. Non-(3,96) Accum.
.045 (1,14)
Circuit No. 1
.05 (1,27) Typ.
.08 (2,0) Typ. Sq. Hole
Center Hook(S) Above 6 Ckt. (See Chart)
.45 ± .02 (11,4 ± 0,05)
inches
mm
.045 Rd. or (1,14) Sq. Pin
.10 (2,5)
.400 Min. (10,16) Insertion Depth
30°
.182 (4,62)
.25 (6,4)
.15 ± .02 (3,8 ± 0,5)
.15 ± .02 (3,8 ± 0,5)
.156 ± .004 (3,96 ± 0,10) Non-Accum.
.310 (7,87)
.060 ± .002 (1,52 ± 0,05)

Recommended Hole Dimensions
For Std. .062 ± .008 (1,57 ± 0,20) P.C. Board

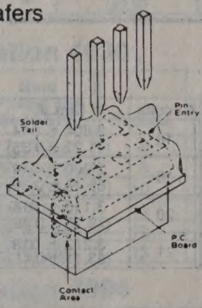
Ordering Information 2145-A

Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*
3	09-52-3031	5	09-52-3051	8	09-52-3081	10	09-52-3101	12	09-52-3121	15	09-52-3151
4	09-52-3041	6	09-52-3061	9	09-52-3091						

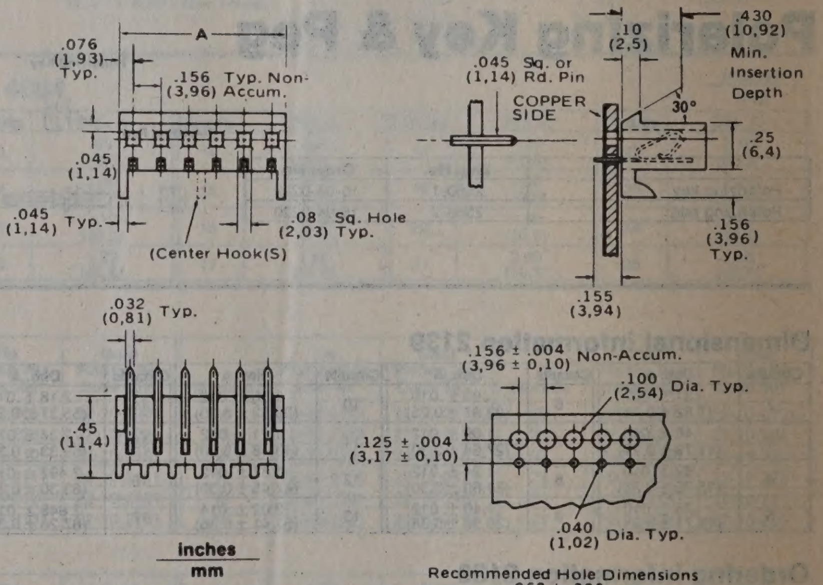
2145-B Series

Bottom Entry Connector Type B

- 3-15 circuits
- Top entry mount
- Polarizing pegs/keys available
- See Molex soldering specifications
- 94V-2 Material
- Mates with Molex KK .156" (3,96mm) center wafers



Solder Tail
Pin Entry
P.C. Board
Contact Area



A
.076 (1,93) Typ.
.156 Typ. Non-(3,96) Accum.
.045 (1,14)
.045 (1,14) Typ.
.08 Sq. Hole (2,03) Typ.
(Center Hook(S))
.032 (0,81) Typ.
.45 (11,4)
inches
mm
.045 Sq. or (1,14) Rd. Pin
COPPER SIDE
.10 (2,5)
.430 (10,92) Min. Insertion Depth
30°
.25 (6,4)
.156 (3,96) Typ.
.155 (3,94)
.156 ± .004 (3,96 ± 0,10) Non-Accum.
.100 (2,54) Dia. Typ.
.125 ± .004 (3,17 ± 0,10)
.040 (1,02) Dia. Typ.

Recommended Hole Dimensions
For Std. .062 ± .008 (1,57 ± 0,20) P.C. Board

For Dimensional Information (Under 2145C)

Ordering Information 2145-B

Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*	Circuits	Tin Plating Per Code 901*
3	09-52-3032	5	09-52-3052	8	09-52-3082	10	09-52-3102	12	09-52-3122	15	09-52-3152
4	09-52-3042	6	09-52-3062	9	09-52-3092						

World Headquarters — Molex Incorporated
2222 Wellington Court, Lisle, Illinois 60532 • 312/969-4550 • TWX: 910-695-3229

.156" (3,96 mm) Center Wafers

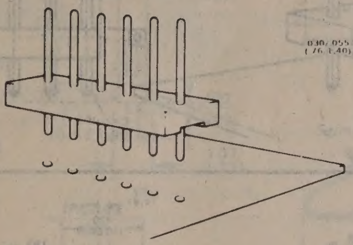
molex

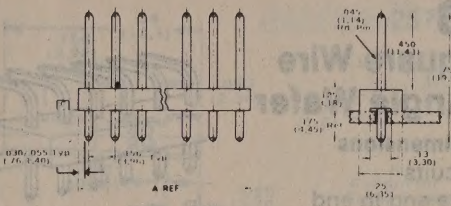
2402

.045" Round Wire Straight Wafer

Features/Dimensions

- 2-18 Circuits
- Stackable end to end
- Mates with 156" connectors
- 94V-2



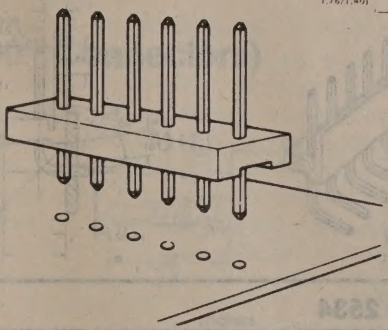

.045
(1,14)
Rd. Pin
.450
(11,43)
.750
(19,05)
.125
(3,18)
.175 Ref
(4,45)
.030/.055 Typ
(.76/1,40)
.156
(3,96) Typ
A REF
.13
(3,30)
.25
(6,35)

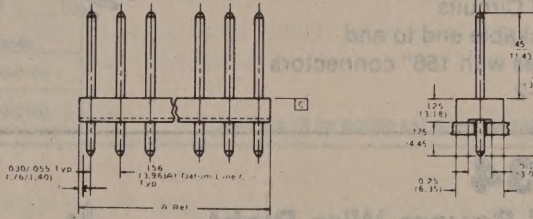
2461

.045" Square Wire Straight Wafer

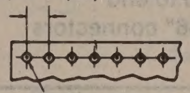
Features/Dimensions

- 2-18 Circuits
- Stackable end to end
- Mates with 156" connectors
- 94V-2




.045
(1,14)
Sq. Pin
.45
(11,43)
.750
(30,48)
.125
(3,18)
.175
(4,45)
C
.030/.055 Typ
(.76/1,40)
.156
(3,96) At Datum Line C
Typ
A Ref
0.25
(6,35)
.12
(3,05)

Recommended P.C. Board Layout for .100" (2,54 mm) Wafers


.100 ± .002 Typ.
(2,54 ± 0,05) Non-Accum.
.047 ± .002 Typ.
(1,19 ± 0,05) Dia. Holes

Dimensional Information 2402 and 2461

inches
mm

Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A
2	.288 (7,32)	5	.756 (19,20)	8	1.224 (31,09)	11	1.692 (42,98)	14	2.160 (54,86)	18	2.628 (66,75)
3	.444 (11,28)	6	.910 (23,11)	9	1.380 (35,05)	12	1.848 (46,94)	15	2.316 (58,83)	18	2.784 (70,71)
4	.600 (15,24)	7	1.068 (27,13)	10	1.536 (39,01)	13	2.004 (50,90)	16	2.472 (62,79)		

Ordering Information 2402

Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*
2	09-64-1021	5	09-64-1051	8	09-64-1081	11	09-64-1111	14	09-64-1141	17	09-64-1171
3	09-64-1031	6	09-64-1061	9	09-64-1091	12	09-64-1121	15	09-64-1151	18	09-64-1181
4	09-64-1041	7	09-64-1071	10	09-64-1101	13	09-64-1131	16	09-64-1161		

Ordering Information 2461

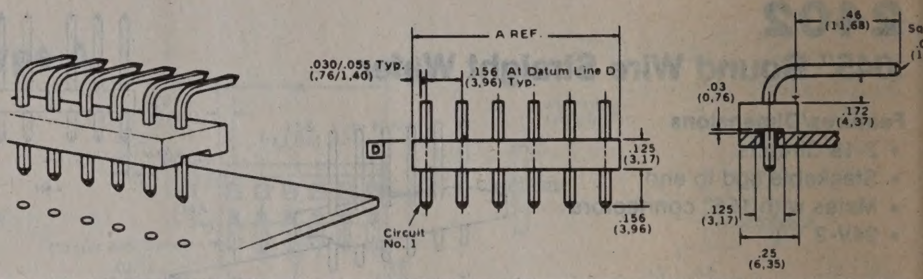
Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*
2	09-67-1023	5	09-67-1053	8	09-67-1083	11	09-67-1113	14	09-67-1143	17	09-67-1173
3	09-67-1033	6	09-67-1063	9	09-67-1093	12	09-67-1123	15	09-67-1153	18	09-67-1183
4	09-67-1043	7	09-67-1073	10	09-67-1103	13	09-67-1133	16	09-67-1163		

.156" (3,96 mm) Center Wafers

molex

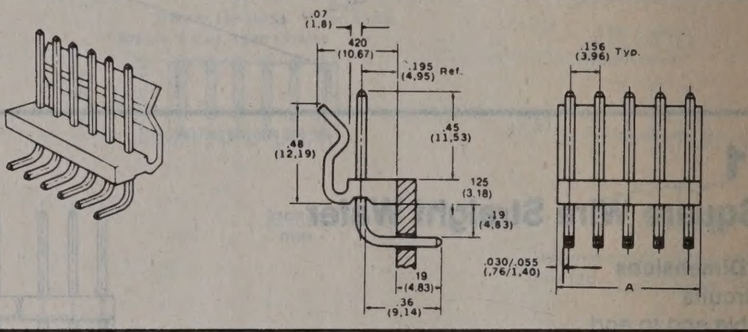
2373
.045" Square Wire Right Angle Wafer

Features/Dimensions
- 2-18 Circuits
- Stackable end to end
- Mates with 156" connectors
- 94V-2


A REF.
.030/.055 Typ.
(,76/1,40)
.156 At Datum Line D
(3,96) Typ.
D
.125
(3,17)
.156
(3,96)
Circuit
No. 1
.46
(11,68)
Sq.
.03
(0,76)
.172
(4,37)
.125
(3,17)
.25
(6,35)

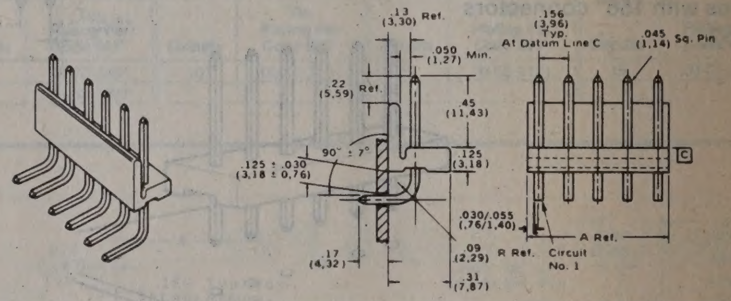
2420 Series
.045" Square Wire Right Angle Friction Lock

Features/Dimensions
- 2-18 Circuits
- Stackable end to end
- Mates with 156" connectors
- 94V-2


.07
(1,8)
420
(10.67)
.195 Ref.
(4,95)
.48
(12,19)
.45
(11,53)
125
(3.18)
.19
(4,83)
19
(4.83)
.36
(9,14)
.156
(3,96) Typ.
.030/.055
(,76/1,40)
A

2534
.045" Square Wire Right Angle Polarizing Wall

Features/Dimensions
- 2-18 Circuits
- Stackable end to end
- Mates with 156" connectors
- 94V-2


.13 Ref.
(3,30)
.050 Min.
(1,27)
.22 Ref.
(5,59)
.45
(11,43)
90° ± 7°
.125 ± .030
(3,18 ± 0,76)
.125
(3,18)
.17
(4,32)
.09 R Ref.
(2,29)
.31
(7,87)
.156
(3,96)
Typ.
At Datum Line C
.045 Sq. Pin
(1,14)
C
.030/.055
(,76/1,40)
A Ref.
Circuit
No. 1

Dimensional Information 2373, 2420 and 2534

inches
mm

Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A	Circuits	Dim. A
2	.288 (7,32)	5	.756 (19,20)	8	1.224 (31,09)	11	1.692 (42,98)	14	2.160 (54,86)	17	2.628 (66,75)
3	.444 (11,28)	6	.912 (23,17)	9	1.380 (35,05)	12	1.848 (46,94)	15	2.316 (58,83)	18	2.784 (70,71)
4	.600 (15,24)	7	1.068 (27,13)	10	1.536 (39,01)	13	2.004 (50,90)	16	2.472 (62,79)		

Ordering Information 2373

Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*
2	09-66-1021	5	09-66-1051	8	09-66-1081	11	09-66-1111	14	09-66-1141	17	09-66-1171
3	09-66-1031	6	09-66-1061	9	09-66-1091	12	09-66-1121	15	09-66-1151	18	09-66-1181
4	09-66-1041	7	09-66-1071	10	09-66-1101	13	09-66-1131	16	09-66-1161		

Ordering Information 2420

Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*
2	09-75-1028	5	09-75-1058	8	09-75-1088	11	09-75-1118	14	09-75-1148	17	09-75-1178
3	09-75-1038	6	09-75-1068	9	09-75-1098	12	09-75-1128	15	09-75-1158	18	09-75-1188
4	09-75-1048	7	09-75-1078	10	09-75-1108	13	09-75-1138	16	09-75-1168		

Ordering Information 2534

Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*	Circuits	Tin Plating Per Code 102*
2	09-88-2021	5	09-88-2051	8	09-88-2081	11	09-88-2111	14	09-88-2141	17	09-88-2171
3	09-88-2031	6	09-88-2061	9	09-88-2091	12	09-88-2121	15	09-88-2151	18	09-88-2181
4	09-88-2041	7	09-88-2071	10	09-88-2101	13	09-88-2131	16	09-88-2161		

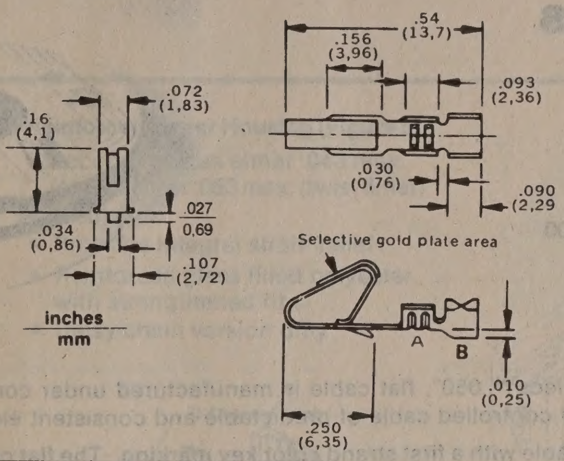
Crimp Terminals for .100″ (2,54 mm) & .156″ (3,96 mm) Center Housings

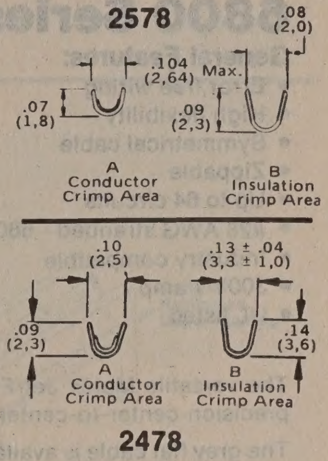
2478, 2578

(.156″ Connectors)

features/dimensions

- patented double cantilever design
- Accepts AWG 18 through 26 AWG leads
- Complete line of terminal crimping equipment available
- For use with 2139 series housings
- For .156″ (3,96mm) application


.072
(1,83)
.16
(4,1)
.027
0,69
.034
(0,86)
.107
(2,72)
inches
mm
.54
(13,7)
.156
(3,96)
.093
(2,36)
.030
(0,76)
.090
(2,29
Selective gold plate area
A
B
.010
(0,25)
.250
(6,35)


2578
.08
(2,0)
.104
(2,64)
Max.
.07
(1,8)
.09
(2,3)
A
Conductor
Crimp Area
B
Insulation
Crimp Area
.10
(2,5)
.13 ± .04
(3,3 ± 1,0)
.09
(2,3)
.14
(3,6)
A
Conductor
Crimp Area
B
Insulation
Crimp Area
2478

Wire Size	Insulation O.D.	Model No.	Tin Plating Per Code 901		Gold Plating Per Code 501	
			Chain	Loose	Chain	Loose
18-24	.110 (2,79) Max.	2478	08-50-0105	08-50-0106	08-56-0105	08-56-0106
22-26	.065 (1,65) Max.	2578	08-50-0107	08-50-0108	08-56-0107	08-56-0108

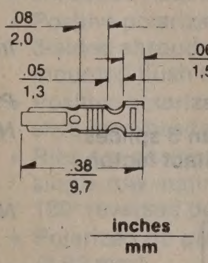
See Page 13 for plating and soldering specifications

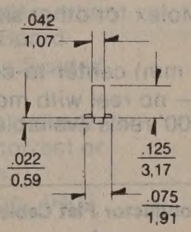
2759 Series

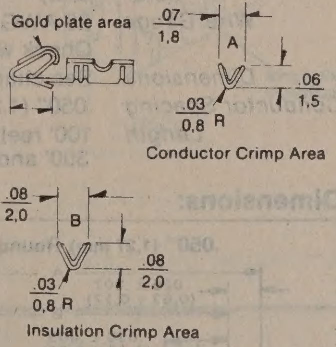
Crimp Terminals (.100″ Connectors)

Features/Dimensions:

- Use with 2695 housings
- Patented double cantilever
- Accepts 22 to 30 AWG wire
- Full line of application tooling available


.08
2,0
.05
1,3
.06
1,5
.38
9,7
inches
mm

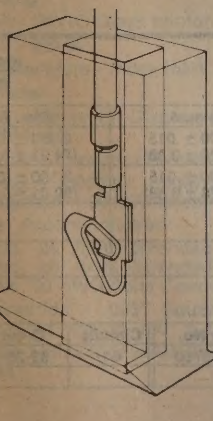

.042
1,07
.022
0,59
.125
3,17
.075
1,91


Gold plate area
.07
1,8
A
.06
1,5
.03
0,8 R
Conductor Crimp Area
.08
2,0
B
.08
2,0
.03
0,8 R
Insulation Crimp Area

Ordering Information 2759

Wire Size	Insulation O.D.	Model No.	Tin Plating Per Code 901		Gold Plating Per Code 550	
			Loose	Chain	Loose	Chain
22-30	.062 1,57 Max.	2759	08-50-0114	08-50-0113	08-56-0110	08-56-0109

Molex KK® Concept



The Molex KK concept utilizes a double cantilever contact design in mating with P.C.-board pins. The time proven double cantilever design provides a high uniform contact pressure for a reliable connector interface. The high pressure creates more contact points at a microscopic level, thereby providing a lower contact resistance. The wiping action of the double cantilever design tends to clean oxides and film when the connector is mated.

Molex crimp terminals are available in a number of crimp variations to accommodate various wire specifications. A number of plating options are also available to meet customers requirements in tin and gold specifications. Molex terminals will meet solderability specifications as noted in this catalog.

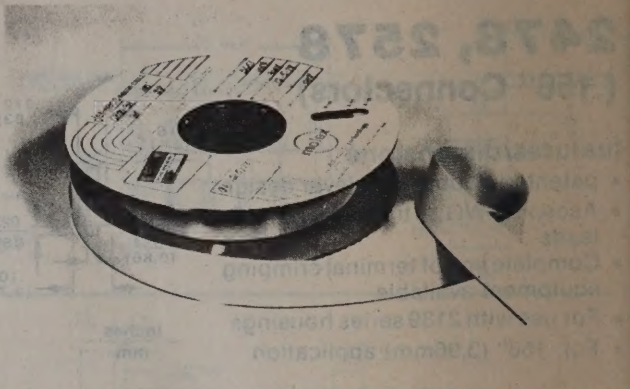
The Molex KK concept provides a durable connector interface at an affordable price ... a totally engineered product.

.050" (1,27 mm) Round Conductor Flat Cable

6800 Series

General Features:

- Error free wiring
- High flexibility
- Symmetrical cable
- Zippable
- Up to 64 circuits
- #28 AWG stranded - 6800
- Industry compatible
- 300V 1 amp
- UL listed



The versatile Molex Jet-Flecs™ .050", flat cable is manufactured under controlled techniques which produces a precision center-to-center controlled cable of predictable and consistent electrical characteristics.

The grey flat cable is available with a first strand color key marking. The flat cable design allows individual or groups of conductors to be separated from the cable through a zipping process.

Jet-Flecs™ flat cables are designed to mate with the Molex 4700 & 7789 series Jet Flecs™ connector, and compatible industry standard insulation displacement systems.

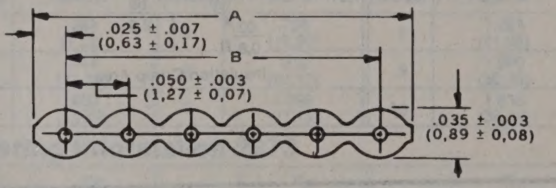
Specifications:

Physical:

UL Style No.	2651
Insulation Material	Polyvinyl chloride (PVC)
Flammability Rating	UL rated FR-1/VW-1
Color	Gray
Wire Gauge	28 AWG - stranded tinned - 6800 Check w/Molex for other sizes
Dimensions	See chart
Conductor Spacing	.050" (1.27 mm) center-to-center
Length	100' reels — no reel with more than 3 splices 300' and 500' reels available. Contact factory.

Dimensions:

.050" (1,27 mm) Round Conductor Flat Cable



Electrical:

Votage rating - 300 V Max.
Insulation resistance - 10^4MΩ
(10 ft. sample)
Dielectric withstand voltage - 1500 VRMS
Impedance - 105 ground/signal/ground
Propagation Delay - 1.4 ns/ft. NOM
Nom. Characteristic Impedance -
GS 123Ω
GSG 100Ω
Nom. Capacitance -
GS 9.1 pf/ft.
GSG 17.0 pf/ft.
Nom. Conductor DCR -
6.2 ohms/100ft.

Environmental:

Temperature rating - -.20° C to 105° C

Dimensional Information 6800

inches / mm

Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B
10	.500 ± .010 (12,70 ± 0,25)	.450 ± .007 (11,43 ± 0,18)	26	1.300 ± .015 (33,02 ± 0,38)	1.250 ± .009 (31,74 ± 0,23)	60	3.000 ± .015 (76,20 ± 0,38)	2.950 ± .011 (74,93 ± 0,28)
11	.700 ± .010 (17,78 ± 0,25)	.650 ± .007 (16,51 ± 0,18)	34	1.700 ± .015 (43,18 ± 0,38)	1.650 ± .009 (41,91 ± 0,23)	64	3.200 ± .015 (81,28 ± 0,38)	3.150 ± .011 (80,01 ± 0,28)
12	.800 ± .010 (20,32 ± 0,25)	.750 ± .009 (19,05 ± 0,23)	40	2.000 ± .015 (50,80 ± 0,38)	1.950 ± .011 (49,53 ± 0,28)			
13	1.000 ± .015 (25,40 ± 0,38)	.950 ± .009 (24,13 ± 0,23)	50	2.500 ± .015 (63,50 ± 0,38)	2.450 ± .011 (62,23 ± 0,28)			

Ordering Information 6800

Circuits	Order No.	Circuits	Order No.	Circuits	Order No.	Circuits	Order No.	Circuits	Order No.	Circuits	Order No.
10	82-28-5710	16	82-28-5716	26	82-28-5726	40	82-28-5740	60	82-28-5760	64	82-28-5764
14	82-28-5714	20	82-28-5720	34	82-28-5734	50	82-28-5750				

World Headquarters — Molex Incorporated
2222 Wellington Court, Lisle, Illinois 60532 • 312/969-4550 • TWX: 910-695-3229

For More Information. Circle No. 524

.050" (1,27 mm) Connectors

molex®

7789 Series

Design Features:

Standard Upper Housing (Figure 4)

- Accommodates .043 max. insulation thickness
- Full ribbed cable slot for positive alignment
- Recessed shelf for easy cable insertion
- Recessed U-channel provides strong latch to housing
- Optional closed (blind) or thru (daisy chain) cable mounting
- Recess for flush cable bend (stackability)
- Probe holes for visual inspection
- Built-in pin stop

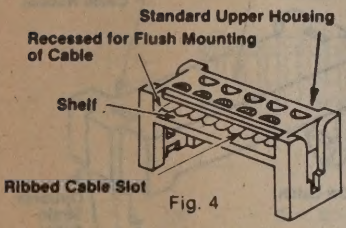
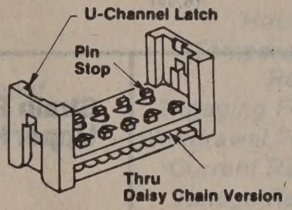


Fig. 4

Also used for twist and flat cable.

Reinforced Upper Housing (Figure 5)

- Accommodates either .043 max. (standard) or .053 max. (twist & flat) insulation
- Provides integral strain relief
- Reinforced glass filled polyester with strengthened ribs
- Daisy chain version only



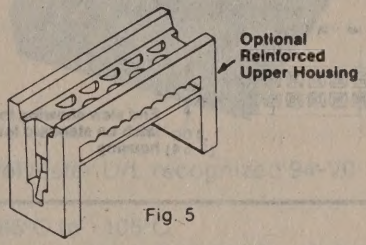


Fig. 5

Polarized Features (Figure 6)

- Positive polarization to fully shrouded headers
- Positive polarization to right angle 3-sided shrouded headers when mounted flush to PC Board
- Positive polarization to 3-sided shrouded headers
- Ribs are positioned to prevent single row mating in correct or 180° reversed position.
- Polarized rib projection: .040" (1,02 mm)

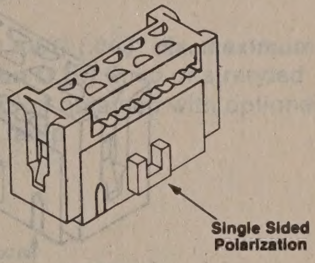


Fig. 6

Specifications:

Product Description

I.D. - Flat Cable/.025" Square-Round Pin Connector

Housing

Rated - 94V-O Glass reinforced polyester

Color - Black

Nomenclature - Index mark on housing

Terminal

Type - Insulation Displacement/Dual (Box) Contact

Material - Phosphor Bronze

Plating - .000030" (.00076mm) Gold over .000050" (.00127mm) min.

Wire Accommodation:

No. 26 AWG Stranded Conductor
No. 28 AWG Stranded Conductor
No. 30 AWG Solid Conductor

Connection - .025" Square or Diameter Round Pins on .100" x .100" grid

Check Molex for availability of other plating types.

Electrical:

Current Rating - 1 (one) ampere (continuous)

Net Terminal Resistance:

No. 26 AWG
Stranded Conductor - 2.7 milliohms
No. 28 AWG
Stranded Conductor - 2.7 to 2.9 milliohms
No. 30 AWG
Solid Conductor - 3.6 milliohms

Withstanding Voltage

Breakdown Voltage - greater than 1000 volts RMS

Insulation Resistance - greater than 10^{12} Ohms

Mechanical:

Terminal Insertion/Withdrawal Forces

Initial Engagement Force is 5 ozs. per circuit (average)

Initial Withdrawal Force is 3.7 ozs. per circuit (average)

After 100 Cycles - Minimum Withdrawal Force is 3.0 oz. per circuit (average)

Environmental:

Vibration - per Mil Std. 202, Method 204, Cond. A

Shock - per Mil. Std. 202, Method 213B, Cond. A

Humidity - per Mil. Std. 202, Method 103, Cond. A

Salt Spray - per Mil. Std. 202, Method 101, Cond. A

Current Cycling - 50 Cycles at 125% Current, 30 minutes on, 15 minutes off per cycle

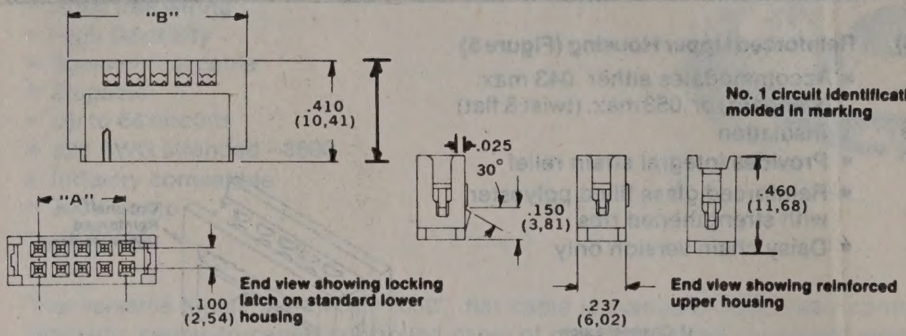
Corrosive Atmosphere - Nitric Acid Vapor - 1 hr. @ amb. (gold)

Thermal - Operating Temperature Range -40°C to +105°C

Heat Life - 300 hrs @ 105°C

.050″ (1,27 mm) Connectors

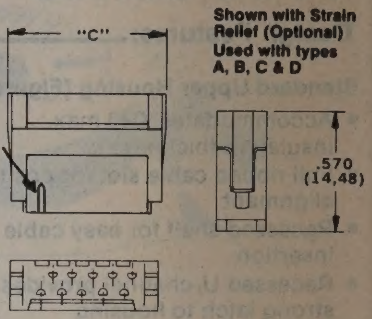
7789 Dimensions



End view showing locking latch on standard lower housing

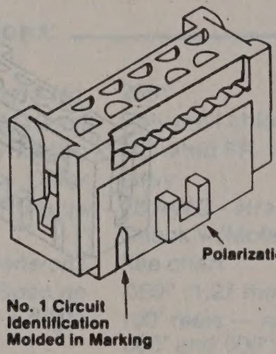
End view showing reinforced upper housing

No. 1 circuit identification molded in marking



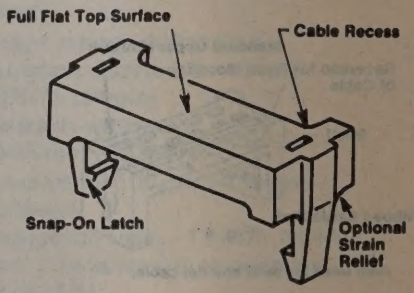
Shown with Strain Relief (Optional) Used with types A, B, C & D

7789 Single Side Polarization



Strain Relief Optional for Non-Reinforced Upper Housing Versions 7789 Connectors

Snap-on, recessed latch
Cable recess for stackability
Full top surface for customer part identification



Dimensional Information 7789

Circuits	Dim. A	Dim. B	Dim. C Optional Strain Relief	Circuits	Dim. A	Dim. B	Dim. C Optional Strain Relief
10	.400 ± .010 (10,16 ± 0,25)	.673 ± .010 (17,09 ± 0,25)	.713 ± .010 (18,11 ± 0,25)	34	1.600 ± .010 (40,64 ± 0,25)	1.873 ± .010 (47,57 ± 0,25)	1.913 ± .010 (48,59 ± 0,25)
14	.600 ± .010 (15,24 ± 0,25)	.873 ± .010 (22,17 ± 0,25)	.913 ± .010 (23,19 ± 0,25)	40	1.900 ± .010 (48,26 ± 0,25)	2.173 ± .010 (55,19 ± 0,25)	2.213 ± .010 (56,21 ± 0,25)
16	.700 ± .010 (17,78) ± 0,25)	.973 ± .010 (24,71 ± 0,25)	1.013 ± .010 (25,73 ± 0,25)	50	2.400 ± .010 (60,96 ± 0,25)	2.673 ± .010 (67,89 ± 0,25)	2.713 ± .010 (68,91 ± 0,250
20	.900 ± .010 (22,86 ± 0,25)	1.173 ± .010 (29,79 ± 0,25)	1.213 ± .010 (30,81 ± 0,25)	60	2.900 ± .010 (73,66 ± 0,25)	3.173 ± .010 (80,59 ± 0,25)	3.213 ± .010 (81,61 ± 0,25)
26	1.200 ± .010 (30,48 ± 0,25)	1.473 ± .010 (37,41 ± 0,25)	1.513 ± .010 (38,43 ± 0,25)	64	3.100 ± .010 (78,74 ± 0,25)	3.373 ± .010 (85,67 ± 0,25)	3.413 ± .010 (86,69 ± 0,25)

Ordering Information 7789 (Single Side Polarization)

Circuits	Type B (Std. Hsg. thru Feed)	Type C (Reinforced Upper Hsg. thru Feed	Type D (Reinforced Upper Hsg./Twist/Flat Cable thru Feed)	Circuits	Type B (Std. Hsg. thru Feed)	Type C (Reinforced Upper Hsg. thru Feed	Type D (Reinforced Upper Hsg./Twist/Flat Cable thru Feed)
10	15-27-2102	15-27-2103	15-27-2104	34	15-27-2342	15-27-2343	15-27-2344
14	15-27-2142	15-27-2143	15-27-2144	40	15-27-2402	15-27-2403	15-27-2404
16	15-27-2162	15-27-2163	15-27-2164	50	15-27-2502	15-27-2503	15-27-2504
20	15-27-2202	15-27-2203	15-27-2204	60	15-27-2602	15-27-2603	15-27-2604
26	15-27-2262	15-27-2263	15-27-2264	64	15-27-2642	15-27-2643	15-27-2644

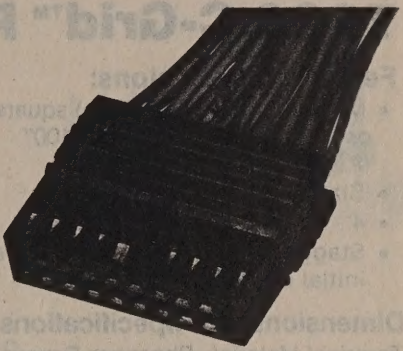
Ordering Information Strain Relief 4704 (Optional)

Circuits	Order No.	Circuits	Order No.	Circuits	Order No.	Circuits	Order No.	Circuits	Order No.
10	15-05-6101	16	15-05-6161	26	15-05-6261	40	15-05-6401	60	15-05-6601
14	15-05-6141	20	15-05-6201	34	15-05-6341	50	15-05-6501	64	15-05-6641

C-Grid™ IDT Connector

molex®

8676
Wire to Board C-Grid™ Connector For .100″ (2,54mm) Centers Ribbon Cable or Discrete Wire



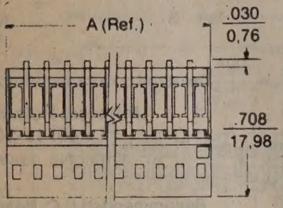
Features/Dimensions:

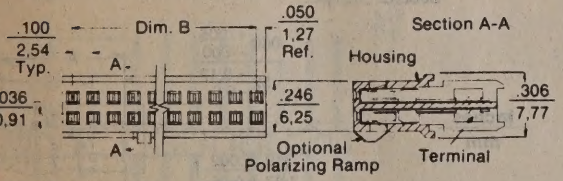
- Mates with .025″ (0,64mm) pins and all Molex dual row headers
- 6-72 circuits, even numbers
- Polarization via ramp
- End to end stackable
- Lower termination cost due to IDT
- Mass termination
- Extruded cover/strain relief

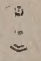
Dimensions and Specifications:

Terminals - Copper alloy
Plating - .000200″ tin over .000100″ copper or .000030″/.000050″ gold over nickel in the critical area with .000150″ tin in the insulation displacement area

Housing - Polyester U/L recognized 94-V0
Temperature Range - -65°C to +105°C
Engaging Force - 9 oz. (255g) maximum per circuit
Withdrawal Force - 1 oz. (28,4g) minimum per circuit
Current Rating - 3 amps maximum (22 AWG wire)
Voltage Rating - 250 VAC
Acceptable Wire Gauges - 28 to 24 AWG **(.048″ dia. maximum insulation O.D.)** Solid or stranded
Polarization - Polarization obtained with optional locking ramp







Delivered on a carrier with 20 pieces per strip.

Universal Polarizing Pin
40713-20
Order No. 15-04-0292

inches
mm

Dimensional Information 8676

Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B
6	.300 7,62	.200 5,08	20	1.000 25,40	.900 22,86	34	1.700 43,18	1.600 40,64	48	2.400 60,96	2.300 58,42	62	3.100 78,74	3.000 76,20
8	.400 10,16	.300 7,62	22	1.100 27,94	.1000 25,40	36	1.800 45,72	1.700 43,18	50	2.500 63,50	2.400 60,96	64	3.200 81,28	3.100 78,74
10	.500 12,70	.400 10,16	24	1.200 30,48	1.100 27,94	38	1.900 48,26	1.800 45,72	52	2.600 66,04	2.500 63,50	66	3.300 83,82	3.200 81,28
12	.600 15,24	.500 12,70	26	1.300 33,02	1.200 30,48	40	2.000 50,80	1.900 48,26	54	2.700 68,58	2.600 66,04	68	3.400 86,36	3.300 83,82
14	.700 17,78	.600 15,25	28	1.400 35,56	1.300 33,02	42	2.100 53,34	2.000 50,80	56	2.800 71,12	2.700 68,58	70	3.500 88,90	3.400 86,36
16	.800 20,32	.700 17,78	30	1.500 38,10	1.400 35,56	44	2.200 55,88	2.100 53,34	58	2.900 73,66	2.800 71,12	72	3.600 91,44	3.500 88,90
18	.900 22,86	.811 20,32	32	1.600 40,64	1.500 38,10	46	2.300 58,42	2.200 55,88	60	3.000 76,20	2.900 73,66			

Ordering Information - Connector

30 microinches gold in contact areas, 150 microinches tin in insulation displacement areas.

22-51-1 X XX

Number of Circuits ← Enter Same Number → Number of Circuits

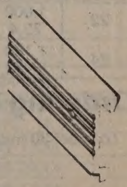
Accepts 26 thru 28 AWG wire
0 - No Polarizing Ramp
1 - Ramp for 7401, 7791, 7881 Series Headers
2 - Ramp for 8723/8724 Headers

Accepts 24 thru 26 AWG Wire
3 - No Polarizing Ramp
4 - Ramp for 7401, 7791, 7881 Series Headers
5 - Ramp for 8723/8724 Series Headers

Contact Factory for Tin Ordering Numbers

Protective Covers
(Order 2 Covers per Connector)

15-05-6 XX 3



Example: If ordering connector
22-51-1220
Order **TWO** 15-05-6203 covers

.100" (2,54 mm) Grid Dual Row Housing

7990 C-Grid™ PCB Connector

Features/Dimensions:

- Mates with .025" (0,64mm) square or round pins on a .100" x .100" (2,54mm x 2,54mm) grid
- Stackable end to end
- 4 - 130 Circuits
- Staggered mating depth to lower initial insertion force
- One row of P.C. tails slightly longer to aid in board loading
- Pin stop to prevent shorting between rows
- P.C. tails locked into housing

Dimensions and Specifications

Terminal Material: Phosphor Bronze

Plating: 1) .000030" (0,00076) gold over .000050" (0,00127) nickel in the critical area. Solder coating on the tails.
2) .000100" (0,00254) tin over .000050" (0,00127) copper.

Housing: Glass filled polyester. U.L. recognized 94V-0.

Engaging Force: 10 oz. (284 grams) max. per circuit

Extraction Force: .75 oz. (22 grams) min. per circuit

Contact Resistance: 20 milliohms max. in tin; 15 milliohms max. in gold

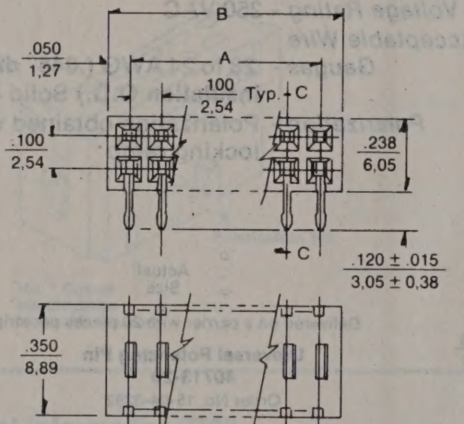
Temp. Range: -55°C to +125°C

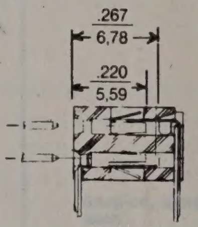
Current Rating: 2 amps at 30°C rise over ambient

Durability: 100 mating cycles in gold; 25 mating cycles in tin

Min. Mating Length of Pin: .225" (5,72mm)

Recommended Max. Length: .275" (6,99mm)





Sect. C

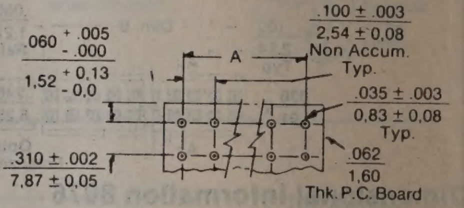
inches
mm

Actual Size

Delivered on a carrier with 20 pieces per strip.

Universal Polarizing Pin
40713-20
Order No. 15-04-0292

Recommended P.C. Board Hole Dims.



Dimensional Information 7990

Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B
4	.100 2,54	.200 5,08	26	1.200 30,48	1.300 33,02	48	2.300 58,42	2.400 60,96	70	3.400 86,36	3.500 88,90	92	4.500 114,30	4.600 116,84	112	5.500 139,70	5.600 142,24
6	.200 5,08	.300 7,62	28	1.300 33,02	1.400 35,56	50	2.400 60,96	2.500 63,50	72	3.500 88,90	3.600 91,44	94	4.600 116,84	4.700 119,38	114	5.600 142,24	5.700 144,78
8	.300 7,62	.400 10,16	30	1.400 35,56	1.500 38,10	52	2.500 63,50	2.600 66,04	74	3.600 91,44	3.700 93,98	96	4.700 119,38	4.800 121,92	116	5.700 144,78	5.800 147,32
10	.400 10,16	.500 12,70	32	1.500 38,10	1.600 40,64	54	2.600 66,04	2.700 68,58	76	3.700 93,98	3.800 96,52	98	4.800 121,92	4.900 124,46	118	5.800 147,32	5.900 149,86
12	.500 12,70	.600 15,24	34	1.600 40,64	1.700 43,18	56	2.700 68,58	2.800 71,12	78	3.800 96,52	3.900 99,06	100	4.900 124,46	5.000 127,00	120	5.900 149,86	6.000 152,40
14	.600 15,24	.700 17,78	36	1.700 43,18	1.800 45,72	58	2.800 71,12	2.900 73,66	80	3.900 99,06	4.000 101,60	102	5.000 127,00	5.100 129,54	122	6.000 152,40	6.100 154,94
16	.700 17,78	.800 20,32	38	1.800 45,72	1.900 48,26	60	2.900 73,66	3.000 76,20	82	4.000 101,60	4.100 104,14	104	5.100 129,54	5.200 132,08	124	6.100 154,94	6.200 157,48
18	.800 20,32	.900 22,86	40	1.900 48,26	2.000 50,80	62	3.000 76,20	3.100 78,74	84	4.100 104,14	4.200 106,68	106	5.200 132,08	5.300 134,62	126	6.200 157,48	6.200 160,02
20	.900 22,86	1.000 25,4	42	2.000 50,80	2.100 53,34	64	3.100 78,74	3.200 81,28	86	4.200 106,68	4.300 109,22	108	5.300 134,62	5.400 137,16	128	6.300 160,02	6.400 162,56
22	1.000 25,4	1.100 27,94	44	2.700 53,34	2.200 55,88	66	3.200 81,28	3.300 83,82	88	4.300 109,22	4.400 111,76	110	5.400 137,16	5.500 139,70	130	6.400 162,56	6.500 165,10
24	1.100 27,94	1.200 30,48	46	2.200 55,88	2.300 58,42	68	3.300 83,82	3.400 86,36	90	4.400 111,76	4.500 114,30						

Ordering Information 7990 - All circuit sizes available, even numbers 4 thru 130 Application Tooling not required.

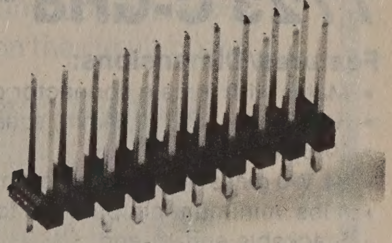
To order 30 microinches gold in critical area, tin on the tails insert number of circuits
04 through 98 in place of **XX**
15-29-50XX
100 through 130 in place of **XXX**
15-29-5XXX

To order tin over copper insert number of circuits
04 through 98 in place of **XX**
15-38-20XX
100 through 130 in place of **XXX**
15-38-2XXX

Dual Row Straight Header

8624 C-Grid™ PCB Header

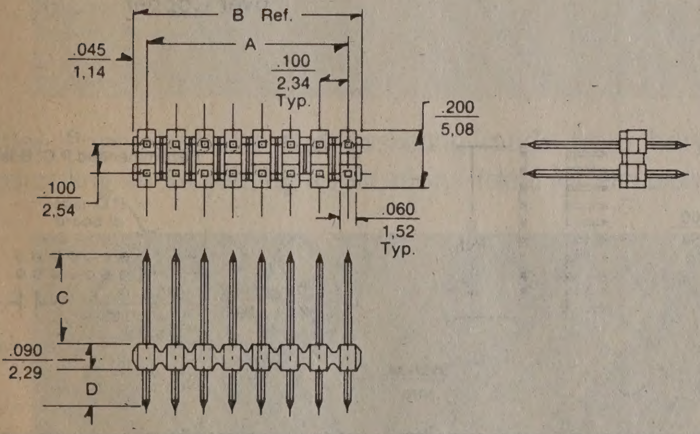
Features/Dimensions

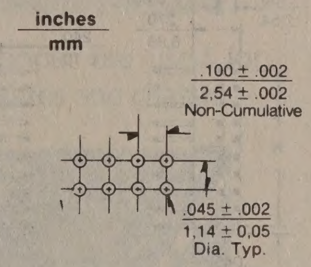


- Mates with female connector on .100" x .100" (2,54mm x 2,54mm) grid
- 4 - 80 Circuits
- 94 V-0 glass filled polyester insulator
- .025" (0,64mm) square pins
- Stackable end-to-end
- Easy breakaway to smaller sizes
- Selective plating
  (gold in mating areas)
  (tin-lead in solder areas)

Dimensions & Specifications

Terminal Material:	Copper Alloy
Insulator Material:	Glass filled polyester U.L. recognized 94V-0
Minimum Pin Pushout Force:	4 lbs.
Current Rating:	2.5 amp (D.C.) at 30°C rise over ambient
Operating Temperature:	-55° to +125°C
Platings:	Selective — 15 microinches Gold over 50 microinches Nickel (Tin lead in solder area) Selective — 30 microinches Gold over 50 microinches Nickel (Tin lead in solder area) Overall — 200 microinches Tin over Copper





Recommended P.C. Board Pattern

Dimensional Information 8624

Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B
4	.100 (2,54)	.190 (4,83)	20	.900 (22,86)	.990 (25,15)	36	1.700 (43,18)	1.790 (45,47)	52	2.500 (63,50)	2.590 (65,79)	68	3.300 (83,82)	3.390 (86,11)
6	.200 (5,09)	.290 (7,37)	22	1.000 (25,40)	1.090 (27,69)	38	1.800 (45,72)	1.890 (48,01)	54	2.600 (66,04)	2.690 (68,33)	70	3.400 (86,56)	3.490 (88,65)
8	.300 (7,62)	.390 (9,91)	24	1.100 (27,94)	1.190 (30,23)	40	1.900 (48,26)	1.990 (50,55)	56	2.700 (68,58)	2.790 (70,87)	72	3.500 (88,90)	3.590 (91.19)
10	.400 (10,16)	.490 (12,45)	26	1.200 (30,48)	1.290 (32,77)	42	2.000 (50,80)	2.090 (53,09)	58	2.800 (71,12)	2.890 (73,41)	74	3.600 (91,44)	3.690 (93,73)
12	.500 (12,70)	.590 (14,99)	28	1.300 (33,02)	1.390 (35,31)	44	2.100 (53,34)	2.190 (55,63)	60	2.900 (73,66)	2.990 (75,95)	76	3.700 (93,98)	3.790 (96,27)
14	.600 (15,24)	.690 (17,53)	30	1.400 (35,56)	1.490 (37,85)	46	2.200 (55,88)	2.290 (58,17)	62	3.000 (76,20)	3.090 (78,49)	79	3.800 (96,52)	3.890 (98,81)
16	.700 (17,79)	.790 (20,07)	32	1.500 (39,10)	1.590 (40,39)	48	2.300 (58,42)	2.390 (60,71)	64	3.100 (78,74)	3.190 (81,03)	80	3.900 (99,06)	3.990 (101,35)
18	.800 (20,32)	.890 (22,61)	34	1.600 (40,64)	1.690 (42,93)	50	2.400 (60,96)	2.490 (63,25)	66	3.200 (81,28)	3.290 (83,57)			

Ordering Information

NOTE: Dim. C = Mating End Dim. D = P.C. Tail

	8624-NA	8624-NB	8624-NC	8624-ND
Plating Option	Dim. C - .240" (6,10mm) Dim. D - .100" (2,80mm)	Dim. C - .240" (6,10mm) Dim. D - .175" (4,45mm)	Dim. C - .320" (8,13mm) Dim. D - .110" (2,80mm)	Dim. C - .320" (8,13mm) Dim. D - .175" (4,45mm)
15 microinches min. Gold	10-89-1XX1	10-89-1XX2	10-89-1XX3	10-89-1XX4
30 microinches min. Gold	10-89-2XX1	10-89-2XX2	10-89-2XX3	10-89-2XX4
Overall Tin	10-88-1XX1	10-88-1XX2	10-88-1XX3	10-88-1XX4

To order required part: Insert desired circuit numbers in place of XX. 04 though 80 even numbers available only.

.100" (2,54mm) Grid Dual Row Right Angle Header

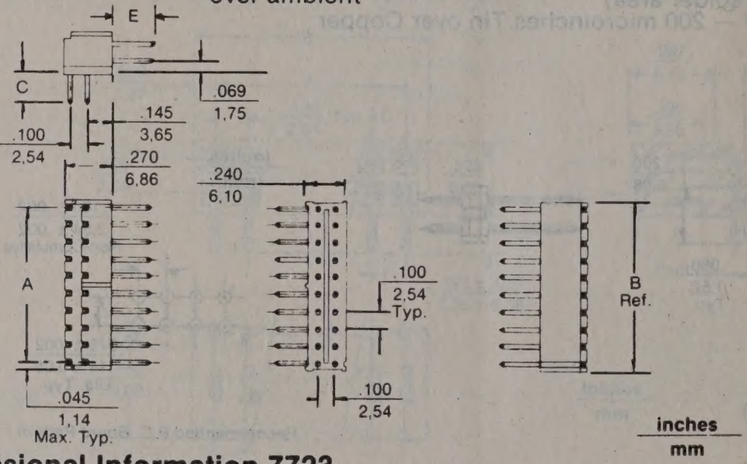
7723 C-Grid™ PCB Header

Features/Dimensions:

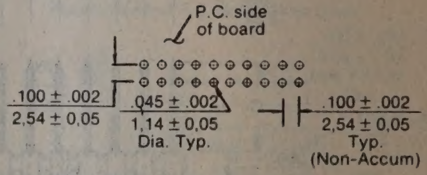
- Mates with female connector on .100" x .100" (2,54 x 2,54 mm) grid
- Right angle .025" (0,64mm) square pins
- 10-80 circuits
- 94 V-0 glass filled polyester insulator
- 4 lbs. minimum pin pushout force
- Stackable end-to-end
- Selective plating (gold in mating areas, tin-lead in solder areas)

Dimensions/Specifications:

Terminal Material - Copper Alloy
Insulator Material - Glass filled polyester, UL recognized 94 V-0
Min. Pin Pushout Force - 4 lbs.
Current Rating - 2.5 amps (D.C.) at 30°C rise over ambient
Operating Temperature - -55°C to +125°C
Platings - Selective — 15 microinches Gold over 50 microinches Nickel (Tin lead in solder area)
Selective — 30 microinches Gold over 50 microinches Nickel (Tin lead in solder area)
Overall — 200 microinches Tin over Copper



Recommended P.C. Board Pattern



Dimensional Information 7723

Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim. B	Circuits	Dim. A	Dim.
			24	1.100 27,94	1.190 30,23	44	2.100 53,34	2.190 55,63	64	3.100 78,74	3.190 81,03
			26	1.200 30,48	1.290 32,77	46	2.200 55,88	2.290 58,17	66	3.200 81,28	3.290 83,57
			28	1.300 33,02	1.390 35,31	48	2.300 58,42	2.390 60,71	68	3.300 83,82	3.390 86,11
10	.400 10,16	.490 12,45	30	1.400 35,56	1.490 37,85	50	2.400 60,96	2.490 63,25	70	3.400 86,36	3.490 88,65
12	.500 12,70	.590 14,99	32	1.500 38,10	1.590 40,39	52	2.500 63,50	2.590 65,79	72	3.500 88,90	3.590 91,19
14	.600 15,24	.690 17,53	34	1.600 40,64	1.690 42,93	54	2.600 66,04	2.690 68,33	74	3.600 91,44	3.690 93,73
16	.700 17,78	.790 20,07	36	1.700 43,18	1.790 45,47	56	2.700 68,58	2.790 70,87	76	3.700 93,98	3.790 96,27
18	.800 20,32	.890 22,61	38	1.800 45,72	1.890 48,01	58	2.800 71,12	2.890 73,41	78	3.800 96,52	3.890 98,81
20	.900 22,86	.990 25,15	40	1.900 48,26	1.990 50,55	60	2.900 73,66	2.990 75,95	80	3.900 100,58	3.990 101,35
22	1.000 25,40	1.090 27,69	42	2.000 50,80	2.090 53,09	62	3.000 76,20	3.090 78,49			

Ordering Information

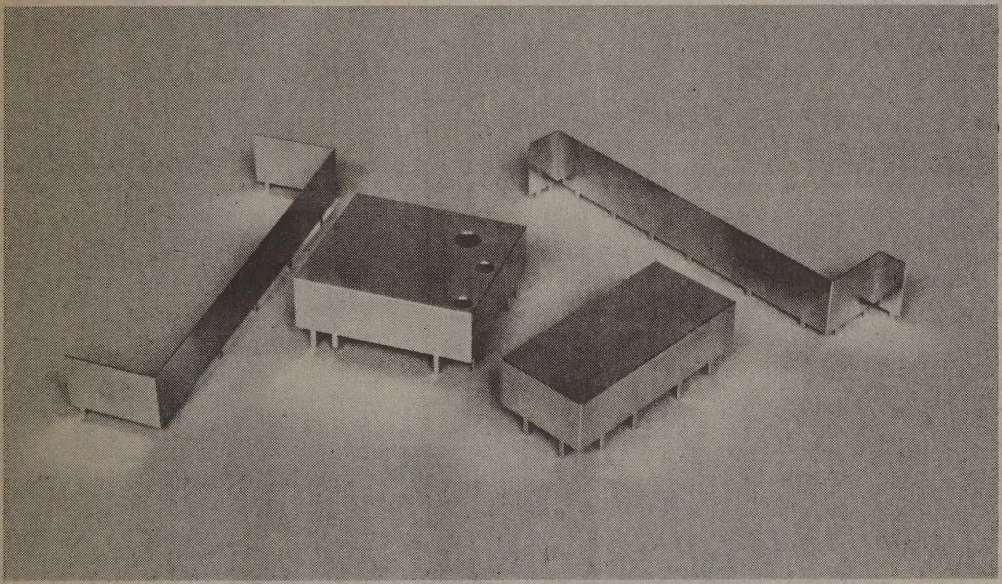
NOTE: Dim. E = Mating End Dim. C = P.C. Tail

	7723-NA	7723-NB	7723-NC	7723-ND
Plating Option	Dim. E - .240" (6,10mm) Dim. C - .100" (2,80mm)	Dim. E - .240" (6,10mm) Dim. C - .175" (4,45mm)	Dim. E - .320" (8,13mm) Dim. C - .110" (2,80mm)	Dim. E - .320" (8,13mm) Dim. C - .175" (4,45mm)
15 microinches min. Gold	10-91-1XX1	10-91-1XX2	10-91-1XX3	10-91-1XX4
30 microinches min. Gold	10-91-2XX1	10-91-2XX2	10-91-2XX3	10-91-2XX4
Overall Tin	10-90-1XX1	10-90-1XX2	10-90-1XX3	10-90-1XX4

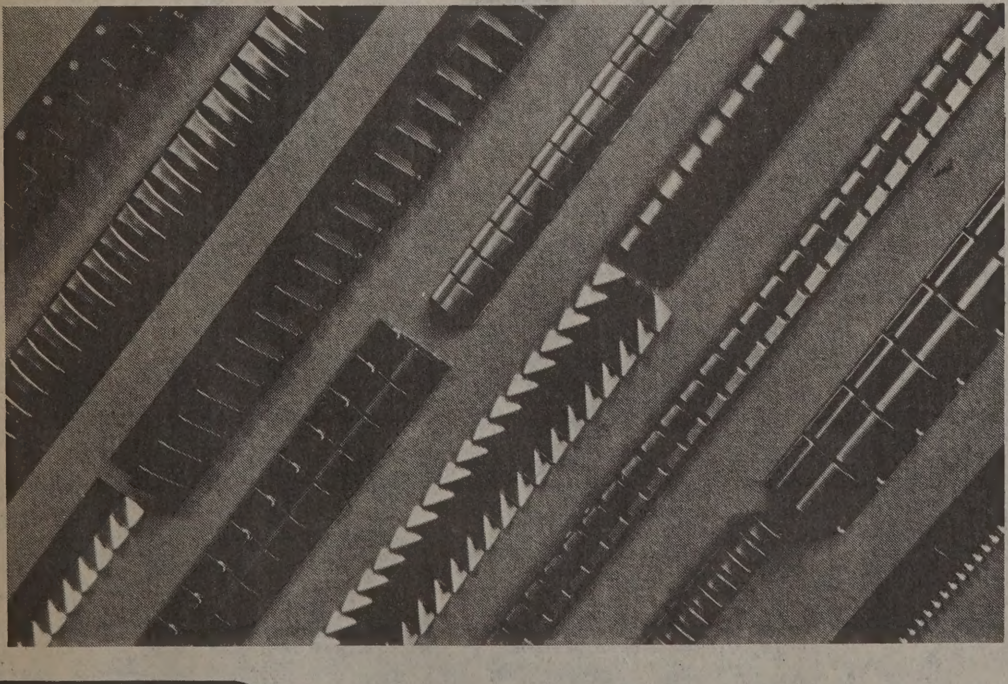
To order required part: Insert desired circuit numbers in place of XX. 04 though 80 even numbers available only.

RFI/EMI SHIELDING

Atlee manufactures custom RFI/EMI shielding made from beryllium copper, brass or nickel silver. These shields are used to isolate the source of RFI on the circuit board.



Atlee finger contacts and gasketing made from beryllium copper are used for grounding and shielding applications. Ideal for electronic enclosures and chassis.



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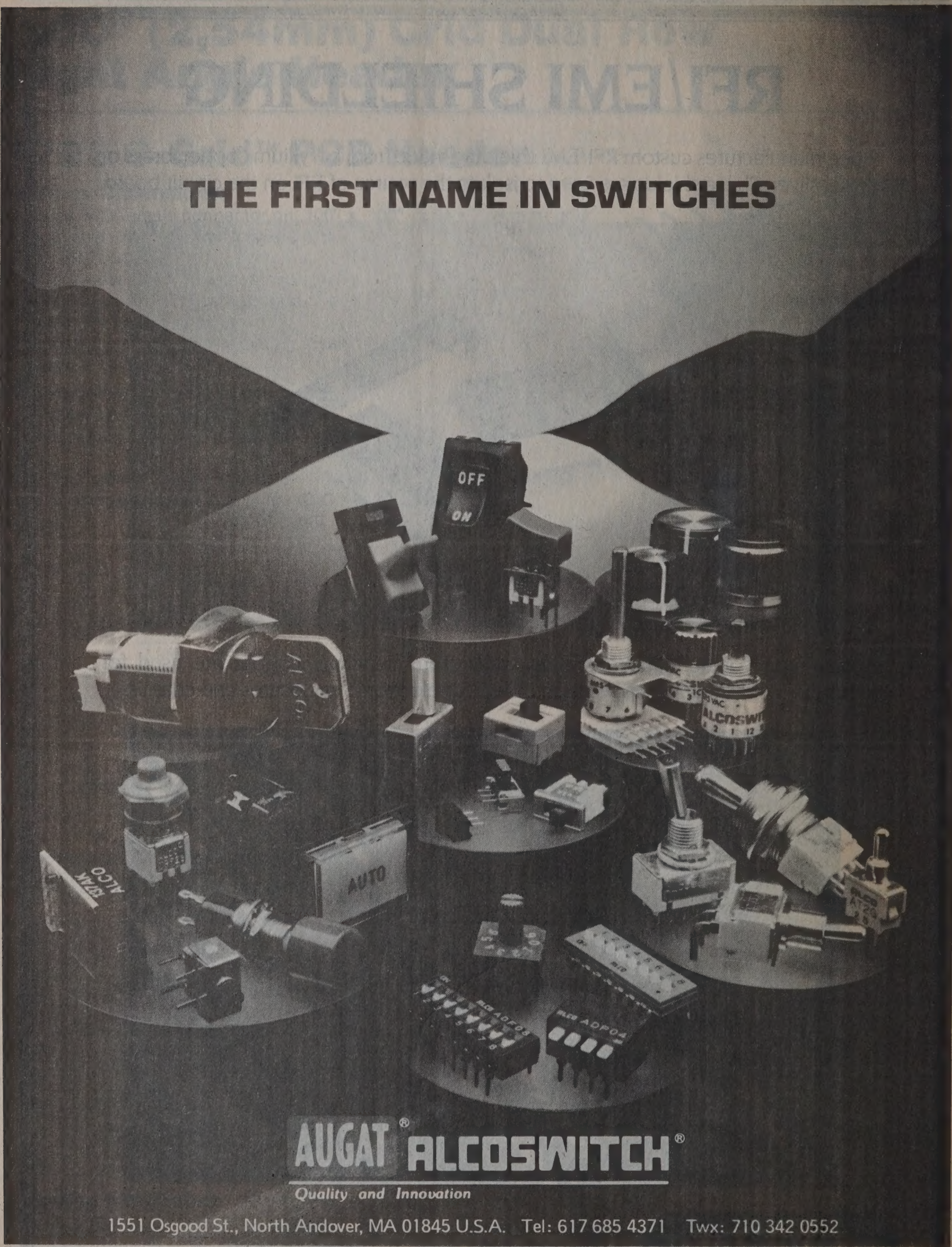

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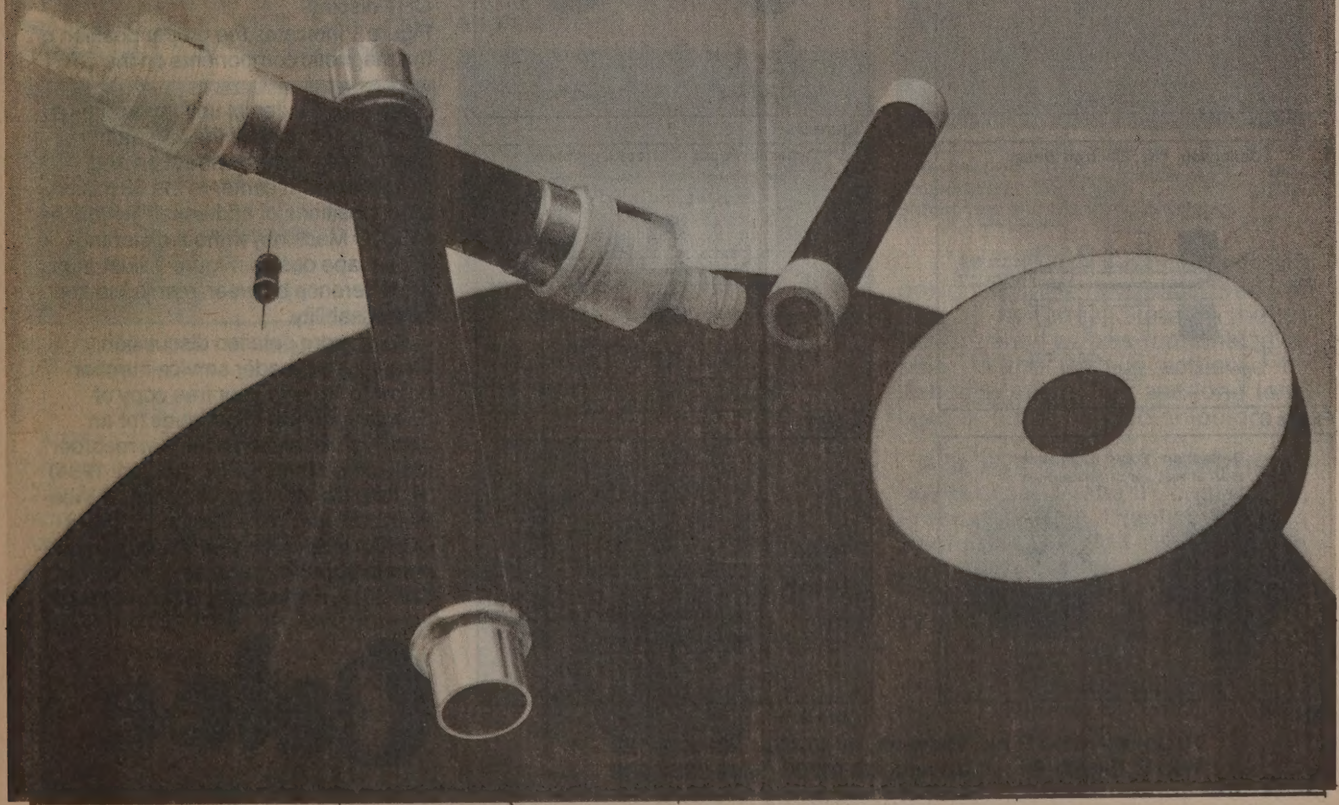

For More Information. Circle No. 532

CELCO's Electron-optical techniques produce ultra-high-resolution CRT displays.

Absolute control over the size, shape and position of the scanning electron beam spot is necessary to produce an ultra-high-resolution CRT display. For example, the CELCO CFR4000 CRT Color Film Recording System yields over 7500 resolvable points across the CRT face with resulting image content in excess of 31 million picture elements per field. This system is presently providing theatre-quality imagery to the rapidly growing computer graphics industry for computer animation and other computer image generation techniques of recent development. Other applications include imagery for oil exploration and analysis and other geological interpretations and LANDSAT.

Proper selection and use of cathode-ray tube, deflection yoke, magnetic focus lens, astigmatism correction, centering and aperture flooding coils is the foundation of your high resolution CRT display.

Figure 1 indicates the proper position of the magnetic components on the CRT neck.

Figures 2-8 depict uniform aperture flooding, focusing of the divergent beam, astigmatism correction and deflection from center to the 63 million other positions of addressability (on the CELCO Machine) without distorting spot shape or size. Figure 9 illustrates the difference between resolution and addressability.

For a more detailed discussion, please circle reader service number below to reserve your free copy of "Electron-optical techniques for an ultra-high resolution color film recorder", (delivered before SPIE, January 1984) by John Constantine, Jr., CELCO Vice-President and Yoke Designer. Or call CELCO today with your display requirements: 201-327-1123. Ask for Doc Christaldi, Engineering Sales Manager.

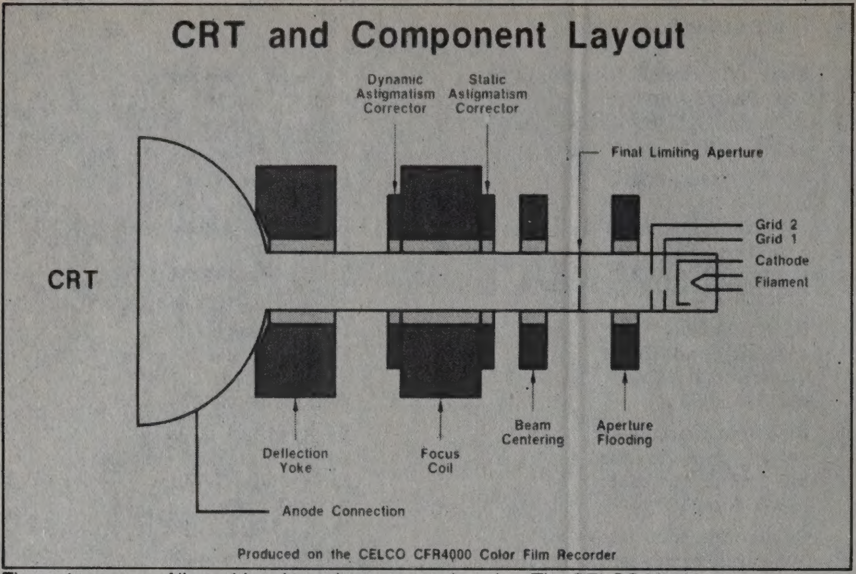
CRT and Component Layout
Dynamic Astigmatism Corrector
Static Astigmatism Corrector
Final Limiting Aperture
Grid 2
Grid 1
Cathode
Filament
CRT
Beam Centering
Aperture Flooding
Deflection Yoke
Focus Coil
Anode Connection
Produced on the CELCO CFR4000 Color Film Recorder

Figure 1 All graphics shown here are produced on The CELCO Machine (CFR4000 CRT Color Film Recording System) at CELCO in Mahwah, NJ.

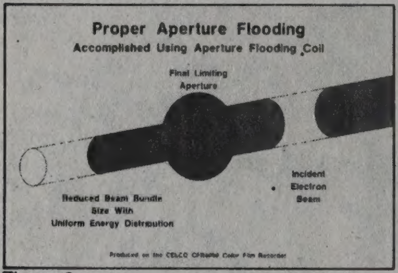
Proper Aperture Flooding
Accomplished Using Aperture Flooding Coil
Final Limiting Aperture
Incident Electron Beam
Reduced Beam Bundle Size With Uniform Energy Distribution
Produced on the CELCO CFR4000 Color Film Recorder

Figure 2

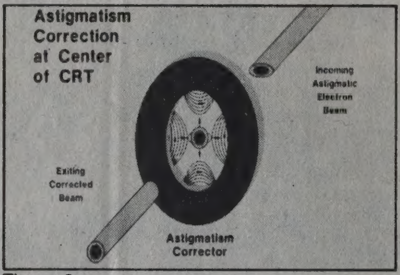
Astigmatism Correction at Center of CRT
Incoming Astigmatic Electron Beam
Exiting Corrected Beam
Astigmatism Corrector

Figure 3

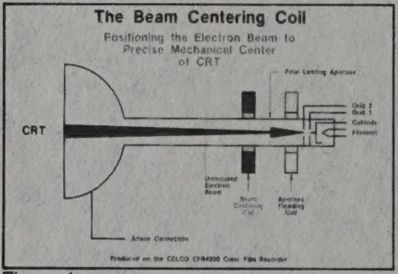
The Beam Centering Coil
Positioning the Electron Beam to Precise Mechanical Center of CRT
Final Limiting Aperture
Grid 2
Grid 1
Cathode
Filament
CRT
Unfocused Electron Beam
Beam Centering Coil
Aperture Flooding Coil
Anode Connection
Produced on the CELCO CFR4000 Color Film Recorder

Figure 4

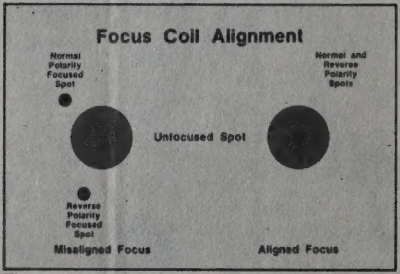
Focus Coil Alignment
Normal Polarity Focused Spot
Normal and Reverse Polarity Spots
Unfocused Spot
Reverse Polarity Focused Spot
Misaligned Focus
Aligned Focus

Figure 5

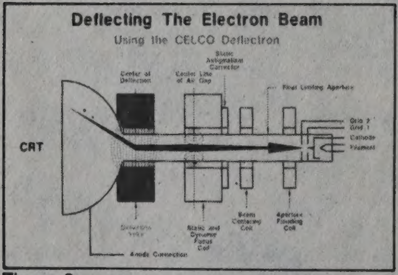
Deflecting The Electron Beam
Using the CELCO Deflectron
Static Astigmatism Corrector
Center of Deflection
Center Line of Air Gap
Final Limiting Aperture
Grid 2
Grid 1
Cathode
Filament
CRT
Deflection Yoke
Static and Dynamic Focus Coil
Beam Centering Coil
Aperture Flooding Coil
Anode Connection

Figure 6

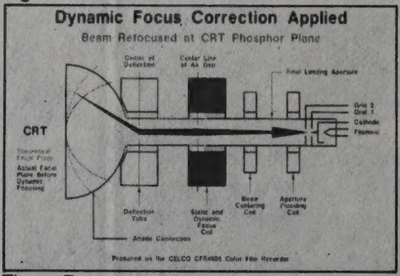
Dynamic Focus Correction Applied
Beam Refocused at CRT Phosphor Plane
Center of Deflection
Center Line of Air Gap
Final Limiting Aperture
Grid 2
Grid 1
Cathode
Filament
CRT
Theoretical Focal Plane
Actual Focal Plane Before Dynamic Focusing
Deflection Yoke
Static and Dynamic Focus Coil
Beam Centering Coil
Aperture Flooding Coil
Anode Connection
Produced on the CELCO CFR4000 Color Film Recorder

Figure 7

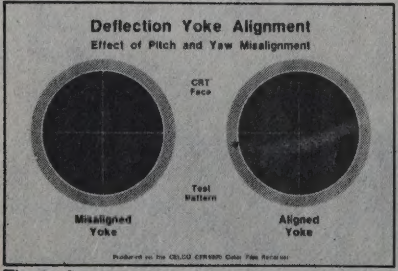
Deflection Yoke Alignment
Effect of Pitch and Yaw Misalignment
CRT Face
Test Pattern
Misaligned Yoke
Aligned Yoke
Produced on the CELCO CFR4000 Color Film Recorder

Figure 8

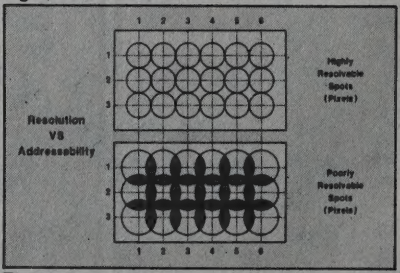
1
2
3
4
5
6
Highly Resolvable Spots (Pixels)
Resolution VS Addressability
Poorly Resolvable Spots (Pixels)

Figure 9

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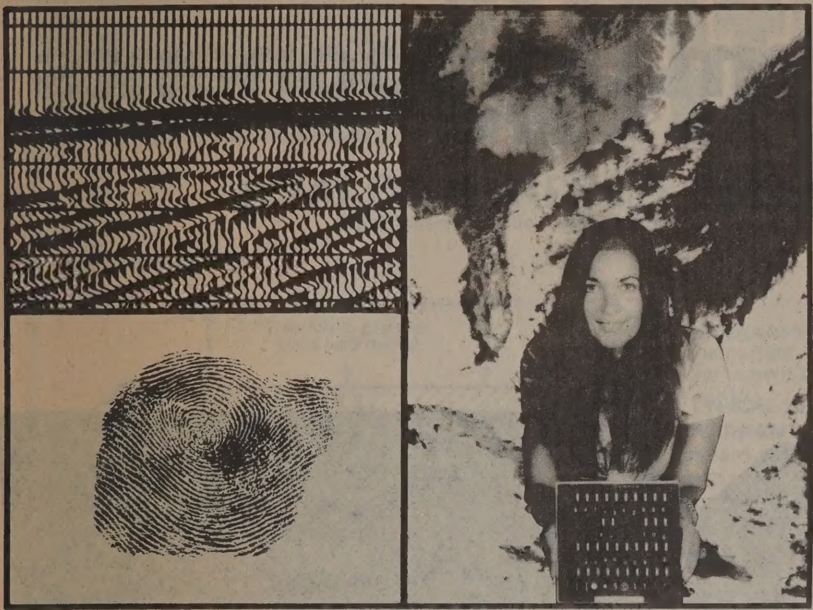
For More Information. Circle No. 533



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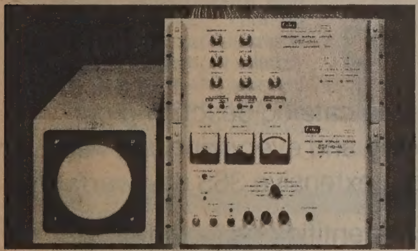
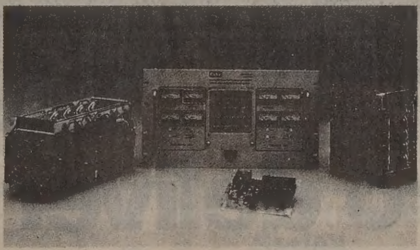
CELCO High Resolution CRT Displays provide to 6000 lines resolution a 7" CRT, and 4200 lines on a 5" cathode ray tube.



CELCO DS7-10-1A 7" High Resolution CRT Display System.

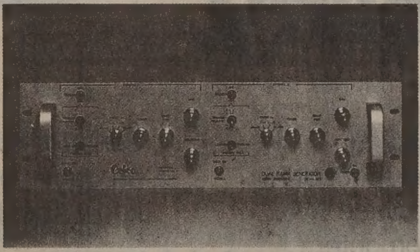
FASTEST SPEEDS

CELCO Precision CRT Deflection Amplifiers used in CELCO Display Systems are available from ±2 Amps at 20 volts to ±10 Amps at 60 volts. CELCO high-speed, X-Y Deflection Amplifiers allow a large range of scan and retrace times to 6 microseconds.



CELCO X-Y Deflection Amplifiers

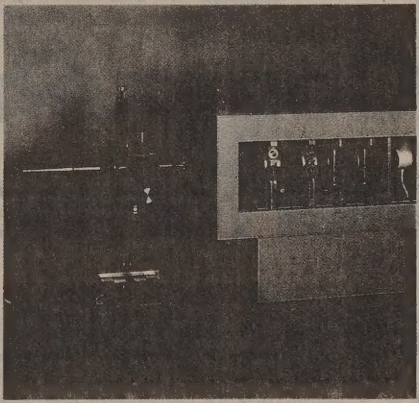
CELCO Dual-Axis Ramp Generators provide 10μsec to 100msec ramp output signal periods, and are extremely linear (0.05%) linearity and stable.



CELCO RG 116 Dual-Axis Ramp Generator

The inherent quality of CELCO High Resolution CRT Displays and Flying Spot Scanners is the result of development of CELCO precision engineered components for two generations.

CELCO CRT Displays include electron beam lenses, astigmatism correctors, high resolution deflection yokes, highly stable deflection amplifiers and high voltage power supplies, analog and digital circuitry and precision electro-mechanical assemblies.



CELCO CRT Spot Analyzer, CRT Display, w/Deflection Yoke, Focus Coil, Lens Assemblies, Correction Circuits, Micro-positioners and Magnetic Shielding.

All CELCO Components are designed and manufactured at CELCO factories. State of the art performance with exceptional reliability in the field is achieved by in-house inspection and long term burn-in times prior to shipping.

FOR FURTHER INFORMATION

Write or call Michael Constantine, President and Display System Designer at 714-985-9868 in Upland, CA. (TWX: 910-581-4301). Your plant is only hours away by CELCO Air Fleet.

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Upland, California 91786
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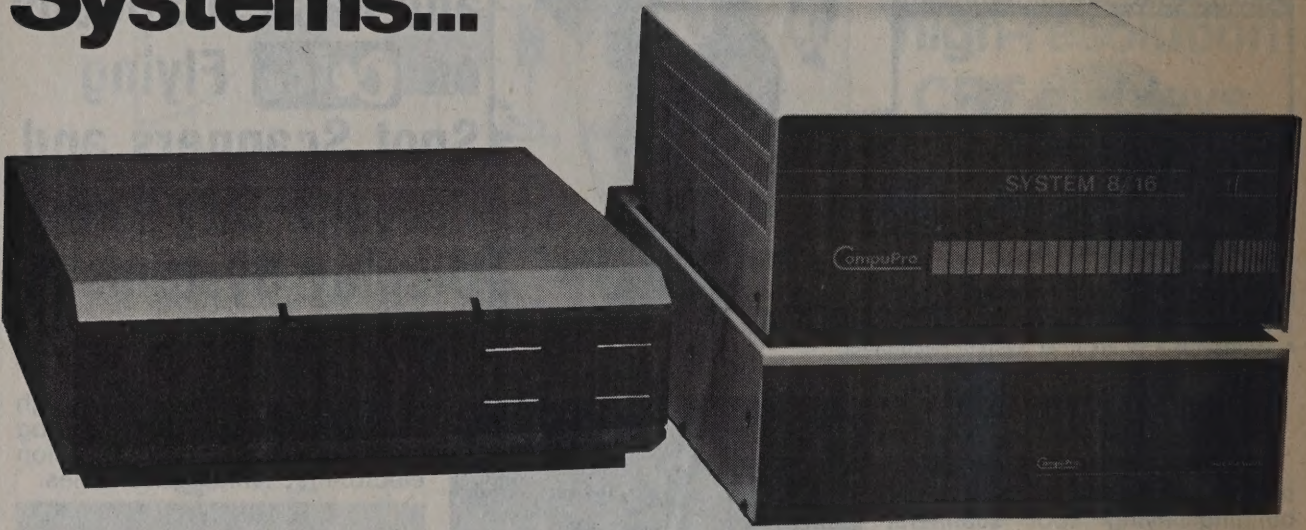

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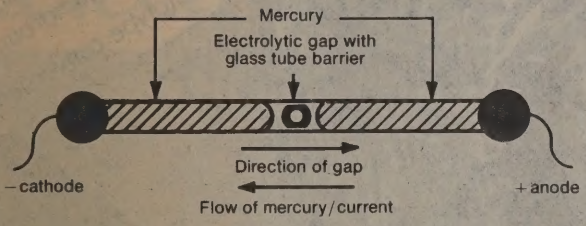

Two columns of mercury in a capillary glass tube separated by an electrolytic gap containing a barrier of glass tube. In the presence of pure or pulsed DC signal at the terminals, mercury electrochemically crosses the gap at a time rate proportional to the current. The gap travels the tube's length as a function of the current-time integral.

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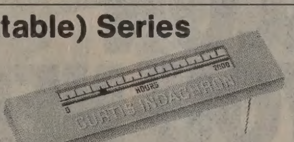
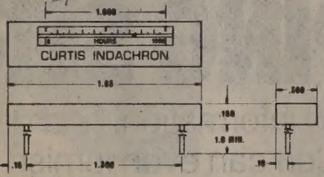
LNA & LC (non-resettable) Series

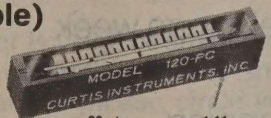
CURTIS
620 LNA
115VAC

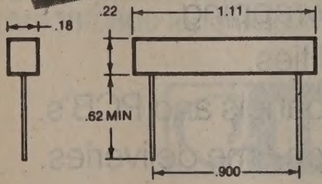




Easily-readable, very low-cost units used by OEM for warranty-by-use and P/M scheduling in office equipment, test instruments, etc. AC and DC with various time scales and electrical ratings. LNAs are adhesive-mounted, LCs via circuit board pins.

120PC (non-resettable) Series





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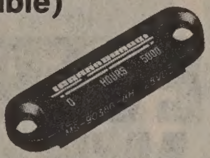
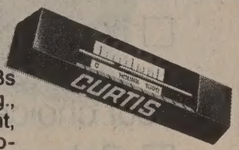
620PC, 620N (non-resettable) MIL Series



CURTIS MIL spec units in two configurations: 620Ns meet MS-90386 and are provided with voltages available in the box—5VDC—as well as 28VDC and 115 VAC. 620PCs meet MS-3311 (AS), are designed for repairable modules and subassemblies, and run from DC current.

CP3 (resettable) Series



Instantly resettable in the field, CP3s are suitable for P/M scheduling, e.g., contract field servicing of equipment, replacement of life-limited components. Scales for any type of scheduling. Available in AC and DC.

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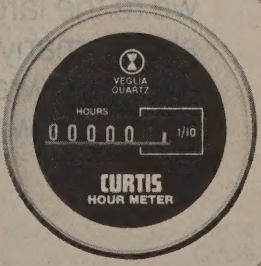

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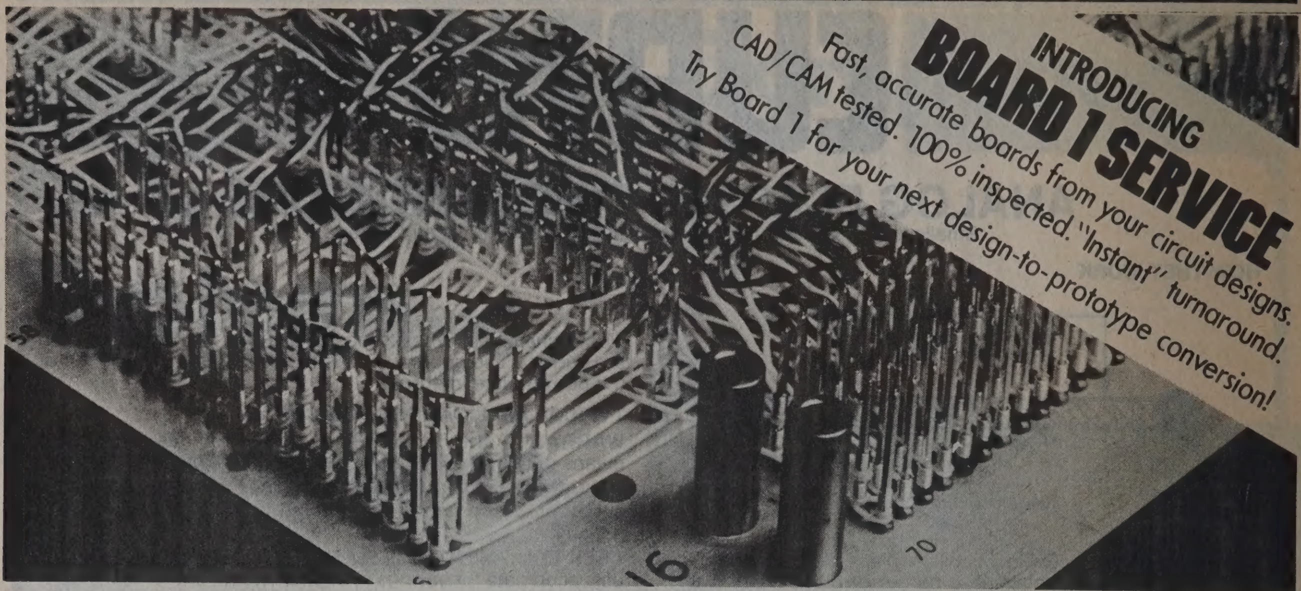
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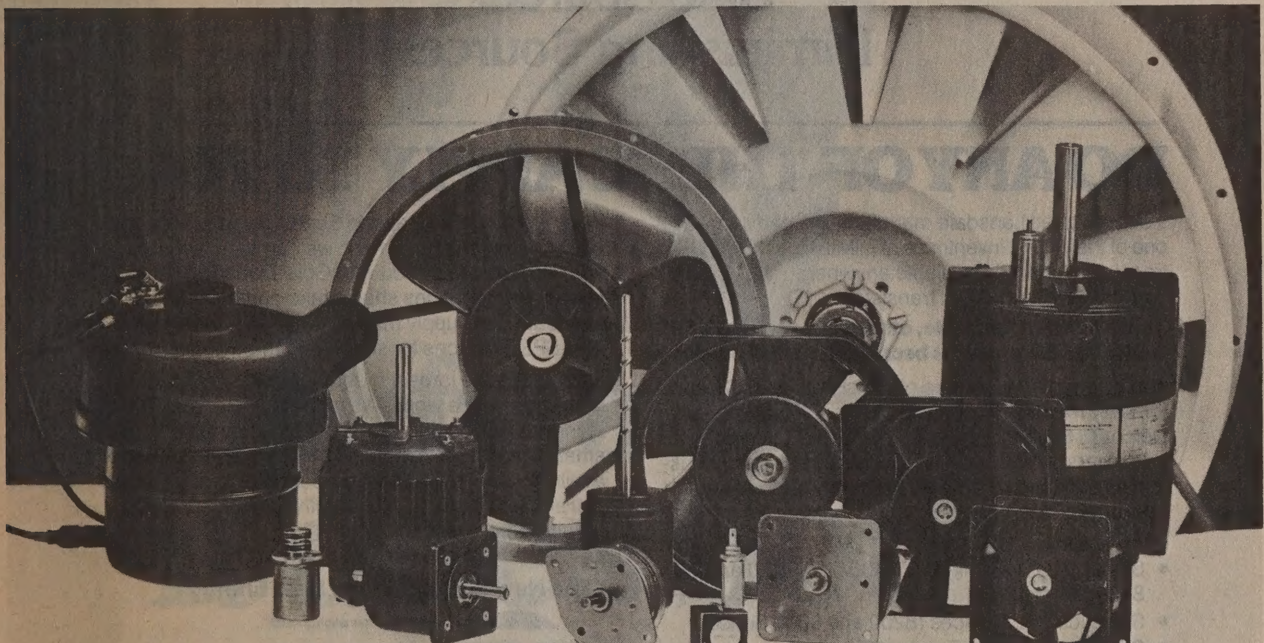

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PRODUCT LITERATURE

MOTOR CATALOG	Custom Designed Models	Circle 538
FAN CATALOG	Custom Designed Axial & Tubeaxial Models	Circle 539
CENTRIFUGAL BLOWER CATALOG	Custom Designed Models	Circle 540
VANEAXIAL CATALOG	Custom Designed Models	Circle 541
AIRMOVER CATALOG	Stock Tubeaxial Models	Circle 542
TORMAX® STEP MOTOR CATALOG	Custom Designed Models	Circle 543
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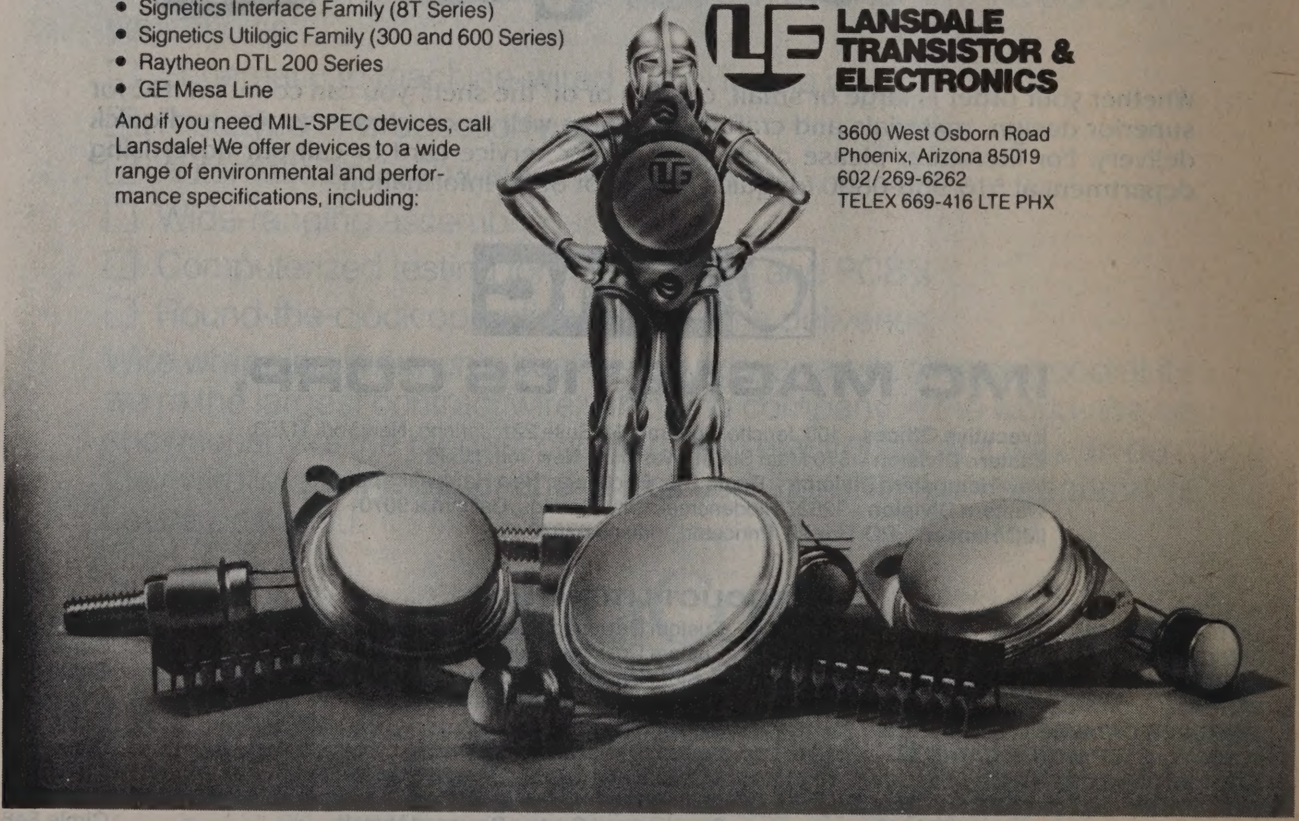

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For complete specifications and performance curves refer to the Goldbook, Vol. 2, pgs. 913-976

ZFL-2000 SPECIFICATIONS

FREQUENCY	10-2000 MHz
GAIN	20 dB
GAIN FLATNESS	±1.5 dB
OUTPUT POWER (1 dB compression)	+17 dBm
NOISE FIGURE	7.0 dB
INTERCEPT POINT (3rd order)	25 dBm
VSWR, 50 OHMS	2:1
DC POWER volt, current	+15 V, 100 mA
HEAT SINK	Internal
OPERATING TEMP	−55°C to +100°C

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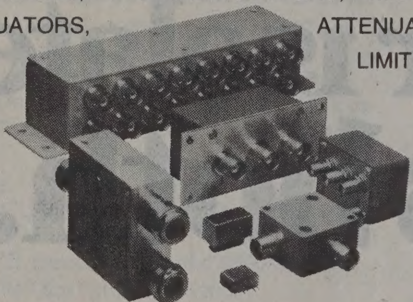

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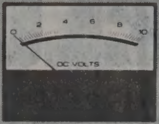

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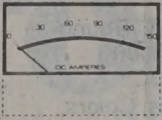

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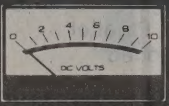

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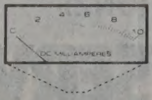

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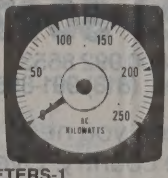

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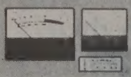

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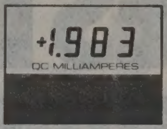

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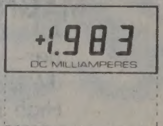

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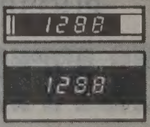

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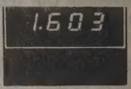

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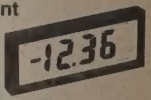

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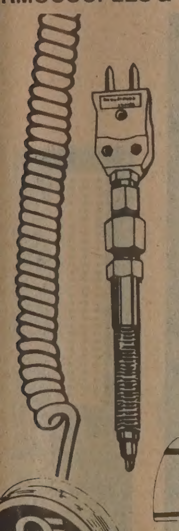

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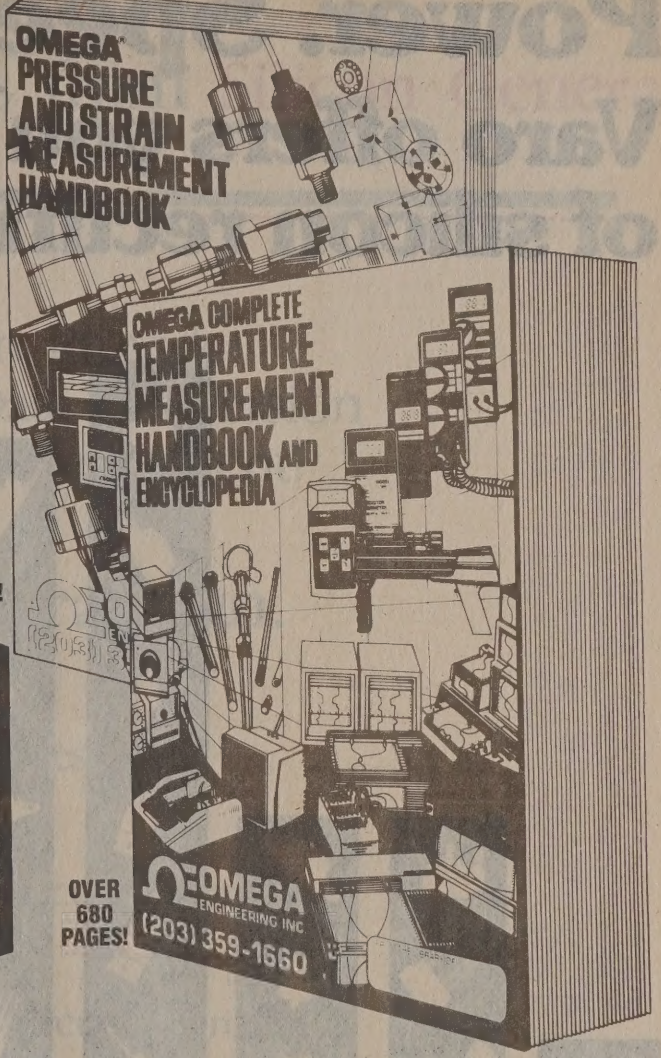
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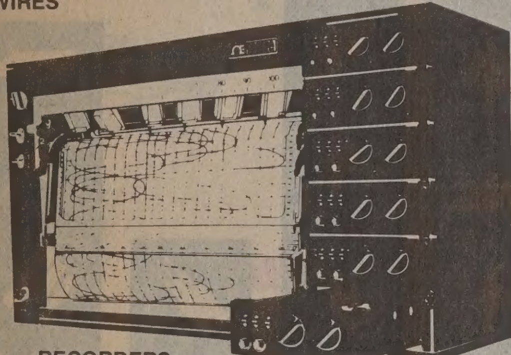

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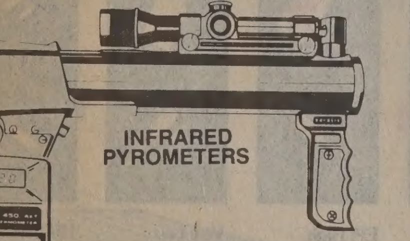

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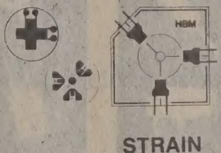

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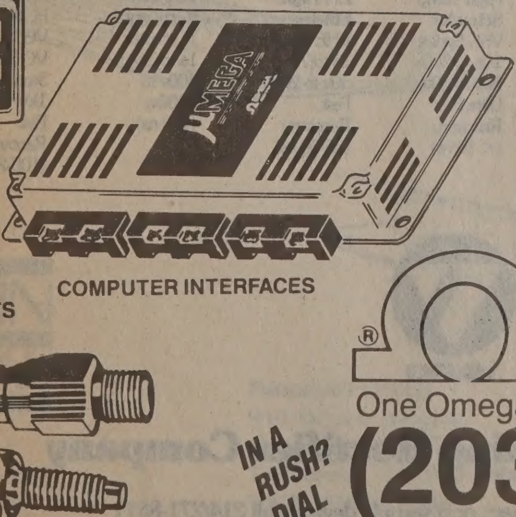

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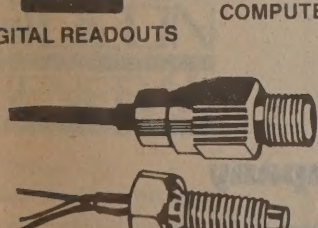

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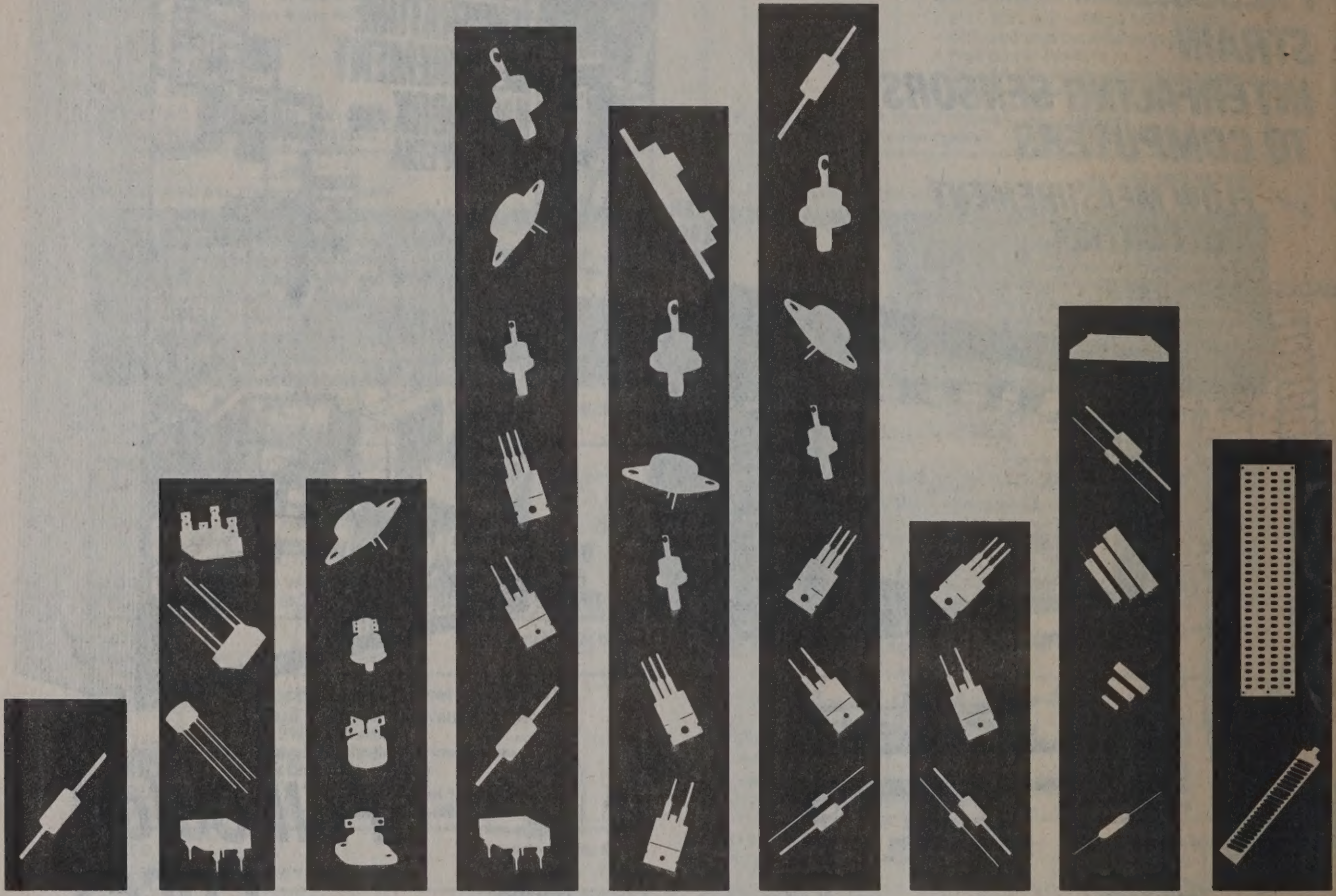

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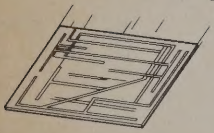

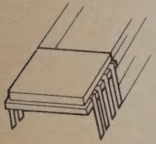

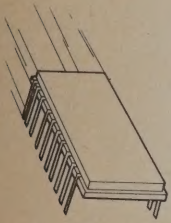

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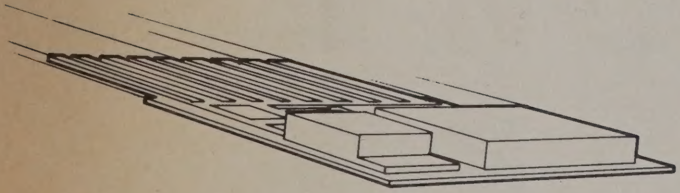

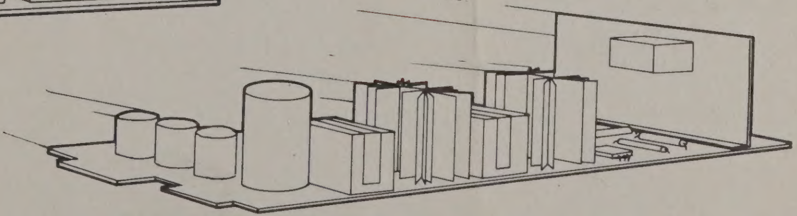

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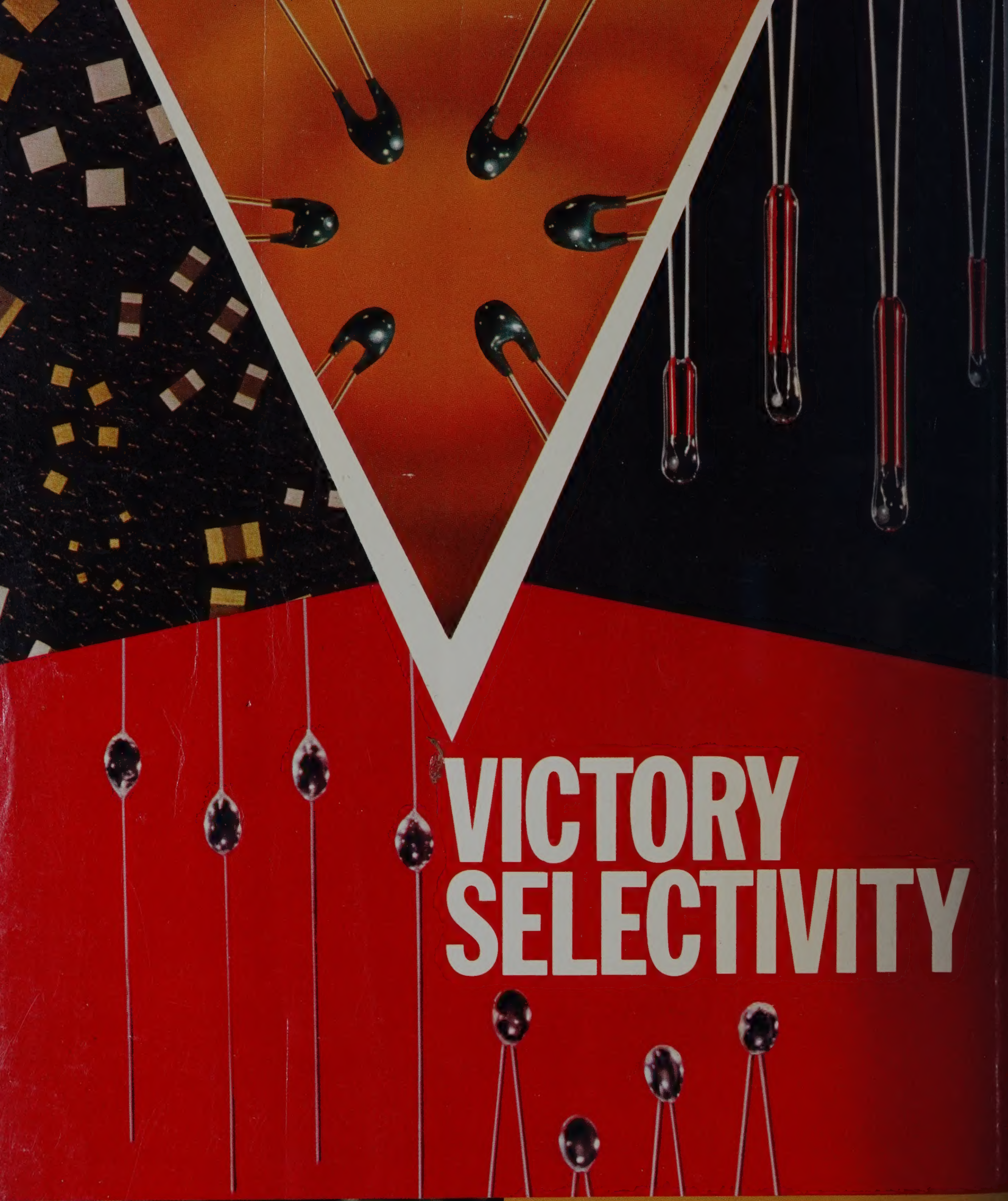

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